Transboundary PM Air Pollution and its Impact on Health in East Asia

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1. Introduction

Even though PM air pollution has been identified as a serious health hazard in China, Korea, and in parts of Japan, the allocation of responsibility for emissions has become a hindrance to negotiation and cooperation. As a result, no international regime for PM mitigation so far has yet been established. In this study, we investigate the current state, characteristics and health hazards related to transboundary PM air pollution in China, Japan and Korea, the three main actors in East Asia with respect to transboundary PM air pollution. We then explore the potential for policy coordination and the prospect for adopting policies aimed at reducing air pollution, based on an analysis using the E3ME model.

2. Scenarios and methodology

In this study, we estimate the level of PM emissions generated in China, Japan and Korea, using the E3ME model. We compare a baseline scenario (i.e. no special limits on fossil-fuel consumption) and a scenario with carbon taxes (Scenario 1, S1) , in which fossil fuel consumption decreases in line with the long-term decarbonisation target. Although PM air pollution policies have already been implemented in China, Japan and Korea, here, we investigate the spillover effects from meeting ambitious long-term emission target in these countries.

3. Expected results and Analysis

Emissions of SO_2, NOx, CO and N_2O, and direct $PM_{2.5}$ emissions for a few selected years in each scenario are shown in Table 1. As expected, large reductions in annual emissions or pollutants can be achieved by enacting carbon-limiting policies. Compared to those of baseline scenario, direct $PM_{2.5}$ emissions in 2015 are reduced in China and Japan by 35% and 25%, respectively, in the climate change mitigation scenario S1; whereas Korea reduces direct $PM_{2.5}$ emissions by 61%. The latter is important in the context of the societal issues currently caused by exposure to $PM_{2.5}$. It should be remembered that the scenario includes only policies to reduce energy-related emissions. Therefore, these results are due to changes in energy use rather than

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policies that directly target improvements in air quality.

Table 1 Development of annual emissions of several air pollutants at baseline scenario and S1[2].

Pollutant		Emission at baseline (kt/y)			Emission at S1 (kt/y)		Change from Baseline (%)	
		2010	2030	2050	2030	2050	2030	2050
Japan	*SO_2*	2390	2473	2391	1504	998	-39	-58
	NOx	2468	2518	2522	1582	1137	-37	-55
	CO	9859	9146	8724	6944	4493	-24	-49
	N_2O	94	97	96	82	73	-15	-23
	PM2.5	167	166	178	133	133	-20	-25
China	*SO_2*	41367	40499	42970	17384	9279	-57	-78
	NOx	21528	24011	23425	12994	8254	-46	-65
	CO	109635	119810	108766	84918	63321	-29	-42
	N_2O	1817	2174	2499	1764	1651	-19	-34
	PM2.5	12431	13355	12992	10428	8468	-22	-35
Korea	*SO_2*	1082	1059	947	632	251	-40	-74
	NOx	1414	1593	1946	1138	920	-29	-53
	CO	3411	3602	3753	2895	2203	-20	-41
	N_2O	67	71	70	61	48	-15	-31
	PM2.5	167	158	148	104	57	-34	-61

Note: 1.Baseline scenario, no fossil-fuel consumption limit.

2.Scenario 1, carbon taxes.

3.Pollutants in bold are direct PM emissions; pollutants in Italics are PM2.5-precursor pollutants.

Source: E3ME model outcome.

4. Conclusion

From our analysis using E3ME, we conclude that emissions of non-CO_2 air pollutants can decrease because of spillover effects from decarbonization policies. Improvement of air quality directly leads to reductions of adverse health impacts and may have further positive economic impacts by improving labor productivity. In such a scenario, government spending on health care is expected to decrease. The model-based analysis also confirms that all of East Asia stands to benefit from reductions in air pollution in China. The challenge for policy makers is, thus, to coordinate a system that provides benefits to the region as a whole.