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Do Japan's Free Trade Agreements Increase Its International Trade?

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Abstract This study analyzes the impacts of free trade agreements (FTAs) on bilateral trade, focusing on Japan's FTAs. In particular, we examined both static and dynamic effects at the aggregated and disaggregated levels, using two datasets between 1995 and 2016 for Japanese trade only and world trade. For the static analysis, we investigated the overall impacts and the effect of individual FTAs. Regarding dynamic analysis, we considered the time since their enactment. Our results indicate that the impacts are heterogeneous among Japan's FTAs and products, with a trade creation effect for some FTA partners. Moreover, our findings reveal that the trade creation effect is probably overestimated when trade between the third countries is not considered. We also found a positive dynamic effect for some products. Such a dynamic effect may emerge due to a longer time for firms to understand FTAs and learn their use and the gradual tariff reduction for some products.

Keywords: free trade agreements, Japan, gravity model, trade creation effects, dynamic effects

JEL Classifications: F13, F14, F15

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I. Introduction

Recently, free trade agreements (FTAs) have attracted the attention of policymakers and researchers globally as a key policy for international trade. Arguably, FTAs have become the most essential and popular of all trade policies. In particular, since the latter half of the 1990s, the number of FTAs globally has been rapidly increasing because of the stalled trade liberalization

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negotiations under the World Trade Organization (WTO). Therefore, many countries interested in trade liberalization have begun establishing FTAs.

Japan developed an interest in FTAs in the late 1990s, and signed its first FTA with Singapore in November 2002. Japan's FTA negotiations mainly centered on the Association of Southeast Asian Nations (ASEAN) countries (Table 1). As of June 2021, Japan had enacted 18 FTAs, including 15 bilateral FTAs, each with Singapore, Mexico, Malaysia, Chile, Thailand, Indonesia, Brunei, the Philippines, Switzerland, Vietnam, India, Peru, Australia, Mongolia, and the United Kingdom (in the order of enactment), and three regional FTAs, each with ASEAN member countries (ASEAN-Japan Comprehensive Economic Partnership, AJCEP), 10 Asia-Pacific countries (Comprehensive

Table 1. *Progress of Japan's FTAs*

(as of February 2021)

	Negotiation started	Signed	Effective
Singapore	Jan 2001	Jan 2002	Nov 2002
Mexico	Nov 2002	Sep 2004	Apr 2005
Malaysia	Jan 2004	Dec 2005	Jul 2006
Chile	Feb 2006	Mar 2007	Sep 2007
Thailand	Feb 2004	Apr 2007	Nov 2007
Indonesia	Jul 2005	Aug 2007	Jul 2008
Brunei	Jun 2006	Jun 2007	Jul 2008
ASEAN	Apr 2005	Apr 2008	Dec 2008 (Singapore, Vietnam, Laos, Myanmar), Jan 2009 (Brunei), Feb 2009 (Malaysia), Jun 2009 (Thailand), Dec 2009 (Cambodia), Jul 2010 (Philippines), Mar 2018 (Indonesia)
Philippines	Feb 2004	Sep 2006	Dec 2008
Switzerland	May 2007	Feb 2009	Sep 2009
Vietnam	Feb 2007	Dec 2008	Oct 2009
India	Jan 2007	Feb 2011	Aug 2011
Peru	May 2009	May 2011	Mar 2012
Australia	Apr 2007	Jul 2014	Jan 2015
Mongolia	Jun 2012	Feb 2015	Jun 2016
CPTTP/TPP11	After Jan 2017	Mar 2018	Dec 2018 (Mexico, Japan, Singapore, New Zealand, Canada, and Australia), Jan 2019 (Vietnam)
EU	Apr 2013	Jul 2018	Feb 2019
United Kingdom	Jun 2020	Oct 2020	Jan 2021
TPP	Mar 2010 (joined since Jul 2013)	Feb 2016	
RCEP	May 2013	Nov 2020	
Colombia	Dec 2012		
China, Korea	Mar 2013		
Turkey	Dec 2014		
(Korea)	Dec 2003	(negotiation stopped)	
(GCC)	Sep 2006		
(Canada)	Nov 2012		

and Progressive Trans-Pacific Partnership, CPTTP or Trans-Pacific Partnership 11, TPP11), and the European Union (Japan-EU Economic Partnership Agreement, Japan-EU EPA).[1] Japan and seven ASEAN countries (namely, Singapore, Malaysia, Thailand, Indonesia, Brunei, the Philippines, and Vietnam in the order of enactment) are engaged in both bilateral and regional FTAs. The remaining three ASEAN member countries (i.e., Lao People's Democratic Republic, Myanmar, and Cambodia) are engaged only in a regional FTA (AJCEP) with Japan.[2]

Traditionally, Japan adopted a principle of nondiscrimination as a trade policy for all member countries in the multilateral trading framework under the General Agreement on Tariffs and Trade (GATT)/WTO. However, Japan now practices a multi-layered approach, which includes discriminatory bilateral/regional frameworks in the form of FTAs and the WTO's multilateral framework.[3] The rapidly growing number of FTAs across various regions has led Japan to shift toward FTAs and secure export markets in an increasingly discriminatory trade environment. Japan also felt the need to establish international rules to improve the business environment for Japanese firms, such as those on the global movements of capital/investment, people, and information, which had not been covered sufficiently by international rules. Thus, Japan and other countries turned to FTAs to establish international rules.

Japan has recently started establishing FTAs; hence, a detailed and rigorous ex-post evaluation of their economic impacts is indispensable for academics and policy assessment. Several empirical studies about the effects of Japan's FTAs on trade have been conducted but unsatisfactorily for the following reasons.

Ando (2007) provided a preliminary ex-post evaluation of Japan's FTAs using gravity model estimation and a detailed analysis of trade and actual tariff reduction by FTAs.[4] Although the study was probably the first attempt at ex-post evaluation of Japan's FTAs using econometric analysis, the period covered by the analysis was too short for conducting an in-depth evaluation. Studies by Ando and Urata (2011) on FTAs with Mexico and Ando and Urata (2015) for three

1) The following are members of CPTTP: Australia, Brunei, Canada, Chile, Japan, Malaysia, Mexico, New Zealand, Peru, Singapore, and Vietnam. Those countries signed the agreement, but only Australia, Canada, Japan, Mexico, New Zealand, Singapore, and Vietnam had ratified the agreement by June 2021. The CPTPP entered into force in December 2018, as an enactment of the agreement needed ratification of six countries. For Brunei Darussalam, Chile, Malaysia, and Peru, the CPTPP will enter into force 60 days after they complete their respective ratification processes.

2) Japan has also signed a regional FTA with 10 ASEAN member countries and 5 East Asian countries (China, South Korea, India, Australia, and New Zealand), which is named as the Regional Comprehensive Economic Partnership (RCEP). The RCEP, the CPTPP, and Japan-EU EPA are called mega-FTAs because they involve many countries, including several major ones. Moreover, Japan is currently negotiating FTAs bilaterally with Colombia and Turkey, trilaterally with China and South Korea (CJK FTA). Meanwhile, three FTA negotiations, each with South Korea, countries in the Gulf Cooperation Council (GCC), and Canada, have been suspended.

3) In exceptional cases, special trade measures, such as voluntary export restraints, were adopted bilaterally with the United States to address trade frictions in the 1960s to the 1980s.

4) The study confirmed a certain degree of positive impact of the Japan-Mexico FTA on trade, particularly on the export side, and investment. Moreover, they found almost no direct impact of the Japan-Singapore FTA, considering that the actual reduction of tariffs by the FTA is limited.

FTAs with Malaysia, Thailand, and Indonesia examined their effects on Japan's bilateral trade. They used trade data at the disaggregated product level by explicitly considering the tariff levels or preferential margins (i.e., gaps between the most-favored-nation (MFN) tariffs and preferential tariffs under FTAs). Although these studies of bilateral FTAs are useful for evaluating individual FTA policies, the same approach cannot be applied to an analysis of multiple FTAs.

Meanwhile, studies focusing only on Japan's trade and ignoring FTA partners' trade with countries other than Japan may bias the estimated results. For instance, Yamanouchi (2019) conducted gravity model estimations to investigate the impact of Japan's FTAs using trade data covering Japan's trade and trade between third countries (third-country trade), and he found some differences. However, he did not consider sectoral differences. Furthermore, the effects of FTAs may be different across agreements or countries, as suggested by Kohl (2014), Baier et al. (2018, 2019), and Freeman and Pienknagura (2019).[5)]

Given the previously mentioned issues, this study examines the effects of Japan's 15 FTAs on trade, with 17 FTA partners. It investigates the impacts of these FTAs on Japan's trade with FTA partners by using two datasets, one consisting of Japan's bilateral trade only and the other world trade that includes bilateral trade between the third countries.[6)] Some of earlier studies have suggested the heterogeneous impact of FTAs among FTAs; therefore, we analyze the overall impact of Japan's 15 FTAs on trade and the impact on bilateral trade with individual FTA partners. Additionally, this study examines the dynamic impact of Japan's FTAs to see whether the effects of FTAs are realized gradually over time, because it may take some time for firms to know about FTAs and to learn how to use them and because the tariff reduction under FTAs is realized gradually for some products.[7)] Furthermore, we conduct the corresponding analyses for both aggregate trade and trade by major products.

The remainder of this paper is structured as follows: section 2 provides an overview of Japan's trade trend by FTA partners and major products; Section 3 explains the methodology to examine the impact of FTAs using gravity model estimations quantitatively, and Section 4 discusses the estimation results; and finally, section 5 presents the conclusions.

