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The Regional Comprehensive Economic Partnership and Its Potential Impact on Greenhouse Gas Emissions

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Abstract

Whether trade liberalization resulting from mega free trade agreements, such as the Regional Comprehensive Economic Partnership (RCEP), will have an impact on the environment is the subject of ongoing debate and remains an empirical matter. In this paper, we contribute to the debate on the relation between trade and the environment by considering the case of the RCEP and examining whether it will increase or decrease greenhouse gas (GHG) emissions. We measure the impact of the RCEP on GHG emissions using the Global Trade Analysis Project (GTAP) model and the GTAP CO_2 and non-CO_2 emissions databases. Our results suggest that the RCEP is likely to "increase" the total amount of GHG emissions in the 16 RCEP members and the world.

Keywords

RCEP, Greenhouse gas, Climate Change, GTAP

1. Introduction

The Regional Comprehensive Economic Partnership (RCEP) is an Association of Southeast Asian Nations (ASEAN)-centered proposal for a regional free trade area, which would initially include the ten ASEAN member states and six other countries with existing Free Trade Agreements (FTAs) with ASEAN, including Australia, China, India, Japan, the Republic of Korea, and New Zealand. Leaders from ASEAN and ASEAN's FTA partners instigated the RCEP negotiations at the East Asia Summit in Phnom Penh, Cambodia in November 2012 [1], with the 11th round of RCEP negotiations held in Brunei in February 2016.

The RCEP is one of several so-called "mega-FTAs", including the FTAAP (Free Trade Area of the Asia Pacific), the TPP (Trans-Pacific Partnership), the TTIP (Transatlantic Trade and Investment Partnership), and the JCKFTA (Japan-China-Korea Free Trade Agreement). Together, the 16 RCEP participants account for almost half

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of the world's population, nearly 30 percent of global GDP, and more than a quarter of world exports [1]. Thus, the RCEP could provide not only a huge economic impact, but may also exert a significant environmental impact on the RCEP region and the world.

However, whether trade liberalization resulting from mega-FTAs, such as the RCEP, will have an impact on the environment is the subject of ongoing debate and remains an empirical matter. While some existing studies address the economic impact of the RCEP [2]-[5], none concern the possible environmental impact of the RCEP.

In this paper, we contribute to the debate on the relation between trade and the environment by considering the case of the RCEP and examining whether it will increase or decrease greenhouse gas (GHG) emissions. We do this by measuring the impact of the RCEP on GHG emissions using the Global Trade Analysis Project (GTAP) model and the GTAP's CO_2 and non-CO_2 emissions databases.

2. Methodology

2.1. Measuring the Economic Impact of the RCEP

It is common to employ the GTAP model to provide a quantitative assessment of the economic impact of the RCEP. This is a computable general equilibrium (CGE) model developed for trade analysis by the GTAP [6]. The latest GTAP database is GTAP 9, published in 2015 and containing data on 57 industries in 140 countries and regions for three years (2004, 2007 and 2011). For our analysis, we use the standard static version of the GTAP model and the GTAP 9 database for 2011.

To facilitate comparison with other mega-FTAs (including the TPP, FTAAP, and JCKFTA), we combine the 129 countries and regions in GTAP 9 into 27 regions. We retain the original 57 industries in the database. **Table 1** provides additional details on the specific regional combinations.

Our scenario assumes the complete removal of all import tariffs among the RCEP members. However, it is unlikely that the RCEP would remove all import tariffs across all sectors among the RCEP participants. In so doing, our scenario provides an upper bound of the possible economic impact of the RCEP.

2.2. Measuring the Environmental Impact of the RCEP

Given the limitations of the available data, we focus only on GHG emissions as the form of environmental load. We employ the GTAP CO_2 emissions database and GTAP non-CO_2 emissions database to measure the impact of the RCEP on GHG emissions. These databases therefore enable us to measure not only CO_2 emissions, but also non-CO_2 emissions, including methane (CH_4), nitrous oxide (N_2O), and fluorinated GHGs (or F-gases) (namely, tetrafluorocarbon, hydrofluorocarbons, and sulfur hexafluoride).

