The Economic and Environmental Impacts of a Free Trade Area of the Asia-Pacific

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Abstract

The formation of the Free Trade Area of the Asia-Pacific (FTAAP) would not only have a huge economic impact but also a significant environmental impact for Asia-Pacific Economic Cooperation members and the world. Several studies have addressed the economic impact of the FTAAP; however, no studies have examined the impact of the FTAAP on greenhouse gas (GHG) emissions. The purpose of this paper is to answer the following question: Does the FTAAP increase GHG emissions? In answering this question, the potential impact of GHG emissions caused by trade liberalization, assuming the complete removal of all import tariffs among the FTAAP members, was estimated using the Global Trade Analysis Project (GTAP) model, the GTAP CO2 emissions database, and the GTAP non-CO2 emissions database. Under the assumption of the complete removal of all import tariffs among the FTAAP members, our results indicate that the FTAAP is likely to increase the total amount of GHG emissions by the FTAAP members and the world.

Keywords: FTAAP, Greenhouse gas, Climate change, GTAP

JEL classification codes: F18, F15, C68

Introduction

The 21 members of the Asia-Pacific Economic Cooperation (APEC) account for approximately 40% of the world population, 55% of world GDP, and 44% of world trade. In November 2009, the APEC leaders agreed to explore a range of possible pathways to achieving the Free Trade Area of the Asia-Pacific (FTAAP) at a meeting in Singapore (APEC, 2010).

The formation of the FTAAP would not only have a huge economic impact but also a significant environmental impact for APEC members and the world. The environmental impact of a regional free trade agreement (FTA) is an empirical question (Thomassin & Mukhopadhyay, 2008). Several studies have addressed the economic impact of the FTAAP (e.g., Lee & Itakura, 2014; Kawasaki, 2010; Kim, Park and Park, 2013). Kim, Park and Park (2013) assessed the economic impact of the FTAAP using several computable general equilibrium models including a static Global Trade Analysis Project (GTAP) model. Lee & Itakura (2014) examined several sequences of region-wide FTAs in the Asia-Pacific region

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using a dynamic GTAP model. Kawasaki (2010) discussed the impact of the FTAAP at the macro and sectoral levels using a modified static GTAP model. Several previous studies analyzed the environmental impact of trade liberalization on greenhouse gas (GHG) emissions (e.g., Akahori, Sawauchi and Yamamoto, 2016; Gumilang, Mukhopadhyay and Thomassin, 2011; Liu et al., 2012; Mukhopadhyay & Thomassin, 2010; Saunders, Wreford and Cagatay, 2006; Thomassin & Mukhopadhyay, 2008; Verburg et al., 2009). Akahori, Sawauchi and Yamamoto (2016) showed that the Regional Comprehensive Economic Partnership (RCEP)—which is one of the mega FTAs in the Asia-Pacific region—is likely to increase both RCEP members and global GHG emissions. However, no studies have examined the environmental impact on GHG emissions caused by the FTAAP.

The purpose of this paper is to contribute to the debate over trade and the environment by asking: Does the FTAAP increase GHG emissions? In answering this question, the potential impact of GHGs caused by trade liberalization, assuming the complete removal of all import tariffs among the FTAAP members, was estimated using the GTAP model (Hertel, 1997) and the GTAP CO_2 emissions database (Lee, 2008), and the GTAP non-CO_2 emissions database (Ahmed et al., 2014).

Methods and Data

In comparing our results with those of the RCEP, which is one of the mega FTAs in the Asia-Pacific region (Akahori, Sawauchi and Yamamoto, 2016), we used the same method, data, and trade liberalization scenario as Akahori, Sawauchi and Yamamoto (2016) to measure the potential impact of GHG emissions caused by trade liberalization under the FTAAP. First, the GTAP model was used to estimate the changes in the corresponding GTAP economic variables caused by the FTAAP, such as the levels of sectoral fuel consumption. Second, the GTAP results, the GTAP CO_2 emissions database, and the GTAP non-CO_2 emissions database were used to estimate the potential impact of GHG emissions caused by the FTAAP.