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5) For instance, Kohl (2014) estimated the effects for each of the 166 FTAs by first-differencing gravity model and highlighting that the trade creation effects are heterogeneous and only about one-quarter of agreements are promoting trade. Meanwhile, Baier et al. (2018) constructed the Melitz-based general equilibrium model to explore the roles of various kinds of trade costs on extensive and intensive margins. They estimated the effects of Economic Integration Agreements (EIAs), including FTAs, using the trade data for 183 countries over the period 1965-2010 at five-year intervals. As a result, they demonstrated that EIAs are effective when the country pair is not distant from each other and has a common language and religion but different legal origins and colonial histories. Baier et al. (2019) demonstrated highly heterogeneous effects within agreements and some determinants of those effects using a two-stage method and trade data for 70 countries over 1986-2006. They found, for example, that the effects of FTAs are small if the country pair has high levels of *ex-ante* trade frictions.

6) See Table 1 for the list of 17 FTA partners for Japan's 15 FTAs. As mentioned earlier, 14 FTA partners have at least bilateral FTA with Japan, and 3 FTA partners (i.e., Lao PDR, Myanmar, and Cambodia) have only a regional FTA with Japan.

7) Yamanouchi (2017) examined the dynamic effects of Japan's FTAs using Japan's trade data only.

II. Overview of Japan's Trade by FTA Partners and Major Products

This section provides an overview of the recent trend of Japan's trade. Table 2 presents Japan's trade by FTA partners since 2000 as a ratio to the value for 1995 on a nominal base. We chose the year 1995 because our gravity model estimations use data covering 1995-2016. In our sample period, Japan has FTAs with 17 countries. The major products of interest in this study include agricultural products (the Harmonized System (HS) 01-HS24), chemical products (HS28-HS40), textile products (HS50-HS63), metal products (HS72-HS83), general machinery (HS84), electric machinery (HS85), transport machinery (HS86-HS89), and precision machinery (HS90-HS92).[8)]

The trade indices in Table 2 are useful for understanding the trend. An index with a small benchmark value must be interpreted carefully because it tends to show an extremely large value over time. As the global figures in Table 2 show, Japan's trade fluctuated but tended to increase with its peaks in 2011/2012. Specifically, Japan's exports to and imports from the world for 2016 were 1.5 and 1.8 times greater than the corresponding values for 1995, respectively. Moreover, they reached their peaks in 2011/2012, recording an increase of 1.9 times for exports and 2.6 times for imports. Although both exports and imports declined in 2009 owing to the Global Financial Crisis, they rapidly recovered. Both exports and imports grew faster than the GDP, whose value in US dollars declined by 10% during 1995-2016.

In terms of FTA partners and major products, the trade trend differed. Regarding trade by FTA partners, Japan's exports to most FTA partners increased. Moreover, Japan's exports to Cambodia, Lao PDR, Myanmar, and Vietnam (CLMV) have expanded rapidly, particularly since 2010. Among CLMV, Vietnam recorded the largest expansion, whereas the Lao PDR recorded the smallest. Exports to Mongolia, Mexico, India, Chile, Peru, and Australia increased faster than Japan's overall exports (1.5 times). The growth rate was positive but lower than Japan's overall exports for Thailand, Indonesia, the Philippines, and Switzerland. By contrast, Japan's exports declined from the 1995 level for Singapore, Malaysia, and Brunei.

Regarding Japan's imports by FTA partners, the imports from CLMV increased rapidly, particularly since 2010, similar to the export patterns. Meanwhile, Japan's imports from Mexico, the Philippines, Peru, Thailand, Australia, and Switzerland increased faster than its overall imports (1.8 times). The growth rates were positive but lower than Japan's overall imports in the case of imports from Singapore, Malaysia, Chile, Brunei, Indonesia, and India. By contrast, Japan's imports from Mongolia in 2016 declined to only 19% of the value for 1995, with some fluctuations during 1995-2016.

8) These are selected products, and therefore, the sum of trade in these major products is not equal to total trade.

Table 2. *Trend of Japan's Trade by FTA Partners*

		2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Country	Value for 1995 (millions US$)	Index: ratio to value for 1995 (1995=100)																
a) Exports																		
SGP	26,330	87	61	55	58	72	73	75	81	98	71	92	99	89	77	76	70	75
MEX	3,951	163	204	236	192	267	331	387	413	412	288	380	417	446	432	444	439	449
MYS	21,183	81	67	67	67	79	78	81	89	91	72	97	100	95	84	78	65	64
CHL	1,013	69	54	52	69	97	125	144	195	316	157	334	289	256	244	233	207	195
THA	21,622	70	63	68	84	103	120	119	138	154	115	175	194	229	190	165	143	142
BRN	168	43	42	122	74	83	80	127	105	138	124	114	109	159	124	86	142	64
IDN	9,217	58	50	47	45	65	74	59	70	164	106	184	210	247	209	184	143	140
LAO	36	75	41	64	48	50	69	73	133	221	270	90	119	199	304	250	199	245
MMR	202	124	193	73	78	67	58	66	112	120	128	108	198	439	675	811	761	622
PHL	9,172	75	76	86	90	87	92	83	78	77	62	79	76	75	60	60	73	111
VNM	1,188	193	183	210	251	299	342	395	520	693	628	758	875	976	972	1082	1193	1409
CHE	2,532	91	79	69	83	96	92	97	115	153	130	139	184	199	159	157	138	141
KHM	99	59	61	64	78	84	100	130	141	114	119	157	249	241	175	265	425	530
IND	2,462	90	72	86	94	120	149	192	236	316	271	335	455	502	426	404	391	398
PER	533	91	80	77	69	67	83	105	147	239	173	257	246	281	269	207	201	194
AUS	8,723	107	95	103	127	147	157	157	182	206	154	200	212	225	205	177	169	167
MNG	55	133	101	72	115	136	137	177	195	538	249	373	756	808	807	668	499	601
World	448,542	107	95	97	109	130	138	149	165	181	136	174	190	189	173	167	151	154
b) Imports																		
SGP	6,864	93	78	73	79	91	97	108	102	114	89	119	126	127	108	114	115	108
MEX	1,496	159	134	120	119	145	169	188	211	254	187	232	266	294	282	286	317	383
MYS	10,564	137	121	106	119	133	138	146	164	219	158	214	288	311	281	276	203	164
CHL	3,166	89	76	67	83	132	161	229	257	250	167	244	310	294	253	257	189	168
THA	10,120	104	102	103	117	139	153	166	181	205	158	207	242	233	217	214	201	199
BRN	1,356	121	125	112	134	139	168	172	184	334	245	303	420	441	349	295	172	128
IDN	14,226	115	104	99	115	131	146	169	186	229	153	198	239	227	203	180	138	128
LAO	30	40	23	22	25	27	27	41	40	61	91	127	328	417	362	389	329	389
MMR	93	128	109	118	149	193	218	264	317	339	366	414	634	722	815	924	928	1004
PHL	3,476	207	184	188	202	237	221	228	251	242	184	228	257	268	265	292	255	259
VNM	1,720	153	151	146	179	224	264	307	355	528	404	475	671	876	827	896	880	943
CHE	4,054	81	81	81	95	118	124	125	128	158	154	167	193	202	179	178	182	188
KHM	7	714	903	1025	1224	1366	1443	1646	1903	1656	1952	2845	4216	5535	7983	10570	13261	16489
IND	2,924	90	75	71	74	89	109	138	142	179	127	194	233	239	241	238	166	159
PER	537	65	79	79	80	127	131	246	416	394	309	406	436	522	492	327	231	246
AUS	14,558	101	99	96	103	133	168	191	214	326	238	309	389	387	350	330	238	209
MNG	90	10	11	8	7	9	7	9	18	40	8	25	19	28	21	18	59	19
World	320,664	112	104	100	114	136	154	173	187	230	165	208	258	266	250	244	187	181

Notes. data before the enactment of FTAs are shadowed. FTA partners are Singapore (SGP), Mexico (MEX), Malaysia (MYS), Chile (CHL), Thailand (THA), Brunei (BRN), Indonesia (IDN), Laos (LAO), Myanmar (MMR), the Philippines (PHL), Vietnam (VNM), Switzerland (CHE), Cambodia (KHM), India (IND), Peru (PER), Australia (AUS), and Mongolia (MNG).

Data: authors' preparation, using data available from UN comtrade.

Table 3 shows changes in trade in constant prices in the 3 years before and after FTA enactments, calculated as the 3-year-average of trade values post- versus pre-enactment. It shows that for many FTAs, the trade value increased after the enactment. Specifically, of the 17 FTA partners under study, 12 FTA partners each registered an increase in exports and imports after the FTA enactment. A significantly large increase is observed for exports to Mexico, Chile, Indonesia, and Cambodia (i.e., more than 50%) and for imports from Cambodia and Lao PDR (i.e., more than twice). In contrast, exports declined after enacting FTAs by more than 10% for Brunei, the Philippines, and Australia, and imports reduced for the Philippines, Australia, and Mongolia.