The GTAP 9 CO_2 emissions database details emissions resulting only from the combustion of fossil fuels, with the levels of CO_2 emissions calculated by multiplying the amount of fuel consumed by emission coefficients [7]. We assume that these emission coefficients remain unchanged with the liberalization of trade, and that the levels of CO_2 emissions will therefore change in the same proportion as the levels of sectoral fuel consumption. Therefore, we calculate the post-RCEP 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 is calculated by multiplying the initial levels of CO_2 emissions resulting from coal use in electricity sector by the change in coal use in electricity sector derived from the GTAP results.

The GTAP 9 non-CO_2 emissions database provides the emissions data for three major non-CO_2 gases (CH_4, N_2O, and F-gases) [8]. In this database, the levels for each type of non-CO_2 emissions are associated with output, endowment use, and input use by industry and private households [9]. We assume that the levels of non-CO_2 gases change in the same proportion as the corresponding GTAP variables. This assumption allows us to calculate the post-RCEP 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 then calculate the post-RCEP 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.

3. Results

3.1. The Economic Impact of the RCEP

Table 2 details the impact of the RCEP on real GDP, total exports, and total imports. As shown, under full trade

Table 1. Regions and sectors.

	Region		Sector		Sector
1	Japan	1	Paddy rice	30	Wood products
2	Korea	2	Wheat	31	Paper products, publishing
3	China	3	Cereal grains nec[d]	32	Petroleum, coal products
4	Indonesia	4	Vegetables, fruit, nuts	33	Chemicals
5	Malaysia	5	Oil seeds	34	Mineral products nec[d]
6	Philippines	6	Sugar cane, sugar beet	35	Ferrous metals
7	Singapore	7	Plant-based fibers	36	Metals nec[d]
8	Thailand	8	Crops nec[d]	37	Metal products
9	Vietnam	9	Cattle	38	Motor vehicles and parts
10	Cambodia	10	Animal products nec[d]	39	Transport equipment nec[d]
11	Laos	11	Raw milk	40	Electronic equipment
12	Brunei	12	Wool, silkworm cocoons	41	Machinery and equipment nec[d]
13	Other ASEAN[a]	13	Forestry	42	Manufactures nec[d]
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[d]	47	Trade
19	Mexico	19	Meat: cattle, sheep, goats, horse	48	Transport nec[d]
20	Peru	20	Meat products nec[d]	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[d]
24	Russia	24	Sugar	53	Insurance
25	EU27	25	Food products nec[d]	54	Business services nec[d]
26	ROW1[b]	26	Beverages and tobacco products	55	Recreation and other services
27	ROW2[c]	27	Textiles	56	Pub Admin/Defence/Health/Education
		28	Wearing apparel	57	Dwellings
		29	Leather products		

a. Other ASEAN includes Myanmar and Timor-Leste. b. ROW1 includes rest of Asian economies. c. ROW2 includes rest of the world. d. nec means not elsewhere classified.

liberalization, the 16 participants are likely to experience a positive average impact of the RCEP on real GDP, total exports, and total imports, which increase by 0.19%, 2.95%, and 5.19%, respectively. In contrast, non-RCEP economies other than Russia are likely to experience a negative impact on real GDP. In percentage terms, the increase in Vietnam is the highest across GDP (0.91%), and the increases in Cambodia are the highest across total exports (8.96%) and total imports (10.31%).

By way of a comparison, reference [2] analyzed the economic effects of an ASEAN + 6 (Japan, China, Korea, Australia, New Zealand, and India) FTA (effectively the RCEP) using the GTAP model and the GTAP 6 database (corresponding to 2001). Reference [2] showed that the ASEAN + 6 FTA, under a full liberalization scenario, also had a positive impact on the real GDP, exports, and imports of the ASEAN + 6 countries.

Table 2. Economic impact of RCEP (%).

