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The Economic and Environmental Impact of the US Withdrawal from the Kyoto Protocol

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ABSTRACT

George W. Bush, the US President, announced factual withdrawal from the Kyoto Protocol. In this study, I have used GTAP-E to estimate economic and environmental influences on each country/region by the withdrawal of the US from economic and environmental perspective. In case the US does not ratify the Kyoto Protocol, the US economy will keep stable economic growth. Other Annex countries, Japan and EU, receive both positive and negative impact. Japan and EU have to bear CO2 abatement cost and lose competitiveness against the US, but the abatement cost decrease and increase competitiveness against non-Annex countries.

However, the withdrawal of the US carbon-leakage and it worsens not only absolute CHGs emission and also efficiency of carbon dioxide reduction on the whole earth.

Key words: Kyoto Protocol, Emission trading, CGE

1. Background and Purpose

After the COP3 (Conference of the Party Agreeing to FCCC), which was held in Kyoto, Japan in December 1997, greenhouse gas reduction target during the first phase (2008-2012) was set up for the associate countries (so-called Annex countries), and the introduction or inspection of the policy has been done in order to achieve the goal, mainly in European countries. However, there has been a movement against the Kyoto Protocol in the US, claiming that the reduction of greenhouse gases (GHGs) only in Annex countries, which are primarily developed nations will not be done efficiently, and there will be a serious influence on domestic industries, economy and household. In response to these movements, George W. Bush, the US President, declared factual withdrawal from the Kyoto Protocol, and the decision has been criticised not only by other countries' governments, but also by citizens, especially in the EU. As the matter of fact, the boycott against American products is on the upbeat. In addition, the effectuation of the Kyoto Protocol without the US has been discussed in the EU, and it is scheduled that the Kyoto Protocol enters into force this September at the

Johannesburg Earth Summit without the US. Based on this background, this research aims to present quantitative evaluations using general equilibrium model and adds prospects about 1) economic and social impact on each country/region and 2) impact on greenhouse gas emissions by the US not ratifying the Kyoto Protocol.

2. Design of the experiments

2.1. Trading categorisation of regions

I use the GTAP-E model for this investigation[1]. The standard GTAP-E model, however, cannot deal with inter-national emission trading within a specific group of countries/regions. As a result, some modification of the model is necessary to conduct this research.

For the purpose, I make a distinction between 'emission trading' and 'non-trading' regions/countries to incorporate international emission trading within the GTAP-E.

2.2. Database

In this study, I use eight countries and ten sectors database, based on GTAP Database version 4. Detailed categorisation of the DB is shown in Table1 and Table2.

Table 1: Categorisation of Sectors

Sector	Description
COL	Coal
OIL	Crude oil
GAS	Gas
P_C	Petroleum, coal products
ELY	Electricity
I_S	Ferrous metals
CRP	Chemical, rubber, plastic products
OMN	Metals nec, Mineral products nec, Paper products and publishing, Other manufacturing, Trade and transport
AGR	Agriculture, forestry and fish
SER	Commercial/public services/Dwellings

[1] For more information on this model, see Truong (1999)

Table 2: Categorisation of Regions/Countries

Region	Description
USA	United States of America
CHN	China
FSU	Former Soviet Union
JPN	Japan
IND	India
E_U	European Union
NEX	Net Energy Exporters
NEM	Net Energy Importers

E_U: Germany, The United Kingdom, Denmark, Sweden, Finland, Rest of European Union

NEX: Australia, Indonesia, Malaysia, Viet Nam, Mexico, Venezuela, Colombia, Rest of Andean Pact, Argentina, Rest of South America, European Free Trade Area, Rest of Middle East, Rest of North Africa, South African Customs Union, Rest of Southern Africa, Rest of Sub Saharan Africa, Rest of World

NEM: New Zealand, Canada, Philippines, Singapore, Thailand, Korea, Hong Kong, Taiwan, Sri Lanka, Rest of South Asia, Central America and Caribbean, Brazil, Chile, Uruguay, Central European Associates, Turkey, Morocco

2.3. GHGs emission scenario

At the COP3 held in Kyoto, Japan, in 1997, emission reduction target between 2008-2012 was set for all Annex countries, for example, 6% for Japan, 7% for the US and 8% for the EU. At the COP7 held in Marrakech, Morocco, 2001, limits of removal by sinks through forest management and afforestration, was arrived at the agreement and the Annex countries that ratify the Kyoto Protocol are allowed to reduce GHGs emission by sinks up to the limits and incorporate the reduction to actual achievement of GHGs emission reduction. Although each country has to take appropriate measures for sink, this research assumes that all countries reduces GHGs by sinks up to the limits. Upon this assumption, net reduction targets which each ratified country/region have to meet shown in Table3. In this study, we deal with only carbon dioxide emitted by fossil fuel combustion as GHGs, but other carbon dioxide, such as carbon dioxides that rise out of processes of cement manufacturing, and other greenhouse gases, such as methane, are written off.