Table 3. *Real Changes in Trade Values: 3-Year-Average After the Enactment of FTAs Relative to that before the Enactment*

	SGP	MEX	MYS	CHL	THA	BRN	IDN	LAO	MMR	PHL	VNM	CHE	KHM	IND	PER	AUS	MNG
Exports	0.93	1.50	0.99	1.65	1.11	0.90	1.64	1.09	1.40	0.87	1.35	1.25	1.65	1.19	1.06	0.89	1.19
Imports	1.02	1.36	1.21	0.97	1.08	1.35	0.97	3.66	1.47	0.89	1.25	1.22	2.18	1.23	1.11	0.82	0.32

Notes. see Table 2 for the country's name. For AUS and MNG, 2-year-average and 1 year before and after FTAs are used respectively. GDP deflator (for US) is used to calculate real trade values.
Data: authors' preparation, using data available from UN comtrade.

Despite fluctuations in Japan's trade by major products, exports of major products increased, except for its exports of textile products, which declined to 92% of the 1995 exports in 2016 (Table 4).[9] Moreover, Japan's exports in 2016 increased twice the amount in 1995 for agricultural products (2.4 times) and chemical products (2.1 times) and nearly doubled for metal products (1.9 times) and transport machinery (1.9 times). Similar to exports, Japan's imports of major products fluctuated but increased. The growth rate was the lowest for agricultural products at 23% from 1995 to 2016. Japan's imports in 2016 increased to twice the value for 1995 for chemical products (2.6 times) and general, electric, and precision machineries (2.3 times, 2.6 times, and 2.5 times, respectively). Trade, particularly imports, increased in the machinery sector. This reflects the remarkable expansion of active back-and-forth transactions of parts and components of machinery within rapidly growing regional production networks in East Asia.

9) The index of Japan's trade by FTA partners/major products provides the following notable features: Japan's metal exports to Mexico and Vietnam expanded remarkably; transport machinery exports to Mexico increased; and imports of most major products from CLMV grew faster than exports. The trade index by FTA partners/major products is available from the authors upon request.

Table 4. *Trend of Japan's Trade by Major Products*

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Product	Value for 1995 (millions US$)	Index: ratio to value for 1995 (1995=100)															
a) Exports																	
1	2,384	94	140	95	97	102	114	127	141	162	156	193	230	192	182	189	204	242
2	41,453	111	103	111	128	152	168	181	205	221	196	245	270	265	257	245	214	214
3	9,317	91	84	81	84	93	88	88	91	97	80	92	107	106	99	97	90	92
4	28,880	95	89	97	109	141	162	186	218	253	198	253	278	281	256	246	211	189
5	109,730	97	83	82	93	112	118	126	140	154	108	148	172	165	143	141	125	127
6	113,976	113	92	91	105	124	127	130	138	144	113	135	137	135	121	118	109	115
7	88,493	114	107	121	132	152	162	182	205	224	151	192	197	213	200	190	180	189
8	31,075	104	93	87	106	131	134	140	135	150	122	157	177	182	164	162	145	147
all	448,542	107	95	97	109	130	138	149	165	181	136	174	190	189	173	167	151	154
b) Imports																	
1	52,176	93	88	86	90	101	103	101	107	128	112	124	153	153	140	135	122	123
2	27,754	106	103	105	121	142	156	171	189	226	198	250	313	301	270	263	257	261
3	24,744	97	93	86	96	106	109	116	117	126	124	131	163	165	164	154	141	138
4	18,528	82	69	65	82	116	131	158	196	212	111	169	209	179	161	181	153	141
5	24,991	143	135	132	150	182	198	209	215	228	178	215	247	249	242	252	231	230
6	30,328	149	134	127	142	169	177	193	213	226	187	250	274	286	282	290	260	259
7	15,477	85	76	90	103	114	120	124	139	143	102	122	138	185	183	185	165	181
8	10,733	143	143	138	156	184	204	234	216	221	186	226	254	274	254	259	244	252
all	320,664	112	104	100	114	136	154	173	187	230	165	208	258	266	250	244	187	181

Note. major products are 1: agriculture products, 2:chemical products, 3: textile products, 4: metal products, 5: general machinery, 6: electric machinery, 7: transport machinery, and 8: precision machinery.
Data: authors' preparation, using data available from UN comtrade.

III. The Estimation Methodology and Data

A. Methodology

Using the data of Japan's exports and imports, we first estimate the effects of Japan's FTAs according to a gravity model. Although this estimation method is straightforward, the trend of FTA partners' trade with other countries cannot be analyzed using only Japan's trade data. Specifically, such analysis excludes the effects of FTA partners' trade policies with countries other than Japan. To consider these issues, we also examine the effects of Japan's FTAs using trade data covering more than 100 countries (Table A.1), that is, trade data including both Japan and third-country trade. This analysis considers the effects of other countries' FTAs.

The gravity model estimation for Japan's trade with country j in year t is expressed as follows:

$$Trade_{jt} = \exp\left(\alpha FTA_{jt} + \beta_1 \ln GDP_{jt} + \beta_2 \ln GDPpc_{jt} + \beta_3 WTO_{jt} + \delta_j^J + \delta_t^T\right) + \epsilon_{jt}, \quad (1)$$

where $Trade_{jt}$ is Japan's aggregate export or import with country j in year t. FTA_{jt} is an FTA dummy and equal to 1 if a trading country is Japan's FTA partner in year t. Like Ando and Urata (2011), we consider a country to be an FTA partner in the enactment year if the FTA was enacted before or during June of that year. $\ln GDP_{jt}$ and $\ln GDPpc_{jt}$ are the *logs* of GDP and GDP per capita of country j in year t, respectively. WTO_{jt} is a WTO dummy and takes the value of 1 if country j is a member of WTO in year t. δ_j^J denotes a country-fixed effect, reflecting all unobserved time-invariant characteristics of the country (e.g., distance) and the relationship with Japan (e.g., the historical relationship). We include the distance with Japan only when the country-fixed effect is not included in the estimating equation. δ_t^T denotes a year-fixed effect, which can be interpreted as Japan's business cycles and unilateral trade policies, and ϵ_{jt} is an error term. Standard errors are clustered at the country level.

Equation (1) is estimated using the Poisson pseudo-maximum likelihood (PPML) method for two reasons. Santos Silva and Tenreyro (2006) emphasized that when a log-linearized model, such as the gravity model, is estimated by ordinary least squares (OLS), heteroskedasticity affects both consistency and efficiency. They recommended using PPML for estimating the log-linearized model. Moreover, trade flow with zero value must be excluded from the sample when OLS with log-linearization is used to estimate the equation because a logged value of zero is not defined. We can address this zero-trade-value problem through PPML estimations.[10)]

We estimate the same equation using trade data by product for the effects of FTAs on trade by major products. As mentioned in Section 2, the major products examined in this study are (1) agricultural, (2) chemical, (3) textile, and (4) metal products, and (5) general, (6) electric, (7) transport, and (8) precision machineries.

The effects of FTAs may differ across agreements or countries, as mentioned in Section 1. Hence, we estimate the effects of Japan's FTAs on bilateral trade with individual FTA partners separately as follows:

$$Trade_{jt} = \exp\left(\alpha_j FTA_{jt} + \beta_1 \ln GDP_{jt} + \beta_2 \ln GDPpc_{jt} + \beta_3 WTO_{jt} + \delta_j^J + \delta_t^T\right) + \epsilon_{jt}, \quad (2)$$

where FTA_{jt} is a dummy variable of Japan's FTA with country j in year t. A coefficient for the dummy variable, α_j, is specific to the partner country j. Other variables are the same as in equation (1). We estimate equation (2) by PPML for both aggregate and disaggregate trades by major products.

An FTA's impact on trade may not be realized immediately because trading firms might take time to learn and understand the FTA. To explore the possible dynamic effects, we estimate

10) PPML with fixed effects is computationally demanding. The present study used the Stata command "ppmlhdfe" written by Correia et al. (2019, 2020). See their papers for the detailed procedure.

the following equation:

$$Trade_{jt} = \exp\left(\sum_{s=-1}^{6} \alpha_s \Delta FTA_{j,t-s} + \alpha_7 FTA_{j,t-7} + \beta_1 \ln GDP_{jt} + \beta_2 \ln GDPpc_{jt} + \beta_3 WTO_{jt} + \delta_j^J + \delta_t^T \right) + \epsilon_{jt}, \quad (3)$$

where $\Delta FTA_{j,t-s}$ is a dummy variable taking the value 1 if an FTA with country j was enforced s year(s) before year t, and $FTA_{j,t-7}$ is a dummy variable taking the value 1 if an FTA has been effective for 7 years or longer before year t. Here we consider the possible dynamic trade expansion effect from 1 year before to 6 years after the enactment of the FTA and assume that the effects are constant after 7 years.