To estimate the economic impact of the FTAAP, we used the standard static version of the GTAP model and the GTAP 9a database for 2011. Our trade liberalization scenario assumed the complete removal of all import tariffs among the FTAAP members. While it is unlikely that all FTAAP members would simultaneously remove all import tariffs across all sectors, our scenario provides an upper bound on the possible economic impact of the FTAAP.

Table 1 shows the regions and sectors used in our analysis. To compare our results with other mega FTAs such as the RCEP, we combined the 140 countries and regions in GTAP 9a into 27 regions and retained the original 57 industries in the database.

We measured the environmental impact of the FTAAP by focusing only on GHG emissions as the form of environmental load because of data availability limitations. We used the GTAP CO_2 emissions database and GTAP non-CO_2 emissions database to measure the impact of the FTAAP on GHG emissions.

The GTAP CO_2 emissions database provided detailed emissions data only from the combustion of fossil fuels, with the CO_2 emission levels calculated by multiplying the amount of fuel consumed by emission coefficients (Lee, 2008). We assumed that these emission coefficients remain unchanged following trade liberalization and that the levels of CO_2 emissions will therefore change by the same proportion as the levels of sectoral fuel consumption. Thus, we calculated the post-FTAAP levels of CO_2 emissions by multiplying the initial level of CO_2 emissions for each sector by the corresponding change in sectoral fuel consumption from the GTAP model results. For example, CO_2 emissions produced by coal use in the electricity sector were calculated by multiplying the initial levels of CO_2 emissions resulting from coal use in the electricity sector by the change in coal use in the electricity sector derived from the GTAP results.

The GTAP non-CO_2 emissions database enabled us to measure methane (CH_4), nitrous oxide (N_2O), and fluorinated GHGs (or F-gases) (namely, tetrafluorocarbon, hydrofluorocarbons, and sulfur hexafluoride) (Ahmed et al., 2014). In this database, the levels of each type of non-CO_2 emission are associated with the output, endowment use, and input use by industry and private households (Rose & Lee, 2009). We assumed that the levels of non-CO_2 gases change by the same proportion as the corresponding GTAP variables. This assumption allows us to calculate the post-FTAAP level of non-CO_2 gases by multiplying the initial level of non-CO_2 emissions by the corresponding sectoral changes derived from the GTAP results. For example, the paddy rice sector emits CH_4. We can then calculate the post-FTAAP level of CH_4 emissions from land use in the paddy rice sector by multiplying the initial CH_4 emissions by the change in land use for paddy rice derived from the GTAP results.

Table 2 shows the data on anthropogenic fossil fuel combustion CO_2 and all non-CO_2 GHG emissions. All emission figures were converted to million metric tons (Mt) of CO_2 equivalent. Globally, about 70% of all GHG emissions are from CO_2 emissions and about 30% are from non-CO_2 emissions. China is the largest GHG emitter in the world. Of the APEC economies, only the Philippines, Vietnam, and New Zealand emit more non-CO_2 emissions than CO_2 emissions.

Figures 1–3 show the sectoral shares of global CO_2 emissions, non-CO_2 emissions, and all GHG emissions, respectively. The electricity sector accounts for 51.2% of global CO_2 emissions. In contrast, agricultural sectors (defined as the agricultural sectors from paddy rice to wool and silkworm cocoons, which correspond to sectors 1 to 12 in Table 1) account for 45% of global non-CO_2 emissions. Globally, 15.5% of all GHG emissions are from the agricultural sector and 34.8% are from the electricity sector.

Results

Under the assumption of the complete removal of all import tariffs among the FTAAP members, the FTAAP is likely to increase the aggregated real GDP, total exports, and total imports of the FTAAP members, which will increase by 0.17%, 3.31%, and 4.38%, respectively (Table 3). Non-FTAAP economies are likely to experience a decrease in real GDP.