Table 3: Emission Reduction Target excl. Removals by Sinks

(mt-CO2:million tonne-CO2)

	1990 emission level	Removed by sinks		Kyoto Target	Net Reduction Target
	mt-CO2	mt-CO2	% of 1990	% of 1990	% of 1990
Japan	1,236	48	3.9%	-6.0%	-2.1%
USA	6,049	103	1.7%	-7.0%	-5.3%
EU	4,208	19	0.5%	-8.0%	-7.6%

(Source) Ministry of Environment, Japan and IPCCC

To evaluate the impacts of ratifying the Kyoto Protocol, we need 1990 and 2010 emission data of Annex countries. I chose emission data supplied by Energy Information Administration (EIA), U.S. Department of Energy (USDOE) to estimate required reduction of GHGs.

Table 4: CO2 emission in 1990 and 2010 and necessary reduction (USA, Japan, EU)

	1990 emission level	2010 emission level	Kyoto Target	Required reduction	
	mt-CO2	mt-CO2	mt-CO2	mt-CO2	% of 2010
USA	4,932	6,903	4,671	2,232	32.3%
JPN	987	1,212	966	246	20.3%
EU	3,409	3,820	3,152	668	17.5%

(Source) Energy Information Administration (EIA), U.S. Department of Energy

2.4. Experiment Set

I carry out two experiments to work out the impacts of the US withdrawal from the Kyoto Protocol. Detailed design of each experiment is shown as Table5. Experimental 1 is a case that the US ratifies the Kyoto Protocol and Experiment 2 is a case that the US does not ratify the Kyoto Protocol. In both experiment, international emission within countries/regions that ratify the Kyoto Protocol is allowed.

Table 5: Categorisation of experiments

Region	Experiment 1		Experiment 2	
	K	IET	K	IET
USA	√	√		
CHN				
FSU				
JPN	√	√	√	√

IND				
E_U	√	√	√	√
NEX				
NEM				

K: Kyoto Target; **IET:** International Emission Trading.

3. Simulation results

3.1. Influence of the US withdrawal on economy in each country/region

In this part, I examine the experimental results from economics perspectives. Firstly, I focus on impacts on energy sector. Energy consumption is conductive to the increase of carbon dioxide emission and thus to reduce emissions affects impacts directly on energy sector, especially carbon intensive fuel like coal. In Experiment 1, all energy sectors' output decreases, and except Japanese gas sector and especially coal sector output decrease is larger than any other energy fuels. In Experiment 2, almost all energy sectors in Japan, EU and US increase output compared to Experiment 1. Table 6 shows huge improvement of the US energy sector's output, because the US does not have to reduce carbon emission, which means that the US does not have to restrict energy consumption in Experiment 2.

Secondary, I examine results of manufacturing sector. By the US withdraw from the Kyoto protocol, the US manufacturing sector output improved. To the contrary, some sectors increase the production, but other sectors decrease the production in Japan and EU manufacturing sectors. Hence it is hardly apropos to conclude that the US withdrawal has negative impacts on Japan and the EU economic activities, because EU and Japan lose competitiveness again the US, but on the other hand carbon abatement cost which EU and Japan have to bear decrease from 25.4 US$/tonne-CO2 to 17.1 US$/tonne-CO2, which leads to increase competitiveness against non-Annex countries. In some manufacturing sectors in the EU and Japan, lowered carbon abatement costs offset their less competitiveness against the US.