The estimation method explained so far only uses Japan's trade data. However, Japan's FTA partners may increase trade values with the rest of the world after their FTAs with Japan were enforced. Here, the increased trade values with Japan may be attributable to factors other than FTAs with Japan. To address such a possible problem, we investigate the effects of Japan's FTAs using trade data, including that between the third countries. We follow Baier and Bergstrand (2007) and Yotov et al. (2016) and estimate the following equations (4) to (6), which correspond to equations (1) to (3), respectively:

$$Trade_{ijt} = \exp\left(\alpha_{i=JP} FTA_{i=JP,j,t} + \alpha_{j=JP} FTA_{i,j=JP,t} + \alpha^W FTA_{ijt}^W + \beta_1 CU_{ijt} + \beta_2 PSA_{ijt} + \delta_{ij}^B + \delta_{it}^X + \delta_{jt}^M \right) + \epsilon_{ijt} \quad (4)$$

$$Trade_{ijt} = \exp\left(\alpha_{i=JP,j} FTA_{i=JP,j,t} + \alpha_{i,j=JP} FTA_{i,j=JP,t} + \alpha^W FTA_{ijt}^W + \beta_1 CU_{ijt} + \beta_2 PSA_{ijt} + \delta_{ij}^B + \delta_{it}^X + \delta_{jt}^M \right) + \epsilon_{ijt} \quad (5)$$

$$Trade_{ijt} = \exp\left(\sum_{s=-1}^{6} \left(\alpha_{i=JP,s} \Delta FTA_{i=JP,j,t-s} + \alpha_{j=JP,s} \Delta FTA_{i,j=JP,t-s} \right) + \alpha_{i=JP,7} FTA_{i=JP,j,t-7} + \alpha_{j=JP,7} FTA_{i,j=JP,t-7} + \alpha^W FTA_{ijt}^W + \beta_1 CU_{ijt} + \beta_2 PSA_{ijt} + \delta_{ij}^B + \delta_{it}^X + \delta_{jt}^M \right) + \epsilon_{ijt} \quad (6)$$

where $Trade_{ijt}$ is the aggregate or disaggregate product-level trade value from country i to country j in year t. $FTA_{i=JP,j,t}$ in equation (4) is an FTA dummy variable, which is equal to 1 if Japan is exporter ($i = JP$) and Japan's trading partner is the member of the same FTA in year t. Similarly, $FTA_{i,j=JP,t}$ in equation (4) is an FTA dummy variable, which is equal to 1 if Japan is importer ($j = JP$) and Japan's trading partner is a member of the same FTA in year t. In equation (4), we assume that the effects of FTAs on Japan's trade are the same

for all Japan's FTA partner countries. On the other hand, in equation (5), we investigate the effects of FTAs by partners, focusing on the heterogeneity of FTAs across partners. The coefficients $\alpha_{i=JP,j}$ and $\alpha_{i,j=JP}$ therefore can be different across partner countries. Alternatively, equation (6) focuses on the effects of FTAs by the years from the enforcement to consider the possible dynamic effects. FTA_{ijt}^{W} is a dummy variable and equal to 1 if both countries of a country-pair, other than Japan, are members of the same FTA in year t. CU_{ijt} is equal to 1 if both countries are members of the same customs union. Similarly, PSA_{ijt} is a partial scope agreement dummy. δ_{ij}^{B} is a country-pair fixed effect and reflects all time-invariant factors that affect the bilateral trade values, such as distance, language, and the historical relationship between the countries. This country-pair fixed effect corresponds to the country-fixed effect in equations (1) to (3). The country-pair fixed effect is directional, and therefore, (i,j) and (j,i) pairs fall in the different clusters. δ_{it}^{X} is an exporter-year fixed effect and reflects the exporter's production capacity, outward multilateral resistance, and unilateral trade policies, such as WTO accession. δ_{jt}^{M} is an importer-year fixed effect, which reflects the importer's total expenditure, inward multilateral resistance, and unilateral trade policies, such as reducing MFN tariff rates. We consider the third-country effects by including these fixed effects in the estimation equation. In all estimations, standard errors are clustered by country pairs.

B. Data

The trade data used in this study were obtained from UN Comtrade. The sample period covers from 1995 to 2016. We first construct a dataset of bilateral trade flows of all countries listed in Table A.1. We then restrict the sample to Japan's trade flows to estimate equations (1)-(3). Although we use the values reported by importers as trade values, the missing import values are replaced with the corresponding export data reported by the exporters. The import values are reported on the cost, insurance, and freight (cif) basis, and the export values are reported on the free on board (fob) basis. Thus, we fill the gap by multiplying the export values by the average gap of 25%.[11)]

We obtained the data on GDP and GDP per capita from World Bank's World Development Indicators. The data on distance and WTO accession come from the Centre d'Etudes Prospectives et d'Informations Internationales (CEPII) website, constructed by Head et al. (2010) and Head and Mayer (2014). Meanwhile, the information on the trade policies is obtained from the Mario Larch Regional Trade Agreements Database, constructed by Egger and Larch (2008).[12)]

11) The gap of 25% is estimated, based on our trade data for country-pairs that have both fob and cif values.

12) We corrected some errors of the data on Japan's FTAs, for instance, when we found differences between the actual year of the enactment of FTAs in the Mario Laurch Regional Trade Agreement Database and the

A country is included in the sample if the average of its trade as a share of world trade during 1995-2016 exceeds 0.1% for at least one aggregate trade and trade by eight major products. Japan's FTA partners are all included in our sample, regardless of the trade share threshold. Our sample is composed of 106 countries, including Japan (Table A.1).[13)]

IV. Estimated Results

A. The static analysis of the effects of FTAs

We conducted PPML estimations for equations (1)-(6) with and without fixed effects using the data on Japan's trade only and world trade at aggregate and disaggregate levels. The fixed effects are importer/exporter-fixed effects and year-fixed effects for the estimate using the data covering Japan's exports/imports, whereas exporter-year fixed effects, importer-year fixed effects, and exporter-importer fixed effects for the estimate used the data covering world trade. Such an estimation method and specifications can deal with the aforementioned problems.

Tables 5 and 6 summarize the results from all relevant estimations to identify the significant findings.[14)] The notable findings are discussed as follows: the overall FTAs as a group, individual FTAs for aggregated products, and individual FTAs by products. First, using the data of either Japan's trade only or world trade, we cannot observe the trade creation effect of Japan's overall FTAs at aggregate trade levels, when fixed effects are included (Table 5). Regarding the disaggregate trade estimate using Japan's trade only, a significantly positive relationship exists for some products: textiles and metal for exports, and agriculture, chemical, textiles, transport machinery, and precision machinery for imports. A positive and statistically significant relationship for some of these products disappears when we expand our data sample from Japan's trade only to the world trade, including third-country trade. The estimated coefficients for the analysis of the world trade are positive and statistically significant only for metal products in the case of exports and for textiles and transport machinery in the case of imports. Japan's trade with some FTA partners increased (as seen in Section 2), but the trade creation effect of Japan's overall FTAs is not observed for aggregate trade. The coefficients for Japan's overall FTAs in equations without importer/exporter-fixed effects using only Japan's trade data are positive

corresponding year in the WTO's Regional Trade Agreements Database.

13) In the estimation using Japan's trade data only, the number of countries is 104, excluding Japan and Syria because Syria does not have GDP data for the whole period of the analysis. Additionally, some trade flows are dropped due to the availability of GDP data for some years, although not the whole period. Moreover, some observations are dropped for the analysis of Japan's trade by major products using PPML estimations with fixed effects if the corresponding trade data are zero for the whole period. Table A.2 provides summary statistics of our dataset.

14) See Tables A.3-A.5 for the results of estimation.

and statistically significant for both exports and imports (see Table A.3); hence, these findings indicate that most of Japan's FTA partners are likely natural trading partners.[15)]

Table 5. *Summary of the Gravity Estimation's Results for Japan's Overall FTAs*

	Major products								
aggregate	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	
	agriculture	chemical	textile	metal	general	electric	transport	precision	No. of +
a) Exports									
Japan's trade only			+	+					2
World trade				+					1
b) Imports									
Japan's trade only	+	+	+				+	+	5
World trade			+				+		2

Notes. + indicates that the coefficient is positive with statistical significance. The results used here are based on PPML estimations with fixed effects. Different numbers between Japan's trade only and world trade in shadow cells imply that the results using the two datasets are different.
Data: authors' preparation, based on Tables A.3 and A.4.

Second, the impacts of Japan's FTAs on trade at the aggregate level vary among different FTAs (column titled "Aggregate" in Table 6). Some FTAs have trade creation effects, whereas others do not. At the aggregate trade level, no trade creation effect occurred when we treated all of Japan's FTAs equally without distinguishing their FTA partners. However, we detected the trade creation effect for some FTAs when we treated Japan's FTAs with different partners separately. The estimated coefficients for a few FTAs are positive with statistical significance, even if the estimation includes fixed effects. In analyzing world trade data at the aggregate level for 17 FTA partners, we determined that the estimated coefficients on FTAs are positive and statistically significant for 11 and 6 FTA partners for exports and imports, respectively. Japan's FTA partners shown to have the trade creation effect are Australia, Cambodia, Chile, India, Indonesia, Lao PDR, Mexico, Mongolia, Myanmar, and Thailand in the case of exports, and Brunei, Cambodia, Lao PDR, Malaysia, Myanmar, and the Philippines in the case of imports. These findings indicate that Japan's FTAs bilaterally generate the trade creation effect (i.e., both exports and imports) in the case of its FTAs with Cambodia, Lao PDR, and Myanmar, which may result from the small magnitude of trade with these countries. Numerous opportunities exist for trade expansion with these countries. Importantly, the number of FTAs with the trade creation effect is larger when Japan's trade rather than world trade is used for the estimation. These observations indicate that the trade creation effect is incorrectly detected in some cases,

15) For the analysis of Japan's trade only, for instance, Malaysia, the Philippines, and Singapore have positive and statistically significant coefficients in the estimation without fixed effects for both exports and imports, except for the case of imports for Singapore. However, their coefficients in equations with fixed effects become negative with statistical significance, excluding the case of imports for Malaysia. This suggests that Japan's trade with these countries increased after the enactment of FTAs but not for the levels beyond the natural trading partners.