	Real GDP	Total export	Total import
16 RCEP members	**0.19**	**2.95**	**5.19**
Japan	0.15	1.39	6.19
Korea	0.73	3.31	6.63
China	0.09	3.55	4.46
Indonesia	0.06	2.66	3.90
Malaysia	0.37	1.94	4.25
Philippines	0.08	2.52	1.62
Singapore	0.06	0.45	1.95
Thailand	0.39	3.05	6.53
Vietnam	0.91	0.64	10.20
Cambodia	0.56	8.96	10.31
Laos	0.36	5.32	8.31
Brunei	0.08	−0.33	1.84
Other ASEAN[a]	0.06	6.99	3.18
India	0.41	8.32	5.07
Australia	0.11	0.99	6.09
New Zealand	0.05	0.66	2.15
United States	−0.01	0.71	−1.04
Canada	−0.01	0.32	−0.14
Mexico	−0.01	0.27	−0.03
Peru	−0.00	0.16	−0.54
Chile	−0.01	0.24	−0.26
Hong Kong	−0.00	−0.01	−0.77
Taiwan	−0.04	−0.44	−1.71
Russia	0.01	0.24	−0.60
EU27	−0.01	0.23	−0.26
ROW1[b]	−0.06	0.21	−1.15
ROW2[c]	−0.02	0.05	−0.51

a. Other ASEAN includes Myanmar and Timor-Leste. b. ROW1 includes rest of Asian economies. c. ROW2 includes rest of the world.

Table 3 provides details of the impact of the sectoral output changes in percentage terms. Throughout the following discussion, we focus on Japan, China, and India, as the three largest RCEP members (in terms of real GDP), Australia, given its greatest growth in non-CO_2 emissions, as shown later in **Table 4**, and the United States (US) and the European Union (EU) as key non-RCEP-member economies.

As shown in **Table 3**, with full trade liberalization among the RCEP participants, farm output (defined as the agricultural sectors from paddy rice to wool, silkworm cocoons) tends to decline in Japan, but increases somewhat in China and Australia. In percentage terms, the decline rate in output from the paddy rice sector (−29.51%) is the most significant decline rate of all the sectoral output changes in Japan. In contrast, the increase rate in output

Table 3. Impact on sectoral outputs (%).

	Japan	China	India	Australia	United States	EU27
Farm output	**−7.96**	**0.19**	**−0.41**	**11.82**	**−0.46**	**−0.03**
Paddy rice	−29.51	1.55	1.57	32.90	−1.40	2.22
Wheat	−4.26	−0.60	0.70	−5.95	0.69	0.05
Cereal grains nec[a]	−0.53	0.75	7.65	43.07	−0.69	−0.07
Vegetables, fruit, nuts	−0.87	0.65	−0.06	−0.19	−0.44	0.04
Oil seeds	−13.03	1.23	−11.71	−1.04	−1.19	−0.15
Sugar cane, sugar beet	−2.10	−6.07	0.72	12.55	0.04	−0.01
Plant-based fibers	2.01	0.27	3.35	−3.90	−0.21	−0.69
Crops nec[a]	−3.14	10.47	−1.42	−5.62	−0.11	0.01
Cattle	−13.17	0.25	0.13	14.83	−0.59	0.20
Wool, silkworm cocoons	1.14	−27.39	1.23	91.83	−8.89	−24.38
Electricity	0.39	−0.07	0.20	−0.26	−0.00	−0.00

a. nec means not elsewhere classified.

from the paddy rice sector is the second most significant increase rate of all sectoral output changes in China (1.55%) and the third most significant increase rate in Australia (32.90%). Electricity sector output, one of the largest sources of CO_2 emissions, increases in Japan, India, and decreases in China, Australia, the US, and the EU.

Regarding the ASEAN + 6 FTA, reference [2] found that Japan was likely to experience a decrease in output in the agricultural and food sectors, while China and Australia were likely to experience an increase. With respect to the JCKFTA, reference [10] showed that Japan was likely to experience a decrease in output in the paddy rice sector, whereas China was likely to experience an increase.

3.2. The Environmental Impact of the RCEP

Table 4 details the impact of the RCEP on GHG emissions. All figures are in million metric tons (Mt) of CO_2 equivalent. We first focus on the results for the 16 RCEP members and the world. As shown, the RCEP is likely to increase the total amounts of GHG emissions in both the 16 RCEP members and the world, with total GHG emissions of the RCEP and the world increasing by 19.32 Mt CO_2 eq. (0.11%) and 25.10 Mt CO_2 eq. (0.06%), respectively. As for our main research question, these GHG emission impact results show that the RCEP is likely to "increase" the total amount of GHG emissions in the 16 RCEP members and the world.