In percentage terms, the increases in Vietnam are the highest: 1.24% in GDP, 6.46% in total exports, and 13.61% in total imports.

Kim, Park and Park (2013) showed that the FTAAP is likely to produce an increase in real GDP, exports, and imports. Kawasaki (2010) also showed that the real GDP of all APEC economies would increase under the FTAAP. Akahori, Sawauchi and Yamamoto (2016) showed that the RCEP is likely to have stronger positive growth in real GDP than suggested by our FTAAP results.

In Tables 4–6, we focus on Japan, China, and the United States (US) as the three largest FTAAP members (in terms of real GDP), Australia and New Zealand given that they have the highest and second highest growth rates in non-CO_2 emissions, and India and the European Union (EU) as key non-FTAAP member economies throughout the following discussion.

Table 4 shows the sectoral output changes in percentage terms. Among the FTAAP participants, farm output (defined as agricultural sectors from paddy rice to wool and silkworm cocoons, which correspond to sectors 1 to 12 in Table 1) declines in Japan and China, but increases in Australia, New Zealand, and the US. In percentage terms, the declines in output from the paddy rice sector (−34.26%) and the wheat sector (−33.61%) are the two largest sectoral output changes in Japan. In contrast, the rate of growth in paddy rice production is more than 10% in Australia (13.51%) and the US (17.35%). Livestock sector output decreases in Japan, but increases in Australia, New Zealand, and the US. In particular, the increase in output of the wool, silkworm cocoons sector is the largest for all sectors in Australia and the US, and that of the raw milk sector is the largest for all sectors in New Zealand. The output of the electricity sector, one of the largest sources of CO_2 emissions, increased in Japan and the US, but decreased in China, Australia, and New Zealand.

Lee & Itakura (2014) showed that agriculture and food sector outputs in Japan decrease and that livestock and food sector outputs in the US increase under the FTAAP. Kawasaki (2010) also showed that agriculture, forestry, and fish production decrease in Japan and increase in the US under the FTAAP. Compared with the results of the RCEP (Akahori, Sawauchi and Yamamoto, 2016), the FTAAP has a more severe impact on Japanese agriculture than the RCEP.

Table 5 shows the impact of the FTAAP on GHG emissions. All figures are in million metric tons (Mt) of CO_2 equivalent. The FTAAP increases the total FTAAP member and global GHG emissions by 34.29 Mt CO_2 eq. (0.14%) and 47.88 Mt CO_2 eq. (0.12%), respectively. As for our main research question, these results indicate that the FTAAP is likely to ‘increase’ both FTAAP member and global GHG emissions. Akahori, Sawauchi and Yamamoto (2016) also showed that the RCEP is likely to increase total RCEP member and global GHG emissions.

Total FTAAP member and global CO_2 emissions increase by 10.81 Mt CO_2 eq. (0.06%) and 26.34 Mt CO_2 eq. (0.09%), respectively. Total FTAAP member and global non-CO_2 emissions increase by 23.48 Mt CO_2 eq. (0.39) and 21.53 Mt CO_2 eq. (0.17%), respectively. Among the non-FTAAP members, the total GHG emissions of India and the EU increase by 2.38 Mt CO_2 eq. (0.08%) and 8.62 Mt CO_2 eq. (0.18%), respectively.

Focusing on individual economy results, in terms of CO_2 emissions, China experiences the largest decrease (−6.66 Mt CO_2 eq.) among all economies, while Japan experiences the largest increase (6.45 Mt CO_2 eq.). In terms of non-CO_2 emissions, Japan experiences the largest decrease (−4.31 Mt CO_2 eq.) among all economies, while the US experiences the largest increase (16.03 Mt CO_2 eq.). In percentage terms, New Zealand has the largest increase in non-CO_2 emissions (7.77%) and Australia has the second largest increase in non-CO_2 emissions (2.99%), while Japan has the largest decrease in non-CO_2 emissions (−4.77%).