Table 6. *Summary of the Gravity Estimation's Results for Individual Japan's FTA Partners*

FTA partners	Aggregate		Major products																	
			Japan's trade only									World trade								
	Japan's trade only	World trade	(1) agriculture	(2) chemical	(3) textile	(4) metal	(5) general	(6) electric	(7) transport	(8) precision	No. of +	(1) agriculture	(2) chemical	(3) textile	(4) metal	(5) general	(6) electric	(7) transport	(8) precision	No. of +
a) Exports																				
Australia	+	+		-	-	+	-	-	-		1		-		+	-	-		-	1
Brunei	+		-	+	-	+	+	+			4				+	-		-		
Cambodia	+	+	-	+	+	-	+	+	+	+	6		+	+			+	+	+	5
Chile	+	+		+	+	+	+	+	+	+	7		+		+	+	-		-	
India	+	+	-	+	+	+	+	+		+	6	-	+	+	+	+	+	+	+	7
Indonesia	+	+	-	+	+	+	+	+	-	+	6	-			+		+	-	+	3
Laos		+	-	-	+	-	+	+	-	-	3	-	-	+	-	+	+	+	+	5
Malaysia	-	-	+	-	+	-	-	-	-		2		-		-	-				0
Mexico	+	+		+	+	+	+	+	+	+	7			+	+	+	+	+	+	6
Mongolia		+	-	+	+	-	-	-		-	2	-	+	+	-	+	-	+	+	5
Myanmar	+	+		-	+	-	-	-	+	-	2			+				+	+	3
Peru	+			+		+	+		-	+	4		+	-	+		-	-		2
Philippines	-		-	-	-	-	-	-	-	-	0				+	-		-	-	1
Singapore	-	-	-	-	-	-	-	-	-	-	0		-				-	-	-	0
Switzerland	+		+	+	+		+	+	-	+	6	+	+	+		+		-		4
Thailand	+	+			+	+	+	+	+	+	6				+	+	+		+	4
Vietnam	+	+	+	+	+	+	+	+	-	+	7	-	+		+	+		+		4
No. of +	12	11	3	10	12	9	11	10	5	9	69	1	7	7	10	8	6	7	8	54
b) Imports																				
Australia	+				-	-	-				0					-		+		1
Brunei	+	+	+	+	-	-	-	+	-	-	3	+	+	-	-	-			+	3
Cambodia	+	+	+	+	+	+	-	+	+		6	-	+	+	+	-	+		-	4
Chile	+		+	-	+	-		+	-		3		-	+			+	+		3
India	+			+			+		+	+	4	-	+	+		+		+		4
Indonesia	-		-	+	+		+		+		4	-		+	-	+	+	+		4
Laos	+	+	+	+	+	+	+	+	+	+	8	+	+	+	+		+	+	-	6

Table 6. *Continued*

FTA partners	Aggregate		Major products																	
			Japan's trade only									World trade								
	Japan's trade only	World trade	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	
			agriculture	chemical	textile	metal	general	electric	transport	precision	No. of +	agriculture	chemical	textile	metal	general	electric	transport	precision	No. of +
Malaysia		+	+			+	-		+		3	+		+		-		+		3
Mexico	+		+	-		+	+	+	+	+	6	+	-	+	+		+		+	5
Mongolia	-	-	+	-	-	+	+	-		-	3	+			+	+	-	+	-	4
Myanmar	+	+		+	+	-	-	-	-	+	3		+	+	-	-		-		2
Peru	+			-		-		-	+	-	1	-	-	+		-	-		-	1
Philippines	-	+	+			+	-		+		3	+		+	+	-			+	4
Singapore	-		+	+	-	-	-	-			2	+		+	+			-		3
Switzerland	+		+	+			+	+	-		4	+		+		+		-	-	3
Thailand			+	+	+	+	+	+	+	+	8	+		+	+			+	+	5
Vietnam	+	-	+	+	+	+	+	+	+	+	8	-	+			-	-	+	-	2
No. of +	11	6	12	10	7	8	8	8	10	6	69	9	6	13	7	4	5	9	4	57

Notes. + (-) indicates that the coefficient is positive (negative) with statistical significance. The results used here are based on PPML estimations with fixed effects. Different numbers between Japan's trade and world trade in shadow cells imply that the results using the two datasets are different. The detailed results by major products for Japan's trade only are available upon request.
Data: authors' preparation, based on Tables A.3 and A.5.

where analysis does not consider third-country trade.

It is interesting to compare the estimation results of the FTAs' impacts on trade with the changes in trade during pre- and post-enactment of FTAs observed in Table 3. Focusing on the changes' direction, that is, the signs of the estimated FTA coefficients and the ratio of the trade pre- and post-FTAs, we found that out of 17 FTA cases, these two indicators are consistent for 12 export cases and six import cases. Considering that the econometric estimation captures the "true" effect, a simple indicator obtained from the changes in the pre- and post-FTA enactment trade leads to an inaccurate assessment of the impacts of FTAs on trade.

Let us look at the results of the estimation based on world trade data for different products by different FTAs (i.e., eight products and 17 FTA partners). For exports, the trade creation effect is detectable for more than 35% of FTAs for seven products, except for agricultural products, for which the trade creation effect is detected for only one FTA. Metal products register the largest number of FTAs (i.e., 10), for which the trade creation effect is detected.

Regarding imports, textiles have the highest number at 13 FTAs with the trade creation effect, followed by transport machinery and agricultural products, both at 9 FTAs. In contrast, general, precision, and electric machineries show lower numbers at four or five FTAs. These findings appear reasonable as textiles and agricultural products, for which many FTAs with the trade creation effect are found, tend to be protected by relatively high MFN tariffs, thus providing importers/exporters an opportunity to benefit from using FTAs. Indeed, Ando and Urata (2018) found that high FTA preferential margin, that is, the difference between MFN and FTA tariff rates, leads to high use of FTAs, thus increasing imports in the case of Japan. Furthermore, they found that the restrictive rules of origin deter the use of FTAs, limiting the import expansion from FTAs.

Overall, the trade creation effect is detectable for approximately 40% of FTAs for both exports (54/136) and imports (57/136) from the analysis of world trade. These values are approximately 10 percentage points lower than those from the estimation using only Japan's trade data at 50% for both exports and imports, indicating the tendency for trade creation effect to be overestimated when the third-country trade is not considered. It implies that some FTA partners increased trade with Japan after the FTA enactment, but they expanded their trade with other countries more significantly, sometimes unilaterally.

Regarding the control variables other than dummy variables for Japan's FTAs in analyzing the data covering Japan's trade, the coefficient for GDP for aggregate exports and imports is positive and statistically significant, as expected (Table A.3). However, it is positive and significant only for agriculture and transport machinery exports and metal imports in major products (Table A.4). It is negative and significant for general machinery imports. As for GDP per capita, the coefficient is statistically significant only for some cases; negative for aggregate imports, positive for electric machinery and precision machinery exports, and chemical, general machinery, electric machinery, and transport machinery imports. The coefficient for the WTO dummy variable is positive and

statistically significant for aggregate trade and trade in most products, as expected.

Regarding dummy variables for other FTAs, customs unions (CUs) and partial scope agreements (PSAs) in analyzing the data covering world trade, only CU shows a significantly positive effect for aggregate trade. PSA and other FTAs are positive and negative, respectively, without statistical significance (Table A.3). For disaggregate major products, we find a trade creation effect for other FTAs (metal products), CUs (chemical and metal products), and PSAs (electric and precision machineries) (Table A.4).

B. The dynamic effects of FTAs

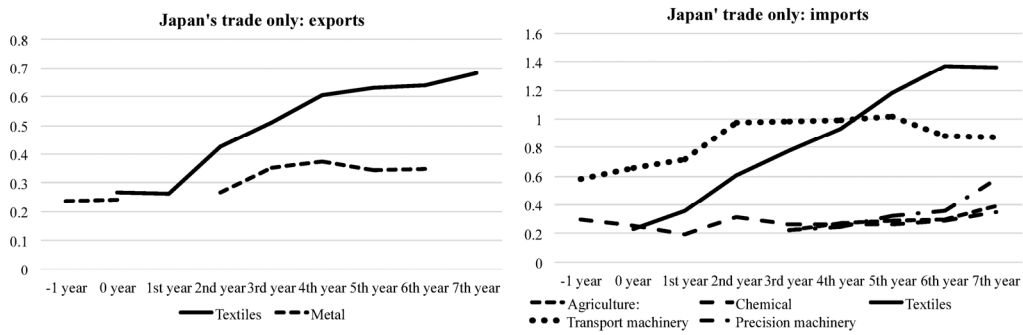
We examine the dynamic effects of FTAs based on the observation that exporting and importing firms may take time to know about FTAs and learn how to use them. Specifically, a firm should prepare documents to obtain the mandatory certificate of origin (COO) to be presented to the importing country's customs, which confirm that the products are produced in the exporting country and satisfy the conditions for preferential treatment. Preparation of a COO requires detailed information about the product, such as the origins of parts and components used for production. In some cases, firms need time to use FTAs because they must change their production methods/processes to satisfy the conditions for COOs. In addition to considering the time required for preparation, dynamic analysis can incorporate the gradual decline in tariff rates under FTAs in the estimation.

Similar to the case of static analysis in the previous section, we conducted a series of PPML estimations with/without fixed effects, including those using aggregate trade data, disaggregate trade data by products, only Japan's trade data, and world trade data covering third-country trade. The dynamic effects are estimated by introducing dummies for the years pre- and post-enactment of FTAs, which take the value of zero for the FTA enactment year and positive numbers indicating the number of years since the FTA enactment.

