EMISSION TRADING OR CARBON TAX OR BOTH? SOME INSIGHTS FROM A MULTI-REGIONAL CGE MODEL OF CHINA

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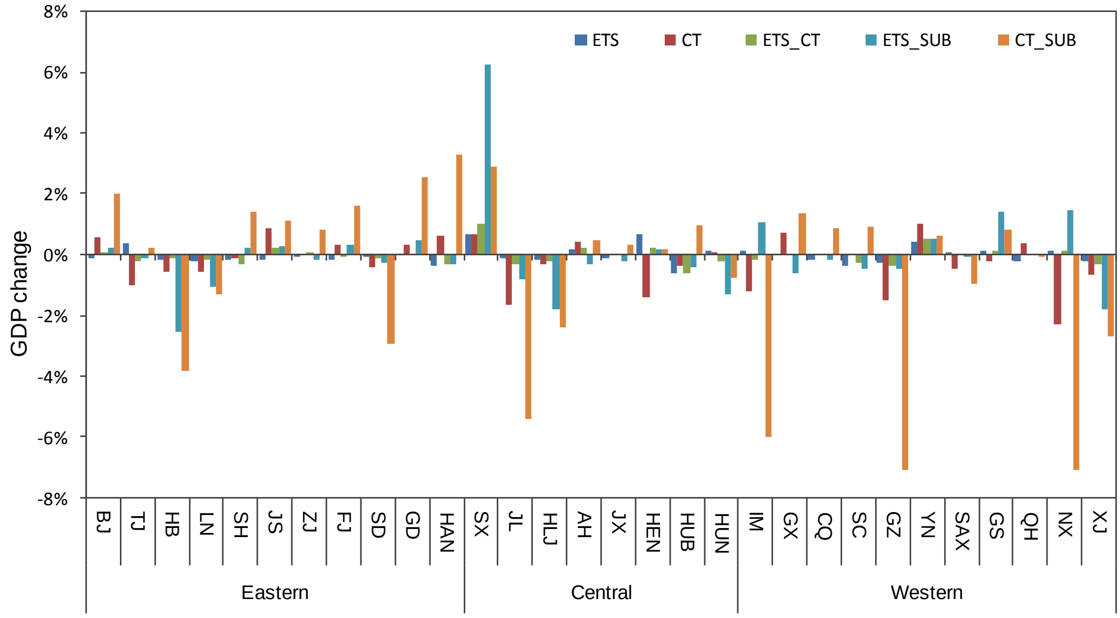
Overview: In December 2017, China introduced a national emission trading scheme in contributing to achieve its Nationally Determined Contribution (NDC) set under the Paris Agreement. China's NDC aims reducing its greenhouse gas (GHG) emission intensity (i.e., CO_2 equivalent emissions per unit of GDP) by 60 to 65 percent below 2005 levels (Wu et al., 2017). The recently introduced national emission trading scheme covers only the electricity sector and is expected to extend to other emission intensive sectors in the near future. However, an emission trading scheme would not be able to cover some key sources of GHG emissions such as the transport sector, household sector and government or service sector. Without reducing emissions from those sectors, meeting China's NDC would be challenging. Since it would be too complicated to cover these sectors through a national emission trading scheme, a carbon tax might be an appropriate instrument to trigger emission reductions in the sectors not covered by the national emission trading scheme. This study compares, using a multi-region, multi-sector CGE model of China, various policy instruments, such as a national emission trading system and a uniform national carbon tax to achieve specified emission reduction targets. It then simulates scenarios combining these policy instruments to investigate if a combination of these policies would be more economic than implemented them in isolation. The study finds that a combination of emission trading and carbon tax would be more economical than these instruments introduced in isolation.

Methodology: We used a multi-region, multi-sector computable general equilibrium (CGE) model of China for this study. The details of the model are available in Fan et al. (2016), Wu et al. (2016) and Wu et al. (2017). The model includes 30 administrative regions (or Provinces) in China. In each province, the model has 17 production sectors, one representative household and one government. Provinces trade goods and services to each other and to the rest of the World. CO_2 emission reductions are traded between provinces and sectors. Emission allowances are allocated through auctioning. The revenues generated from allowance auctioning and carbon tax are recycled to households in a lump-sum manner. In some scenarios, the revenue is used to subsidize clean fuels for transportation instead of recycling it to households. We simulated five policy scenarios to achieve a given level of emission reduction targets (here 10% below the baseline). These scenarios are: (i) national emission trading covering energy and energy-intensive sectors (ETS Scenario), (ii) uniform carbon tax for the entire economy (CT Scenario), (iii) ETS for energy and energy-intensive sectors and CT for the rest of the sectors (ETS_CT Scenario), (iv) ETS as in Scenario 1 and subsidies to clean fuel for transportation (ETS_SUB Scenario) and (v) CT as in Scenario 2 and subsidies to clean fuel for transportation (CT_SUB Scenario).

Results: Figure 1 shows the GDP impacts (percentage deviation from the baseline) in different provinces in China under the various policy scenarios we simulated. While reducing 10% CO_2 emissions from the baseline, China would experience GDP losses of 0.07%, 0.13%, 0.05%, 0.13% and 0.16% under the ETS, CT, ETS_CT, ETS_SUB and CT_SUB scenarios, respectively. An interesting finding of the study is that the emission trading system (ETS Scenario) would be more efficient than a uniform carbon tax (CT Scenario) in China. If the ETS and CT are combined so that ETS reduces emissions from the covered sectors and CT does the same for the rest of the economy (ETS_CT scenario), it would be the most efficient to achieve a given CO_2 emission reduction in China at the national level. However, the efficiency of climate change mitigation (i.e., GDP impacts at provincial level) of these scenarios would vary differently in different provinces. The study reveals that clean fuel subsidies on top of either ETS or CT would not be economically desirable options as they cause higher GDP losses than a situation in the absence of those subsidies. The study also find that sectoral impacts would be significantly different across the sectors, provinces and scenarios.

Figure 1: Economic impacts of various policy scenarios



Conclusions: While a national emission trading system and a uniform national carbon tax would produce the same outcome theoretically, they are much different in practice and would have different implications in the real world. A uniform carbon tax can be implemented across all emitters. On the other hand, it would be difficult to design an emission trading system that is equally applicable to all emitters. For example, a carbon tax is equally suitable for both intermediate consumers (i.e., production sectors) and final consumers (e.g., households), it would be too difficult, if not impossible, to design an emission trading system where final consumers can trade emission allowances with intermediate consumers. Designing emission trading system is also complicated in some energy intensive intermediate consumers, such as the transportation sector. It would be more appropriate, therefore, to design a policy portfolio, that combines both emission trading system and the carbon tax system. Such a system, on one hand, provides incentives and flexibilities for emitters to participate in climate change mitigation efforts, on the other hand, this system requires all emitters to reduce their emissions, no matter whether they are intermediate consumers or final consumers. Our study finds that a national emissions trading system would be more efficient than a carbon tax policy to achieve a given level of CO_2 reduction in China. However, further cost efficiency would be gained if the national emission trading system is supplemented by a carbon tax in those sectors which are not covered by the emission trading system. The study also shows that subsidizing cleaner fuels for transportation in the presence of emission trading or carbon tax would not be economically desirable as they cause additional economic (i.e., GDP) losses.

References

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