Table 6 identifies the sectors that contribute the most in terms of the absolute changes in CO_2, CH_4, and N_2O emissions. We omitted F-gases from the table because relatively few sectors emit these GHGs. In the case of CO_2 emissions, the most common sectors are electricity and transport for all seven economies followed by ferrous metals. Electricity is the sector that contributes the most to changes in CO_2 emissions in four out of seven economies. As Figure 1 shows, electricity is the largest CO_2-emitting sector, which is why it has a relatively small rate of change compared with the other top five sectors.

In the case of CH_4 and N_2O emissions, the common sectors for all of the economies are paddy rice and livestock industries. CH_4 emissions in these sectors decrease in Japan, while they increase in China, Australia, New Zealand, and the US. Regarding both CH_4 and N_2O emissions, three or more of the top five emitting sectors in each economy are agricultural sectors. This result indicates that the changes in non-CO_2 emissions are caused mainly by agriculture.

As Table 5 shows, the increase in non-CO_2 emissions contributes greatly to the increase in total FTAAP member and global GHG emissions. However, as Figure 3 shows, agriculture accounts for only 19% of global GHG emissions. These facts suggest that agriculture plays a key role in the changes in GHG emissions caused by the FTAAP in spite of its relatively small composition ratio of global GHG emissions.

Thomassin & Mukhopadhyay (2008) analyzed the impact of a regional trade agreement between six East Asian countries (Japan, Korea, China, Indonesia, Thailand, and Vietnam) on GHG emissions. They obtained similar results to us: electricity is one of the most affected sector for CO_2 emissions, and paddy rice and livestock industries are one of the most affected sectors for CH_4 and N_2O emissions in each country. Akahori, Sawauchi and Yamamoto (2016) also showed that the RCEP is likely to increase CO_2 emissions in the nonagricultural sectors in each economy and increase CH_4 and N_2O emissions substantially in the Australian cattle sector.

Conclusions

The purpose of this paper is to contribute to the debate over trade and the environment by asking: Does the FTAAP increase GHG emissions? In order to answer this question, the potential impact of GHGs from trade liberalization among the FTAAP members is examined using the GTAP model and the GTAP CO_2 and non-CO_2 emissions databases. Our scenario assumed the complete removal of all import tariffs among the FTAAP members.

The economic results show that aggregate real GDP, total exports, and total imports of the FTAAP members increase and that agricultural output declines in Japan and China but increases in Australia, New Zealand, and the US.

As for our main research question, the environmental results indicate that the FTAAP is likely to increase the total amount of GHG emissions by the FTAAP members and the world. The results also suggest that agriculture plays a key role in the changes in GHG emissions caused by the FTAAP.

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Table 1 Regions and sectors

Region	Sector	
1 Japan	1 Paddy rice	30 Wood products
2 Korea	2 Wheat	31 Paper products, publishing
3 China	3 Cereal grains nec	32 Petroleum, coal products
4 Indonesia	4 Vegetables, fruit, nuts	33 Chemical, rubber, plastic prods
5 Malaysia	5 Oil seeds	34 Mineral products nec
6 Philippines	6 Sugar cane, sugar beet	35 Ferrous metals
7 Singapore	7 Plant-based fibers	36 Metals nec
8 Thailand	8 Crops nec	37 Metal products
9 Vietnam	9 Cattle, sheep, goats, horses	38 Motor vehicles and parts
10 Cambodia	10 Animal products nec	39 Transport equipment nec
11 Laos	11 Raw milk	40 Electronic equipment
12 Brunei	12 Wool, silkworm cocoons	41 Machinery and equipment nec
13 Other ASEAN countries	13 Forestry	42 Manufactures nec
14 India	14 Fishing	43 Electricity
15 Australia	15 Coal	44 Gas manufacture, distribution
16 New Zealand	16 Oil	45 Water
17 United States	17 Gas	46 Construction
18 Canada	18 Minerals nec	47 Trade
19 Mexico	19 Meat: cattle, sheep, goats, horse	48 Transport nec
20 Peru	20 Meat products nec	49 Sea transport
21 Chile	21 Vegetable oils and fats	50 Air transport
22 Hong Kong	22 Dairy products	51 Communication
23 Taiwan	23 Processed rice	52 Financial services nec
24 Russia	24 Sugar	53 Insurance
25 EU27	25 Food products nec	54 Business services nec
26 ROW1	26 Beverages and tobacco products	55 Recreation and other services
27 ROW2	27 Textiles	56 PubAdmin/Defence/Health/Educat
	28 Wearing apparel	57 Dwellings
	29 Leather products	