The dynamic results are presented in Tables A.6, A.7, and A.8. The coefficients for FTA tend to be larger for longer periods since the enactment of FTAs for the equations without fixed effects, suggesting the existence of the dynamic effects of FTAs on aggregate trade (Table A.6). However, no statistically significant result on FTA dummies with time lags is estimated using aggregate trade data with fixed effects.[16] The estimation of disaggregated product-level data yields positive and statistically significant results for some products (Tables A.7 and A.8), which correspond to the cases with statistically significant positive results in Table 5. Figure 1 shows the cases with statistically significant positive results for Japan's trade only, and Figure 2 shows the corresponding cases for world trade.

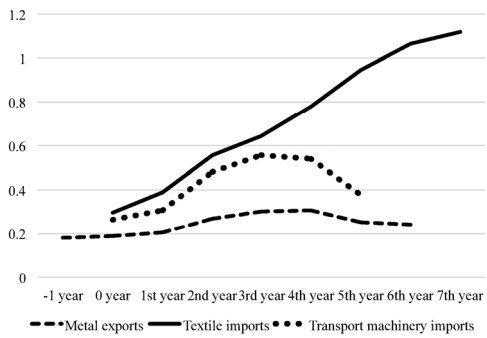
16) Egger et al. (2020) also explored the dynamic effects of FTAs and found that the effects do not appear immediately after FTAs are entered into force. In their estimation, the full impact of FTAs can be reached in about 10 years.

Figure 1. Dynamic effects by major products for Japan's trade only: the case with statistical significance



Note. The products in this figure correspond to those with statistical significance in Table A.4.
Data: authors' preparation, based on Table A.7.

Figure 2. Dynamic effects by major products for world trade: the case with statistical significance



Note. The products in this figure correspond to those with statistical significance in Table A.4.
Data: authors' preparation, based on Table A.8.

Figure 1 shows that the dynamic effect of FTAs on exports continues to expand and is substantial, particularly since the second year for textiles. The effect is rather small for metal products. For metal products, the impact slightly increases through the third year, but it almost stops increasing afterward. Regarding imports, a dynamic effect exists for agricultural products, textiles, chemical products, transport machinery, and precision machinery, in which the effect is most conspicuous for textiles. Although transport machinery also registers a large dynamic effect, the increasing pace over time is slow. The dynamic effect is not large for agricultural, chemical, and precision products.

Moreover, the dynamic effect is found for fewer products from the estimation using world trade data: metals exports and imports of textiles and transport machinery (Figure 2). It is remarkably large for textile imports because its magnitude keeps rising through the seventh year. For transport machinery imports, the dynamic impact notably increases through the third year and then declines. Furthermore, the dynamic effect is detected relatively long for metal

product exports, but its magnitude is rather small.

In some cases, the result shows an announcement effect that the coefficient of the FTA variable for -1 year (one year before the enactment) turns out to be significantly positive. Such cases occur for metals in exports (in the cases of data using Japan's trade and world trade) and chemical products and transport machinery in the case of imports (using Japan's trade data only). These findings may reflect the high monitoring capability of these sectors (or their business organization) regarding the development of FTA trade negotiations.

V. Conclusion

This study used the gravity model estimation to examine if Japan's FTAs contributed to expanding its bilateral trade with FTA partners. We examined the trade data from three aspects: (1) aggregated trade by overall/individual FTA partners (17 FTA partners), (2) disaggregated trade by eight products for overall/individual FTA partners, and (3) aggregated/disaggregated trade from the dynamic perspective. We used two different sets of trade data for the analysis: one consisting of only Japan's trade and the other global trade, including third-country trade. For the analysis from the dynamic perspective, we examined the impacts of Japan's FTAs by incorporating information on the passage of time since the enactment of FTAs.

We did not find any trade creation effect of the overall FTAs at the aggregated product level based on world trade data's estimation results. However, we found the trade creation effect of individual FTAs with some variations among different FTAs. The trade creation effect was found for 11 cases for exports and six cases for imports out of the 17 FTA partners. The results using the data covering only Japan's trade show more trade-enhancing cases of FTAs, that is, 12 and 11 cases for exports and imports, respectively. Hence, the results using the data covering world trade show that ignoring third-country trade leads to overestimating the trade creation effect of FTAs. Furthermore, we found that a simple comparison of trade changes for pre- and post-enactment of FTAs results in an inaccurate evaluation of the impact of FTAs. The analysis results using disaggregated trade data by different FTAs show that metal products for exports and textiles and transport machinery for imports generated a significant trade creation effect in many FTAs. Our dynamic analysis of the impact of FTAs on trade revealed that the trade creation effect for some products increased over time.

Several factors may have led to the ineffectiveness of Japan's FTAs in expanding trade with some FTA partners (or for some products). Exporters or importers' lack of knowledge of FTAs is likely to have resulted in the absence of the trade creation effect of FTAs. Limited or a lack of benefits of using FTAs is another factor limiting the trade creation effect. Traders do not use FTAs unless they expect to increase profits. However, the expected profits are

limited in several cases. For instance, FTA preferential margins are small, and the cost of obtaining the COO, which is mandatory for using FTAs, is high. The cost of obtaining the COOs is high when the rules of origin (ROOs) are restrictive. In an analysis of imports using Japan's trade data, Ando and Urata (2018) found that small preferential margins and restrictive ROOs deter the use of FTAs. Our analysis could be extended by incorporating such information in the global trade database, although obtaining the necessary data for global trade is difficult.

Based on these observations, we can argue that the Japanese government can help exporters and importers use FTAs by providing the necessary information and assistance for the use of FTAs. Furthermore, the Japanese government should apply low or zero FTA tariffs and simplify the procedure for obtaining the COOs to promote Japanese imports through FTAs. In turn, the Japanese government should successfully negotiate with the FTA partner countries to win similar treatment to promote Japanese exports to the FTA partners. Implementing the self-certification system, which has been introduced in recent FTAs (e.g., CPTPP), instead of third-party certification is recommended because of its tendency to reduce the cost of obtaining COOs to realize the trade creation effect.

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Table A.1. *The List of Countries in Our Gravity Model Estimations*

Algeria	Croatia	Iceland	Marshall Isds	Romania	Uruguay
Angola	Cuba	India	Mauritius	Russia	Uzbekistan
Argentina	Czechia	Indonesia	Mexico	Saudi Arabia	Venezuela
Australia	Cote d'Ivoire	Iran	Mongolia	Singapore	Viet Nam
Austria	Congo	Iraq	Morocco	Slovakia	Yemen
Bahrain	Denmark	Ireland	Myanmar	Slovenia	Zambia
Bangladesh	Dominica	Israel	Netherlands	South Africa	
Belarus	Ecuador	Italy	New Zealand	Spain	
Belgium	Egypt	Japan	Nigeria	Sri Lanka	
Brazil	El Salvador	Jordan	Norway	Sweden	
Brunei	Estonia	Kazakhstan	Oman	Switzerland	
Bulgaria	Ethiopia	Kenya	Pakistan	Syria	
Cambodia	Finland	Kuwait	Panama	Thailand	
Canada	France	Laos	Paraguay	Trinidad and Tobago	
Chile	Germany	Latvia	Peru	Tunisia	
China	Ghana	Lebanon	Philippines	Turkey	
Hong Kong	Greece	Liberia	Poland	USA	
Macao	Guatemala	Libya	Portugal	Ukraine	
Colombia	Honduras	Lithuania	Qatar	United Arab Emirates	
Costa Rica	Hungary	Malaysia	Korea	United Kingdom	

Table A.2. *Summary Statistics*

Variables	N	Mean	SD	Max	Min
a) Japan					
Japan's export value (millions US$)	2,271	5,849	18,492	194,568	0.391
Japan's import value (millions US$)	2,271	4,994	14,934	188,500	0.004
GDP (millions US$)	2,271	505,818	1,540,973	16,920,328	129
GDP per capita (US$)	2,271	16,586	18,806	91,617	183
b) World					
Trade value (millions US$)	242,352	954	6,972	504,028	-
FTA (Japan's export)	242,352	0.0005		1	0
FTA (Japan's import)	242,352	0.0005		1	0
FTA (other)	242,352	0.1259		1	0
CU	242,352	0.0497		1	0
PSA	242,352	0.0906		1	0