Table 6: Production output change in Japan, USA and the EU

(% Change)

	With the US ratification			Without the US ratification			Direction of Change		
	JPN	USA	E_U	JPN	USA	E_U	JPN	USA	E_U
COL	-9.43	-33.50	-20.12	-3.50	-1.93	-11.74	+	+	+
OIL	-3.24	-5.41	-3.95	-0.61	-0.34	-0.48	+	+	+

GAS	5.33	-29.93	-11.11	6.22	-0.14	-7.28	+	+	+
P_C	-4.84	-16.17	-0.18	-4.20	0.55	-1.37	+	+	-
ELY	-0.12	-3.09	-6.31	-0.09	0.26	-4.25	+	+	+
I_S	-0.42	-3.91	-2.90	-0.63	0.65	-2.53	-	+	+
CRP	0.03	-2.47	-1.19	-0.32	0.57	-1.44	-	+	-
OMN	-0.11	-1.31	-0.64	-0.26	0.12	-0.62	-	+	+
AGR	0.48	-3.17	-0.17	-0.24	0.21	-0.62	-	+	-
SER	-0.42	0.49	0.19	-0.06	-0.10	0.17	+	-	-

As for China, India and Former Soviet Union, meaningful finding is that manufacturing sector's output decrease by the US withdrawal. Main reason is that the US does not have to bear additional cost and increase the international competitiveness again other regions including China, India and Former Soviet Union. In addition, as already cited, carbon abatement cost that Japan and EU have to bear decrease by the US withdrawal from the Kyoto Protocol, Japan and EU increase their competitiveness against China, India and Former Soviet Union.

Table 7: Production output change in China, India and Former Soviet Union

(% Change)

	With the US ratification			Without the US ratification			Direction of Change		
	CHN	IND	FSU	CHN	IND	FSU	CHN	IND	FSU
COL	-2.71	-1.3	-4.2	-1.61	-0.76	-2.45	+	+	+
OIL	-2.55	-3.1	-3.1	-0.36	-0.4	-0.36	+	+	+
GAS	0	0.26	-2.41	0.25	0.27	-2.73	+	+	-
P_C	2.65	4.25	-0.47	0.38	0.44	-0.74	-	-	-
ELY	0.16	-0.4	2.03	0.27	0.06	1.32	+	+	-
I_S	1.29	1.7	7.32	0.69	0.93	3.74	-	-	-
CRP	1.74	1.91	3.26	0.6	0.57	1.32	-	-	-
OMN	0.96	0.79	0.88	0.31	0.26	0.37	-	-	-
AGR	0.28	0.17	1.07	0.03	0.02	0.26	-	-	-
SER	-1.9	-0.84	-0.53	-0.61	-0.29	-0.17	+	+	+

3.2. Effects on global CO2 reduction

In case that the US does not ratify the Kyoto Protocol, the carbon-leakage rate (the rate of the increasing amount of CO2 in other countries/regions against the CO2 reduction in the countries/regions that reduce green house gases) worsens from 0.16 to 0.32. Therefore, not only there will be a decrease in absolute amount of CO2 emission to be reduced, but also GHGs emission will increase in the countries/regions that do not have any obligation to reduce their GHGs emission by 30% of CO2 reduced in the countries/regions that have reduction targets. In sum, not only amount of the countries/regions that reduce CO2 will decrease, but also the CO2 reduction efficiency from a point of the entire globe will become extremely low.

Table 8: Changes of Carbon Dioxide Emission in Each Region

(%Change)

	With the US ratification	Without the US ratification
JPN	-22.00	-18.02
CHN	2.83	1.58
IND	0.88	0.17
USA	-30.37	1.11
E_U	-21.59	-18.26
FSU	3.24	2.03
NEX	4.16	1.94
NEM	4.09	1.62

4. Prospect and conclusion

I assess the impact of the US withdrawal from economic and environmental perspective by using the GTAP-E. From economic point of view, the US receive huge benefit and the US business sector, especially energy sector, increases the output, because the US increase the competitiveness again other regions/countries by withdrawing the Kyoto Protocol. Other Annex countries, Japan and EU, receive both positive and negative benefit. Japan and EU have to bear CO2 abatement cost and lose competitiveness against the US, but increase competitiveness against China, India and Former Soviet Union due to lowered carbon abatement cost

From the environmental aspect, the Kyoto protocol itself will be extremely low because of the increase of the carbon-leakage caused by the US withdrawal from the Kyoto Protocol. The US withdrawal derogate the primary objective of the Kyoto Protocol, which aims to stabilise GHGs concentration in the atmosphere and lead to a failure of sustainable development.

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