Note 1: Other ASEAN countries include Myanmar and Timor-Leste. ROW1 includes the remaining Asian economies. ROW2 includes the rest of the world.
Note 2: nec means not elsewhere classified.

Table 2 GHG emissions by region (Mt CO_2 equivalent)

	Non-CO_2 GHGs			All non-CO_2	CO_2	All GHGs
	CH_4	N_2O	F-Gas			
FTAAP members	**4,093**	**1,441**	**457**	**5,992**	**18,308**	**24,299**
Japan	29	25	36	90	1,030	1,120
Korea	30	15	6	51	502	553
China	1,886	615	183	2,684	7,241	9,925
Indonesia	243	88	0	332	387	719
Malaysia	34	18	0	51	203	254
Philippines	69	11	0	80	79	159
Singapore	2	2	3	8	66	74
Thailand	104	29	0	133	242	375
Vietnam	126	22	0	149	127	276
Brunei	5	0	0	5	8	13
Australia	156	107	5	267	380	647
New Zealand	27	15	1	42	32	75
United States	527	285	155	967	5,108	6,075
Canada	105	43	14	162	523	686
Mexico	116	47	9	173	424	597
Peru	30	9	0	39	44	83
Chile	20	10	0	30	80	110
Hong Kong	3	0	0	4	84	87
Taiwan	10	5	4	19	244	263
Russia	571	94	41	706	1,503	2,209
Cambodia	24	5	0	29	5	34
Laos	10	3	0	12	2	14
Other ASEAN countries	85	18	0	103	8	112
India	899	332	18	1,249	1,771	3,020
EU	652	293	158	1,103	3,670	4,773
ROW1	375	136	2	512	293	806
ROW2	2,664	971	36	3,670	4,761	8,431
World	**8,802**	**3,198**	**671**	**12,671**	**28,818**	**41,490**

Source: GTAP 9 CO_2 emissions database and non-CO_2 emissions database.

Notes: Other ASEAN countries include Myanmar and Timor-Leste. ROW1 includes the remaining Asian economies. ROW2 includes the rest of the world.

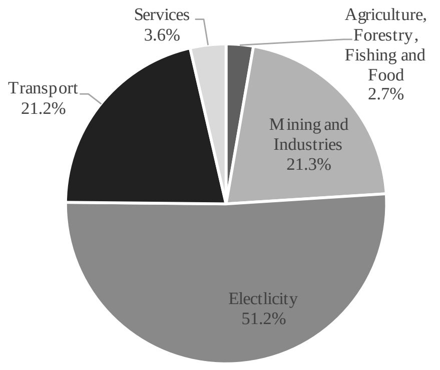

Figure 1 Global CO_2 emissions by sector (%)
Source: GTAP9 CO_2 emissions database.

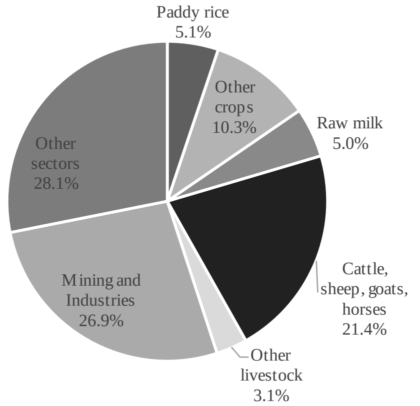

Figure 2 Global non-CO_2 emissions by sector (%)
Source: GTAP9 non-CO_2 emissions database.