Table A.3. *The Results for Aggregate Trade: a) Japan's Trade Only and b) World Trade*

a) Japan's trade only									b) World trade			
	i) Overall FTAs				ii) Individual FTA partners					i) Overall FTAs	ii) Individual FTA partners	
	EX	EX	IM	IM	EX	EX	IM	IM			_ex	_im
FTA	1.001***	0.0890	0.693***	0.0662					FTA_ex	0.0695		
									FTA_im	0.0816		
FTA by partner									FTA by partners_ex/_im			
_Australia					0.270	0.121***	1.208***	0.118*	_Australia		0.138*	0.129
_Brunei					-0.707	0.240***	1.987***	0.490***	_Brunei		0.0794	0.593***
_Cambodia					0.222	0.393***	0.377	1.356***	_Cambodia		0.532***	0.837***
_Chile					0.728***	0.564***	1.524***	0.209***	_Chile		0.366***	0.143
_India					-0.389**	0.371***	-1.107***	0.0566*	_India		0.174**	-0.0455
_Indonesia					0.620***	0.505***	0.920***	-0.116*	_Indonesia		0.230**	-0.0520
_Laos					-0.614	-0.0459	-1.285***	0.974***	_Laos		0.512***	0.596***
_Malaysia					1.431***	-0.398***	1.581***	0.0859	_Malaysia		-0.192***	0.329***
_Mexico					0.804***	0.656***	-0.713***	0.316***	_Mexico		0.432***	0.0539
_Mongolia					0.177	0.0349	-3.130***	-1.040***	_Mongolia		0.752***	-0.929***
_Myanmar					0.141	0.593***	-0.666**	0.708***	_Myanmar		1.066***	0.775***
_Peru					0.379*	0.250***	0.418	0.232***	_Peru		0.0458	-0.0229
_Philippines					0.424*	-0.513***	0.419*	-0.201***	_Philippines		-0.0882	0.254**
_Singapore					1.567***	-0.623***	0.516	-0.438***	_Singapore		-0.273***	-0.119
_Switzerland					-0.401**	0.397***	0.184	0.248***	_Switzerland		0.0334	-0.0221
_Thailand					1.906***	0.337***	1.187***	0.126	_Thailand		0.209***	0.0424
_Vietnam					1.758***	0.463***	1.488***	0.422***	_Vietnam		0.234*	-0.202*
lnGDP	0.874***	0.952**	0.778***	0.881***	0.892***	1.296***	0.801***	0.925***	FTA_others	-0.0310		-0.0310
lnGDPpc	0.164*	-0.0361	0.0851	-0.329***	0.140	-0.297	0.0623	-0.337***	CU	0.104*		0.104*
WTO	0.504***	0.499***	-0.0168	0.478***	0.514***	0.419***	-0.0157	0.435***	PSA	0.0781		0.0786

Table A.3. *Continued*

a) Japan's trade only									b) World trade			
	i) Overall FTAs				ii) Individual FTA partners					i) Overall FTAs	ii) Individual FTA partners	
	EX	EX	IM	IM	EX	EX	IM	IM			_ex	_im
lnDistance	-0.949***		-0.836***		-0.919***		-0.806***					
									Observations	242,352		242,352
Observations	2,271	2,271	2,271	2,271	2,271	2,271	2,271	2,271	Exporter-year fixed effects	Yes		Yes
IM/EX fixed effects	No	Yes	No	Yes	No	Yes	No	Yes	Importer-year fixed effects	Yes		Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Exporter-importer fixed effects	Yes		Yes

Notes. ***, **, and * indicate 1%, 5%, and 10% significance, respectively. t statistics are omitted but are available upon request. Standard error is clustered by countries for Japan's trade only and by country-pairs for world trade. EX and IM denote exports and imports. IM/EX fixed effects are importer/exporter fixed effects for the equations of exports/imports.
Data: authors' estimation.

Table A.4. *The Results for Overall FTAs and Major Products: a) Japan's Trade Only and b) World Trade*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	agriculture	chemical	textile	metal	general	electric	transport	precision
a) Japan's trade only								
1: exports								
FTA	-0.0898	0.0209	0.497***	0.251**	0.111	0.0732	-0.0188	0.348
lnGDP	0.949*	0.424	0.000518	0.513	0.377	-0.616	2.111***	-0.382
lnGDPpc	-0.666	0.391	-0.0741	0.00617	0.346	1.593*	-0.372	1.541*
WTO	0.0387	0.523***	0.378***	0.443***	0.627***	0.710***	0.319***	0.644***
Observations	2,271	2,271	2,271	2,271	2,271	2,271	2,271	2,271
2: imports								
FTA	0.216**	0.222***	0.769***	0.154	0.0995	0.143	0.801***	0.227*
lnGDP	-0.364	-0.325	1.153	1.192**	-4.400***	-0.314	-0.575	0.932
lnGDPpc	0.385	1.096**	-0.475	-0.148	5.363***	1.860**	1.836*	-0.481
WTO	0.186**	0.332***	0.587***	0.122	1.351***	0.545***	0.698***	0.475***
Observations	2,249	2,227	2,271	2,271	2,249	2,271	2,209	2,271
b) Word trade								
FTA_ex	-0.199	0.0316	0.0659	0.207**	0.00365	0.0289	0.0111	0.148
FTA_im	0.0523	2.07e-05	0.708***	0.0626	-0.129	-0.0866	0.314***	-0.0239
FTA_others	-0.0544*	-0.0229	-0.161**	0.0942***	-0.0931	-0.202**	0.00596	-0.0582
CU	0.623***	0.173***	-0.405***	0.201***	-0.0696	-0.327***	0.107	-0.182*
PSA	-0.194**	-0.0171	-0.411***	-0.0628	0.142	0.347***	-0.362**	0.650***
Observations	233,684	234,454	233,596	230,076	232,892	231,110	224,510	222,288

Notes. ***, **, and * indicate 1%, 5%, and 10% significance, respectively. t statistics are omitted but are available upon request. Standard error is clustered by countries for Japan's trade only and by country-pairs for world trade.Fixed effects are included; Importer-year fixed effects for a1), exporter-year fixed effects for a2), and exporter-year fixed effects, importer-year fixed effects, and exporter-importer fixed effects for (b).

Data: authors' estimation.

Table A.5. *The Results for Individual FTA Partners and Major Products: World Trade*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	agriculture	chemical	textile	metal	general	electric	transport	precision
FTA by partner								
_Australia_ex	0.0134	-0.135*	-0.276	0.361***	-0.278***	-0.591***	0.00245	-0.0971**
_Brunei_ex	-0.0114	0.236	-0.195	0.648***	-0.574***	0.0124	-0.437**	0.381
_Cambodia_ex	-0.0733	1.036***	0.538**	0.106	0.0478	0.452*	1.051**	1.307***
_Chile_ex	-0.162	0.453***	0.0416	0.809***	0.115*	-0.297**	0.0282	-0.105**
_India_ex	-0.610***	0.153**	0.487**	0.457***	0.181***	0.257***	0.505***	0.207***
_Indonesia_ex	-0.836***	0.128	-0.368	0.396***	0.0610	0.346**	-0.387***	0.448***
_Laos_ex	-0.772***	-0.659***	2.595***	-0.807***	0.426***	0.642***	1.282***	0.384**
_Malaysia_ex	0.200	-0.265**	0.302	-0.261***	-0.250**	-0.0581	-0.196	-0.0539
_Mexico_ex	-0.0833	0.139	0.653**	0.509***	0.263***	0.436**	1.030***	0.967***

Table A.5. *Continued*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	agriculture	chemical	textile	metal	general	electric	transport	precision
_Mongolia_ex	-0.259**	0.683***	3.278***	-0.197***	0.191**	-0.964***	1.693***	0.518***
_Myanmar_ex	0.0549	-0.111	1.388***	0.117	-0.0492	0.115	1.838***	0.464**
_Peru_ex	-0.121	0.403***	-0.613**	0.237**	-0.0785	-0.455***	-0.471***	-0.00377
_Philippines_ex	-0.0640	0.116	-0.0611	0.408*	-0.456***	0.0678	-0.326**	-0.730***
_Singapore_ex	-0.120	-0.312***	0.276	0.0252	-0.171	-0.348***	-0.567***	-0.331***
_Switzerland_ex	0.653***	0.176*	0.615**	-0.0183	0.383***	0.0169	-0.128*	0.00994
_Thailand_ex	-0.179	0.0714	0.344	0.215**	0.222**	0.356***	-0.168	0.417***
_Vietnam_ex	-0.577***	0.436***	-0.262	0.333**	0.212*	-0.306	0.413**	0.0356
_Australia_im	0.00486	0.114	-0.452	-0.102	-0.432***	0.0399	0.546***	0.0423
_Brunei_im	2.701***	3.560***	-1.424***	-2.500***	-4.046***	-0.0920	-0.641	1.260*
_Cambodia_im	-0.578**	4.138***	2.797***	2.564***	-1.730***	1.602**	0.315	-2.235***
_Chile_im	-0.000514	-0.308***	1.381***	-0.238	-0.0220	0.793***	0.606**	-0.549
_India_im	-0.435***	0.330***	0.204*	0.0981	0.193***	0.00788	0.834***	0.0787
_Indonesia_im	-0.551***	0.0568	0.945***	-0.232***	0.398***	0.173**	0.384**	0.0222
_Laos_im	2.496***	2.731***	3.138***	2.373***	0.0752	2.693***	6.953***	-1.054***
_Malaysia_im	0.534***	-0.0818	1.211***	-0.00417	-0.510***	-0.0298	0.592***	-0.158
_Mexico_im	0.118**	-0.439***	0.780***	0.129*	-0.0485	0.186***	-0.0280	1.295***
_Mongolia_im	1.205***	0.101	0.450	0.562*	1.942***	-1.622***	-1.055*	-1.031**
_Myanmar_im	0.180	2.390***	2.660***	-1.547**	-1.548***	-0.0474	-2.473***	-0.202
_Peru_im	-0.333*	-0.737***	0.250**	-0.307	-0.468***	-1.679***	0.0988	-0.773**
_Philippines_im	0.202***	-0.0327	0.812***	0.870***	-0.302*	0.151	0.442	0.220**
_Singapore_im	0.598***	0.0507	0.284*	0.317***	-0.127	-0.245	-0.296*	0.0947
_Switzerland_im	1.350***	0.0193	0.310**	0.00762	0.159***	0.0767	-0.386***	-0.199***
_Thailand_im	0.219***	-0.0828	1.076***	0.404***	-0.000197	-0.0524	0.309***	0.178**
_Vietnam_im	-0.274***	0.232**	0.0344	-0.0968	-0.741***	-1.875***	0.727***	-0.530***
FTA_others	-0.0566*	-0.0227	-0.164**	0.0926***	-0.0940	-0.208**	0.00456	-0.0628
CU	0.621***	0.174***	-0.408***	0.201***	-0.0708	-0.332***	0.106	-0.185*
PSA	-0.191**	-0.0169	-0.412***	-0.0647	0.139	0.348***	-0.321*	0.642***
Observations	233,684	234,454	233,596	230,076	232,892	231,110	224,510	222,288

Notes. ***, **, and * indicate 1%, 5%, and 10% significance, respectively. t statistics are omitted but are available upon request. Standard error is clustered by country-pairs. Exporter-year fixed effects, importer-year fixed effects, and exporter-importer fixed effects are included.