In other findings, the total CO_2 emissions of the 16 RCEP members and the world will increase by 7.08 Mt CO_2 eq. (0.06%) and 10.38 Mt CO_2 eq. (0.04%), respectively, and the total non-CO_2 emissions of the 16 RCEP members and the world will increase by 12.24 Mt CO_2 eq. (0.23%) and 14.72 Mt CO_2 eq. (0.12%), respectively. Among the non-RCEP members, the total GHG emissions of the US will decrease by 0.23 Mt CO_2 eq. (less than 0.01%), while those of the EU will increase by 6.55 Mt CO_2 eq. (0.14%).

We next focus on the results for the individual economies. In terms of CO_2 emissions, Japan and Korea will experience the greatest and the third greatest increase of all the economies, with the sum of its increases in CO_2 emissions (5.59 Mt CO_2 eq. and 4.14 Mt CO_2 eq.) almost equaling the increase across all 16 RCEP members (7.08 Mt CO_2 eq.) and the world (10.38 Mt CO_2 eq.).

In terms of non-CO_2 emissions for the individual economies, Australia will experience the greatest increase (11.92 Mt CO_2 eq.), which is almost equal to the increase across all 16 RCEP members (12.24 Mt CO_2 eq.). In percentage terms, New Zealand has the highest rate of increase in non-CO_2 emissions (5.00%), while the Philippines has the largest rate of decrease (−3.45%).

Table 5 identifies the industrial sectors that contribute most in terms of CO_2, CH_4, and N_2O emissions. We selected the top five sectors by the absolute change in each emission. We omitted F-gases from the table because

Table 4. Impact on GHG emissions (Mt CO_2 equivalent, %[a]).

	CO_2		Non-CO_2		GHG	
16 RCEP members	**7.08**	**(0.06)**	**12.24**	**(0.23)**	**19.32**	**(0.11)**
Japan	5.59	(0.54)	−2.69	(−2.97)	2.90	(0.26)
Korea	4.14	(0.83)	0.18	(0.35)	4.32	(0.78)
China	−0.86	(−0.01)	2.64	(0.10)	1.78	(0.02)
Indonesia	−1.45	(−0.37)	−0.60	(−0.18)	−2.05	(−0.29)
Malaysia	−0.49	(−0.24)	−0.20	(−0.39)	−0.69	(−0.27)
Philippines	0.07	(0.09)	−2.78	(−3.45)	−2.71	(−1.70)
Singapore	0.43	(0.65)	0.22	(2.81)	0.65	(0.88)
Thailand	−0.10	(−0.04)	2.68	(2.02)	2.58	(0.69)
Vietnam	1.57	(1.24)	−0.60	(−0.41)	0.97	(0.35)
Cambodia	0.41	(8.61)	−0.43	(−1.47)	−0.02	(−0.06)
Laos	0.11	(5.66)	−0.20	(−1.67)	−0.10	(−0.68)
Brunei	−0.06	(−0.72)	−0.04	(−0.83)	−0.10	(−0.76)
Other ASEAN[b]	0.02	(0.21)	0.79	(0.76)	0.81	(0.72)
India	−2.07	(−0.12)	−0.76	(−0.06)	−2.83	(−0.09)
Australia	−0.28	(−0.07)	11.92	(4.46)	11.64	(1.80)
New Zealand	0.05	(0.16)	2.12	(5.00)	2.17	(2.90)
United States	−0.17	(−0.00)	−0.06	(−0.01)	−0.23	(−0.00)
Canada	0.19	(0.04)	−0.57	(−0.35)	−0.38	(−0.06)
Mexico	−0.02	(−0.01)	−0.53	(−0.30)	−0.55	(−0.09)
Peru	0.04	(0.08)	−0.03	(−0.07)	0.01	(0.01)
Chile	0.16	(0.20)	−0.05	(−0.18)	0.10	(0.10)
Hong Kong	0.17	(0.20)	0.00	(−0.04)	0.17	(0.19)
Taiwan	−1.38	(−0.56)	−0.05	(−0.28)	−1.43	(−0.54)
Russia	−0.32	(−0.02)	0.32	(0.04)	0.00	(−0.00)
EU27	4.23	(0.12)	2.32	(0.21)	6.55	(0.14)
ROW1[c]	0.09	(0.03)	−0.41	(−0.08)	−0.32	(−0.04)
ROW2[d]	0.31	(0.01)	1.55	(0.04)	1.86	(0.02)
World	**10.38**	**(0.04)**	**14.72**	**(0.12)**	**25.10**	**(0.06)**

a. Figures in parentheses are percentage deviations from the initial period. b. Other ASEAN includes Myanmar and Timor-Leste. c. ROW1 includes rest of Asian economies. d. ROW2 includes rest of the world.

relatively few sectors emit these GHGs. In terms of CO_2 emissions, non-agricultural sectors appear in the top five sectors. Four of six economies in **Table 5** have an electricity sector.