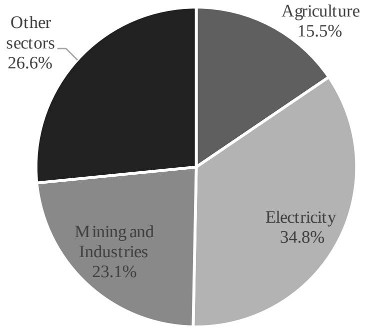

Figure 3 Total global GHGs emissions by sector (%)
Source: GTAP9 CO_2 and non-CO_2 emissions database.

Table 3 Economic impact of the FTAAP (%)

	Real GDP	Total export	Total import
FTAAP members	**0.17**	**3.31**	**4.38**
Japan	0.25	3.38	6.62
Korea	1.13	3.51	7.49
China	0.28	5.29	6.98
Indonesia	0.07	3.16	4.01
Malaysia	0.75	2.23	4.85
Philippines	0.12	3.43	2.81
Singapore	0.04	0.73	1.45
Thailand	0.41	3.50	6.89
Vietnam	1.24	6.46	13.61
Brunei	0.09	–0.31	1.78
Australia	0.07	1.43	4.29
New Zealand	0.09	0.87	3.45
United States	0.02	2.93	1.90
Canada	0.25	3.82	3.14
Mexico	0.15	2.24	2.08
Peru	0.02	1.31	0.78
Chile	0.02	0.67	0.54
Hong Kong	–0.00	0.41	0.28
Taiwan	0.08	2.23	4.09
Russia	0.16	2.54	4.89
Cambodia	–0.62	1.58	–5.30
Laos	–0.13	0.88	–1.60
Other ASEAN countries	–0.07	4.32	–3.13
India	–0.07	0.39	–0.86
EU	–0.02	0.31	–0.50
ROW1	–0.10	0.06	–2.52
ROW2	–0.03	0.07	–0.80

Notes: Other ASEAN countries include Myanmar and Timor-Leste. ROW1 includes the remaining Asian economies. ROW2 includes the rest of the world.

Table 4 Impact on sectoral outputs (%)

	Japan	China	Australia	New Zealand	United States	India	EU
Farm output	**–14.74**	**–0.11**	**10.45**	**5.57**	**2.69**	**–0.15**	**–0.31**
Paddy rice	–34.26	1.18	13.51	8.43	17.35	0.35	1.58
Wheat	–33.61	–0.88	–8.34	–2.45	–2.63	–0.47	0.90
Cereal grains nec	–5.82	0.15	–0.05	–2.59	4.56	–0.00	–0.49
Vegetables, fruit, nuts	–3.24	0.26	–1.22	–4.83	–1.03	0.01	0.20
Oil seeds	–10.86	–0.09	2.77	–7.24	1.61	–1.02	0.10
Sugar cane, sugar beet	–2.75	–6.44	14.19	–1.10	–0.55	–0.05	–0.07
Plant-based fibers	4.44	3.64	5.72	–1.11	1.78	–0.22	1.56
Crops nec	–5.11	4.28	–4.61	–12.45	0.33	–0.26	–0.20
Cattle, sheep, goats, horses	–18.45	0.82	13.53	0.52	3.13	–0.24	–0.37
Animal products nec	–25.19	0.10	–1.23	–4.48	6.24	–0.19	–1.29
Raw milk	–16.17	–0.89	5.02	16.80	4.81	–0.05	–0.44
Wool, silkworm cocoons	–0.68	–27.66	103.39	–39.84	29.06	0.71	–24.02
Electricity	0.51	–0.14	–0.78	–1.56	0.02	0.08	0.02

Note : nec means not elsewhere classified.