Data: authors' estimation.

Table A.6. *The Results for Dynamic Effects on Aggregate Trade: a) Japan's Trade Only and b) World Trade*

a) Japan's trade only					b) World trade		
	EX	EX	IM	IM		_ex	_im
FTA					FTA_ex/_im		
_ -1 year (before 1 year)	0.640***	0.0365	0.756***	0.115	_ -1 year (before 1 year)	0.00844	0.104*
_ 0 year (effective date)	0.704***	0.0696	0.653**	0.0716	_ 0 year (effective date)	0.0385	0.0719
_1st year	0.716***	0.0780	0.651***	0.0616	_1st year	0.0796	0.0593
_2nd year	0.858***	0.128	0.597**	0.0802	_2nd year	0.0974	0.0742
_3rd year	0.945***	0.149	0.672***	0.0864	_3rd year	0.0895	0.0757
_4th year	0.996***	0.155	0.698***	0.0688	_4th year	0.116	0.0996
_5th year	1.189***	0.125	0.907***	0.0885	_5th year	0.0733	0.135
_6th year	1.168***	0.114	0.927***	0.136	_6th year	0.0719	0.145
_7th year and after	1.356***	-0.00215	0.715**	0.0950	_7th year and after	0.0327	0.144
lnGDP	0.880***	0.990**	0.782***	0.883***	FTA_others		-0.0312
lnGDPpc	0.163*	-0.0711	0.0917	-0.330***	CU		0.104*
WTO	0.500***	0.494***	-0.0365	0.482***	PSA		0.0786
lnDistance	-0.952***		-0.841***				
					Observations		242,352
Observations	2,271	2,271	2,271	2,271	Exporter-year fixed effects		Yes
IM/EX fixed effects	No	Yes	No	Yes	Importer-year fixed effects		Yes
Year fixed effects	Yes	Yes	Yes	Yes	Exporter-importer fixed effects		Yes

Notes. ***, **, and * indicate 1%, 5%, and 10% significance, respectively. t statistics are omitted but are available upon request. Standard error is clustered by countries for Japan's trade only and by country-pairs for world trade. EX and IM denote exports and imports. IM/EX fixed effects are importer/exporter fixed effects for the equations of exports/imports.

Data: authors' estimation.

Table A.7. *The Results for Dynamic Effects on Trade by Major Products: Japan's Trade Only*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	agriculture	chemical	textile	metal	general	electric	transport	precision
a) Exports								
FTA								
_ -1 year	0.205**	0.00685	0.119	0.237**	0.0134	0.0404	-0.157	0.127
_ 0 year	0.0677	0.00827	0.268**	0.240**	0.0476	0.0385	-0.115	0.246
_1st year	-0.137	-0.0288	0.262**	0.172	0.0777	0.0684	-0.110	0.299
_2nd year	-0.216*	0.0386	0.424***	0.269*	0.0648	0.0770	0.0637	0.381
_3rd year	-0.179	0.0815	0.513***	0.355**	0.135	0.128	0.0151	0.366*
_4th year	-0.0233	0.0799	0.607***	0.374**	0.230	0.107	0.0228	0.520**
_5th year	0.0315	0.0282	0.630***	0.346**	0.164	0.0818	0.0852	0.357
_6th year	0.0111	0.0321	0.638***	0.349**	0.150	0.134	-0.0177	0.396
_7th year and after	-0.0579	-0.0431	0.681***	0.285	0.0759	0.0368	-0.110	0.371

Table A.7. *Continued*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	agriculture	chemical	textile	metal	general	electric	transport	precision
lnGDP	0.917	0.458	-0.0324	0.498	0.383	-0.589	2.121***	-0.428
lnGDPpc	-0.633	0.358	-0.0342	0.0278	0.339	1.566	-0.380	1.585
WTO	0.0336	0.521***	0.375***	0.446***	0.628***	0.709***	0.315***	0.647***
Observations	2,271	2,271	2,271	2,271	2,271	2,271	2,271	2,271
b) Imports								
FTA								
_ -1 year	0.0346	0.299***	0.140	0.0649	0.0485	0.131	0.580***	0.0423
_ 0 year	0.0874	0.253***	0.230*	0.0411	0.00914	0.0877	0.654***	0.0476
_1st year	0.164	0.192***	0.355**	0.0967	-0.00195	0.108	0.717***	0.130
_2nd year	0.176	0.311***	0.605***	0.190	0.0676	0.130	0.978***	0.166
_3rd year	0.221**	0.265***	0.777***	0.257	0.120	0.207	0.982***	0.223*
_4th year	0.270**	0.259***	0.934***	0.176	0.113	0.210	0.995***	0.241*
_5th year	0.287**	0.261***	1.182***	0.223	0.186	0.203	1.014***	0.324**
_6th year	0.296**	0.284**	1.366***	0.196	0.245**	0.280	0.880***	0.357**
_7th year and after	0.392***	0.347**	1.364***	0.238	0.231*	0.275	0.873***	0.583***
lnGDP	-0.471	-0.473	0.315	1.175**	-4.734***	-0.724	-0.702	0.271
lnGDPpc	0.478	1.234***	0.460	-0.135	5.706***	2.285**	1.949*	0.172
WTO	0.194**	0.345***	0.520***	0.128	1.341***	0.531***	0.700***	0.473***
Observations	2,249	2,227	2,271	2,271	2,249	2,271	2,209	2,271

Notes. ***, **, and * indicate 1%, 5%, and 10% significance, respectively. t statistics are omitted but are available upon request. Standard error is clustered by countries. Importer fixed effects and year fixed effects are included for exports, and exporter fixed effects and year fixed effects are included for imports.
Data: authors' estimation.

Table A.8. *The Results for Dynamic Effects on Trade by Major Products: World Trade*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	agriculture	chemical	textile	metal	general	electric	transport	precision
FTA								
_ -1 year_ex	0.140	0.0424	-0.167	0.179***	-0.111*	0.0373	-0.0148	0.0221
_ 0 year_ex	-0.0476	0.0155	-0.0729	0.186**	-0.0794	0.0571	-0.0294	0.127
_1st year_ex	-0.245	0.0205	-0.0719	0.201**	-0.0158	0.0734	-0.0236	0.113
_2nd year_ex	-0.345**	0.0593	0.0260	0.266***	-0.0111	0.107	0.0950	0.194
_3rd year_ex	-0.310*	0.0848	0.141	0.301***	0.0230	0.0373	-0.0301	0.150
_4th year_ex	-0.193	0.100	0.140	0.307***	0.0655	0.00596	-0.0349	0.303**
_5th year_ex	-0.110	0.0568	0.112	0.254**	0.0141	-0.0121	0.00349	0.142
_6th year_ex	-0.105	0.0424	0.0902	0.239*	-0.0229	0.0173	0.00428	0.180
_7th year and after_ex	-0.154	-0.0347	0.0145	0.197	-0.0361	0.00445	0.0807	0.0846
_ -1 year_im	-0.0768	0.144**	0.230	-0.000876	-0.162*	0.0478	0.162	-0.0931
_ 0 year_im	-0.0727	0.115*	0.296*	0.0116	-0.184	0.0229	0.264*	-0.133

Table A.8. *Continued*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	agriculture	chemical	textile	metal	general	electric	transport	precision
_1st year_im	-0.00416	0.0132	0.386**	0.0172	-0.159	-0.0117	0.309*	-0.124
_2nd year_im	-0.0670	0.0274	0.555***	-0.0233	-0.0586	-0.0429	0.478***	-0.0829
_3rd year_im	-0.00804	-0.0673	0.642***	0.119	-0.0676	-0.0913	0.553***	-0.0354
_4th year_im	0.0837	-0.0401	0.778***	0.0705	-0.150	-0.0957	0.541***	-0.0628
_5th year_im	0.0995	-0.0160	0.945***	0.105	-0.167	-0.124	0.375***	-0.000722
_6th year_im	0.129	0.0139	1.066***	0.106	-0.166	-0.131	0.205	0.0201
_7th year and after_im	0.247**	0.125	1.119***	0.153	-0.198	-0.126	0.172	0.119
FTA_others	-0.0562*	-0.0227	-0.163**	0.0946***	-0.0935	-0.202**	0.00536	-0.0579
CU	0.621***	0.173***	-0.406***	0.202***	-0.0696	-0.327***	0.107	-0.182*
PSA	-0.193**	-0.0163	-0.412***	-0.0608	0.141	0.347***	-0.361**	0.651***
Observations	233,684	234,454	233,596	230,076	232,892	231,110	224,510	222,288

Notes. ***, **, and * indicate 1%, 5%, and 10% significance, respectively. t statistics are omitted here but are available upon request. Standard error is clustered by country-pairs.Exporter-year fixed effects, importer-year fixed effects, and exporter-importer fixed effects are included.

Data: authors' estimation.