In terms of work elsewhere, reference [11] assessed the impact of a regional trade agreement that decreased import tariffs among the six East Asian countries (Japan, Korea, China, Indonesia, Thailand, and Vietnam), also selecting the top five sectors according to the absolute change for each of the GHGs. They also showed that in all six of the countries they analyzed, the electricity sector was one of the major CO_2 emitters.

Table 5. Most affected sectors by country for GHG emissions (Mt CO_2 equivalent, %[a]).

Japan	CO_2			CH_4			N_2O	
Electricity	1.84	(0.40)	Paddy rice	−1.05	(−15.21)	Paddy rice	−0.30	(−29.51)
Mineral products nec[b]	0.48	(2.06)	Cattle	−0.51	(−15.29)	Cattle	−0.26	(−15.21)
Ferrous metals	0.47	(1.16)	Raw milk	−0.20	(−12.06)	Raw milk	−0.06	(−11.76)
Air transport	−0.28	(−1.90)	Animal products nec[b]	−0.06	(−1.35)	Crops nec[b]	−0.03	(−3.14)
Petroleum, coal products	0.21	(0.78)	PADHE[c]	0.01	(0.14)	Animal products nec[b]	−0.02	(−1.15)
China	CO_2			CH_4			N_2O	
Mineral products nec[b]	1.81	(0.32)	Paddy rice	1.16	(0.99)	Vegetables, fruit, nuts	1.07	(0.65)
Chemicals	−1.73	(−0.65)	Cattle	0.78	(0.43)	Cattle	0.45	(0.43)
Ferrous metals	−1.00	(−0.24)	Wool, silkworm cocoons	−0.41	(−27.39)	Animal products nec[b]	0.39	(0.62)
Electricity	−1.00	(−0.02)	PADHE[c]	−0.38	(−0.10)	Paddy rice	0.36	(1.55)
Textiles	0.61	(2.60)	Animal products nec[b]	0.26	(0.58)	Crops nec[b]	0.17	(10.47)
India	CO_2			CH_4			N_2O	
Electricity	−2.04	(−0.21)	Paddy rice	1.71	(1.72)	Oil seeds	−1.54	(−11.70)
Vegetable oils and fats	−0.46	(−43.18)	PADHE[c]	−0.84	(−0.48)	Cereal grains nec[b]	0.60	(7.65)
Chemicals	0.44	(0.98)	Oil seeds	−0.62	(−11.70)	Crops nec[b]	−0.52	(−1.41)
Mineral products nec[b]	−0.38	(−0.39)	Cattle	−0.32	(−0.12)	Plant-based fibers	0.34	(3.35)
Transport nec[b]	0.36	(0.24)	Cereal grains nec[b]	0.31	(7.65)	Wheat	0.23	(0.70)
Australia	CO_2			CH_4			N_2O	
Electricity	−0.50	(−0.26)	Cattle	8.68	(17.78)	Cattle	5.50	(17.72)
Wool, silkworm cocoons	0.48	(91.86)	Cereal grains nec[b]	1.46	(27.57)	Cereal grains nec[b]	2.33	(29.23)
Air transport	−0.44	(−2.07)	Wheat	−0.98	(−10.26)	Wheat	−1.42	(−9.78)
Metals nec[b]	−0.21	(−1.79)	Vegetables, fruit, nuts	−0.59	(−5.71)	Vegetables, fruit, nuts	−0.80	(−5.14)
Ferrous metals	−0.19	(−4.69)	Plant-based fibers	−0.45	(−8.66)	Plant-based fibers	−0.63	(−8.32)
United States	CO_2			CH_4			N_2O	
Air transport	1.49	(0.41)	Cattle	−0.80	(−0.78)	Cattle	−0.40	(−0.77)
Transport nec[b]	0.65	(0.10)	Coal	0.17	(0.22)	Cereal grains nec[b]	−0.25	(−0.69)
Chemicals	0.20	(0.18)	Raw milk	−0.15	(−0.44)	Oil seeds	−0.18	(−1.18)
Ferrous metals	0.18	(0.49)	Animal products nec[b]	−0.12	(−0.44)	Chemicals	0.09	(0.17)
Sea transport	0.15	(0.37)	Paddy rice	−0.06	(−0.79)	Animal products nec[b]	−0.08	(−0.40)
EU27	CO_2			CH_4			N_2O	
Sea transport	2.64	(1.63)	Cattle	0.21	(0.20)	Cattle	0.09	(0.20)
Transport nec[b]	1.95	(0.29)	Raw milk	−0.15	(−0.22)	Raw milk	−0.05	(−0.22)
Air transport	0.96	(0.49)	Transport nec[b]	0.14	(0.29)	Wool, silkworm cocoons	−0.03	(−24.38)
Petroleum, coal products	0.19	(0.15)	Coal	0.12	(0.25)	Oil seeds	−0.02	(−0.15)
Mineral products nec[b]	−0.17	(−0.21)	Paddy rice	0.09	(1.84)	Petroleum, coal products	0.01	(0.17)