Table 5 Environmental impact of FTAAP (Mt CO_2 equivalent, %)

	CO_2		Non-CO_2		GHG	
FTAAP members	**10.81**	**(0.06)**	**23.48**	**(0.39)**	**34.29**	**(0.14)**
Japan	6.45	(0.63)	–4.31	(–4.77)	2.14	(0.19)
Korea	5.21	(1.04)	0.31	(0.61)	5.52	(1.00)
China	–6.66	(–0.09)	0.65	(0.02)	–6.01	(–0.06)
Indonesia	–0.78	(–0.20)	–1.55	(–0.47)	–2.33	(–0.32)
Malaysia	–0.78	(–0.38)	–0.28	(–0.54)	–1.06	(–0.42)
Philippines	0.11	(0.14)	–2.00	(–2.49)	–1.90	(–1.19)
Singapore	0.49	(0.74)	0.21	(2.71)	0.70	(0.95)
Thailand	–0.50	(–0.21)	0.72	(0.54)	0.22	(0.06)
Vietnam	1.09	(0.85)	–1.44	(–0.97)	–0.35	(–0.13)
Brunei	–0.05	(–0.62)	–0.04	(–0.88)	–0.10	(–0.71)
Australia	–1.52	(–0.40)	7.99	(2.99)	6.47	(1.00)
New Zealand	0.07	(0.20)	3.29	(7.77)	3.36	(4.49)
United States	5.03	(0.10)	16.03	(1.66)	21.07	(0.35)
Canada	0.11	(0.02)	1.25	(0.77)	1.36	(0.20)
Mexico	–0.53	(–0.13)	1.39	(0.81)	0.86	(0.14)
Peru	0.06	(0.13)	–0.07	(–0.17)	–0.01	(–0.01)
Chile	0.03	(0.04)	0.41	(1.38)	0.44	(0.41)
Hong Kong	0.02	(0.02)	–0.01	(–0.22)	0.01	(0.01)
Taiwan	3.66	(1.50)	–0.03	(–0.15)	3.63	(1.38)
Russia	–0.68	(–0.05)	0.94	(0.13)	0.26	(0.01)
India	4.38	(0.25)	–2.01	(–0.16)	2.38	(0.08)
EU	5.95	(0.16)	2.67	(0.24)	8.62	(0.18)
World	**26.34**	**(0.09)**	**21.53**	**(0.17)**	**47.88**	**(0.12)**

Notes: Figures in parentheses are percentage deviations from the initial period.

Table 6 Most affected sectors by country for GHG emissions (Mt CO_2 equivalent, %)