a. Figures in parentheses are percentage deviations from the initial period. b. nec means not elsewhere classified. c. PADHE is PubAdmin/Defence/Health/Education.

Regarding CH_4 emissions, we observe a significant increase in the volume of emissions in the cattle sector in Australia (8.68 Mt CO_2 eq.), whereas in percentage terms CH_4 emissions from the cattle sector decreased most significantly in Japan (−15.29%). These particular results mainly arise because of the large increase in output from the cattle sector in Australia and the large decrease in output from the cattle sector in Japan, as shown in

Table 3. In Japan, the paddy rice sector also shows the significant decrease (−1.05 Mt CO_2 eq.). All six economies in **Table 5** also have a cattle sector, while all six economies other than Australia also have a paddy rice sector. Reference [11] also found that in all six countries they analyzed, the paddy rice sector was one of the top five CH_4-emitting sectors.

As for N_2O emissions, we identify a significant increase in emissions from the cattle sector in Australia (5.50 Mt CO_2 eq.), while in percentage terms the decrease in these same emissions is the second largest in Japan (−15.21%). Once again, these results are due to the large increase in output from the cattle in Australia and the large decreases in output from the cattle sector in Japan, as shown in **Table 3**. Five economies in **Table 5** other than India also include the cattle sector in their top five sectors.

For both CH_4 and N_2O emissions, three or more of the top five emitting sectors in each economy are farm sectors. Worldwide in 2005, while CO_2 emissions are concentrated in the energy sector, agriculture accounts for the largest share of non-CO_2 emissions [12]. In sum, our results show that the RCEP is likely to increase the total amount of GHG emissions for both the 16 RCEP members and the world.

4. Conclusions

In this paper, we contribute to the debate on the relation between trade and the environment by considering the case of the RCEP and examining whether it will increase or decrease GHG emissions. To respond to this important research question, we measure the impact of the RCEP on GHG emissions using the GTAP model and the GTAP CO_2 and non-CO_2 emissions databases. Our scenario assumes the complete removal of all import tariffs among the RCEP members.

The results in terms of economic impact show that the 16 RCEP participants are likely to experience a positive effect on real GDP. In contrast, non-RCEP economies other than Russia are likely to experience a negative impact on real GDP. Further, farm output will tend to decline in Japan and the US and increase in Australia. The output of the electricity sector, one of the largest sources of CO_2 emissions, will tend to increase in Japan and India, and decrease in China, Australia, the US, and the EU.

As for our main research question, the GHG emission impact results show that the RCEP is likely to "increase" the total amount of GHG emissions in the 16 RCEP members and the world. We observe increases in the amount of CO_2 emissions in the non-agricultural sectors in each economy, and a substantial increase in the amount of CH_4 and N_2O emissions in the Australian cattle sector.

Finally, we briefly note the limitations of our study as a means of informing future research. In our model, we did not include the changes in environmental policy that may also result from the RCEP. In addition, because of limitations in the available data, we included only CO_2, CH_4, N_2O, and F-gases as GHG emissions.

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