Japan	CO_2			CH_4			N_2O	
Electricity	2.38	(0.52)	Animal products nec	–1.16	(–27.68)	Animal products nec	–0.43	(–27.45)
Ferrous metals	0.74	(1.81)	Paddy rice	–1.13	(–16.34)	Cattle, sheep, goats, horses	–0.36	(–20.89)
Chemicals	0.49	(1.13)	Cattle, sheep, goats, horses	–0.70	(–20.99)	Paddy rice	–0.34	(–34.26)
Mineral products nec	0.45	(1.97)	Raw milk	–0.31	(–18.76)	Raw milk	–0.09	(–18.40)
Air transport	–0.23	(–1.55)	PADHE	0.01	(0.17)	Chemicals	0.05	(0.98)
China	CO_2			CH_4			N_2O	
Electricity	–5.70	(–0.14)	Cattle, sheep, goats, horses	1.66	(0.92)	Cattle, sheep, goats, horses	0.96	(0.92)
Chemicals	–3.30	(–1.24)	Coal	–1.27	(–0.18)	Plant-based fibers	0.59	(3.64)
Mineral products nec	3.02	(0.53)	Paddy rice	1.16	(0.99)	Vegetables, fruit, nuts	0.43	(0.26)
Ferrous metals	–2.71	(–0.65)	Wool, silkworm cocoons	–0.42	(–27.66)	Chemicals	–0.30	(–1.23)
Textiles	1.54	(6.57)	Petroleum, coal products	–0.32	(–0.61)	Paddy rice	0.28	(1.18)
Australia	CO_2			CH_4			N_2O	
Electricity	–1.52	(–0.78)	Cattle, sheep, goats, horses	7.68	(15.73)	Cattle, sheep, goats, horses	4.87	(15.69)
Metals nec	–0.57	(–4.89)	Wheat	–1.03	(–10.76)	Wheat	–1.52	(–10.49)
Wool, silkworm cocoons	0.54	(103.41)	Vegetables, fruit, nuts	–0.52	(–5.03)	Vegetables, fruit, nuts	–0.72	(–4.64)
Air transport	–0.21	(–0.97)	Crops nec	–0.33	(–7.76)	Crops nec	–0.47	(–7.45)
Ferrous metals	–0.11	(–2.69)	Raw milk	0.26	(6.60)	Cereal grains nec	–0.29	(–3.66)
New Zealand	CO_2			CH_4			N_2O	
Dairy products	0.21	(20.24)	Raw milk	2.14	(18.69)	Raw milk	0.92	(18.23)
Electricity	–0.08	(–1.56)	Cattle, sheep, goats, horses	0.19	(1.58)	Cattle, sheep, goats, horses	0.13	(1.56)
Raw milk	0.06	(16.83)	Animal products nec	–0.01	(–3.71)	Vegetables, fruit, nuts	–0.02	(–4.83)
Air transport	–0.06	(–0.99)	Gas manufacture, distribution	0.01	(0.64)	Animal products nec	–0.01	(–4.24)
Transport nec	–0.03	(–0.49)	Wool, silkworm cocoons	–0.01	(–39.84)	Wool, silkworm cocoons	–0.00	(–39.84)
United States	CO_2			CH_4			N_2O	
Transport nec	0.67	(0.11)	Cattle, sheep, goats, horses	4.13	(4.01)	Cattle, sheep, goats, horses	2.07	(3.97)
Air transport	0.64	(0.18)	Animal products nec	2.03	(7.36)	Cereal grains nec	1.64	(4.53)
Cereal grains nec	0.57	(4.56)	Raw milk	2.00	(5.84)	Animal products nec	1.43	(7.08)
Electricity	0.50	(0.02)	Paddy rice	1.00	(12.63)	Raw milk	0.42	(5.63)
Meat products nec	0.33	(9.50)	PADHE	–0.09	(–0.07)	Oil seeds	0.24	(1.58)
India	CO_2			CH_4			N_2O	
Electricity	3.41	(0.35)	Cattle, sheep, goats, horses	–1.04	(–0.38)	Cattle, sheep, goats, horses	–0.28	(–0.38)
Ferrous metals	1.29	(0.87)	Paddy rice	0.43	(0.43)	Wheat	–0.15	(–0.47)
Chemicals	0.16	(0.35)	Coal	0.30	(0.57)	Oil seeds	–0.13	(–1.02)
Transport nec	–0.12	(–0.08)	PADHE	–0.30	(–0.17)	Crops nec	–0.10	(–0.26)
Textiles	–0.12	(–1.59)	Raw milk	–0.11	(–0.18)	PADHE	–0.07	(–0.17)
EU	CO_2			CH_4			N_2O	
Sea transport	3.98	(2.45)	Animal products nec	–0.52	(–1.37)	Animal products nec	–0.31	(–1.36)
Transport nec	2.85	(0.42)	Cattle, sheep, goats, horses	–0.45	(–0.41)	Cattle, sheep, goats, horses	–0.19	(–0.41)
Air transport	1.45	(0.74)	Raw milk	–0.32	(–0.49)	Wheat	0.15	(0.90)
Electricity	0.40	(0.03)	Transport nec	0.20	(0.42)	Raw milk	–0.10	(–0.48)
Mineral products nec	–0.36	(–0.43)	Coal	0.16	(0.33)	Cereal grains nec	–0.09	(–0.49)

Note 1: Figures in parentheses are percentage deviations from the initial period.
Note 2: PADHE means Public Admin, Health and Education.
Note 3: nec means not elsewhere classified.