Uncovering the macro-level relationships between CO_2 and air pollutants abatement in China's iron and steel industry

Abstract submitted to the theme of

2. Natural resources, ecosystem services and environmental quality

2.4. Economic issues in environmental quality and degradation

The co-control of CO_2 and air pollutants is an important strategy for mitigating the climate and environmental impacts of China's iron and steel industry, which is one of the highest emitting sectors and is producing the largest amount of pig iron and crude steel globally. The channels for the interactions between the abatement of these non-separable emissions range from the bottom level of production processes up to the top level of aggregate output changes induced by climate and pollution-control policies (Agee et al., 2014). Studies on the iron and steel industry were mostly done at the bottom level, trying to map the co-control measures, calculate their costs, and compare the mitigation effects with and without co-control measures (Mao et al., 2013; Zhang et al., 2014). The relationships between CO_2 and air pollutants may also differ in terms of total emission and emission intensity, but the existing research usually did not simultaneously consider both of them, not to mention the reasons and implications behind this difference. Research is highly needed to reveal whether the mitigation of CO_2 and air pollutants in the iron and steel industry, in terms of both total emission and emission intensity, synergize or conflict with each other at the macro level, and to analyze the key macroeconomic forces that shape their interactions. This will be an important basis for further macro and micro level studies and shed light on the design of co-control policies.

To fill the knowledge gaps, we adopted the vector error correction model, a widely used econometric method, to analyze interactions among the time series of CO_2 emissions, air pollutants emissions, together with investment and technological progress which characterized the development of the iron and steel industry in China. The time period ranged from 1991 to 2012, and SO_2 was taken as a representative air pollutant in the model. Impulse response analyses showed that reduction of total CO_2 emissions and emission intensity led to reduction of total SO_2 emissions and SO_2 emission intensity, respectively, while the influences of SO_2 emissions on CO_2 emissions were less significant or clear. Investment and technological progress greatly drove up total emissions, and technological progress significantly reduced emission intensities. Results of granger causality tests further consolidated the above inferences, and analyses of some more types of air pollutants other than SO_2 showed similar outcomes.

These results indicate that at the macro level, CO_2 abatement has a positive effect on air pollution control in China's iron and steel industry, while the influence of the latter on the former is less clear. This may be partly explained by the asynchronized and unbalanced regulation on them. The government has been relatively less decisive in formulating and implementing mitigation policies on CO_2 emission. This may lead the iron and steel enterprises

and the industry as a whole to care less about the ancillary consequence on CO_2 emissions than the consequence on air pollution when they invest and adopt new technologies. The output shrink due to more stringent regulation on air pollution can cause the lowering of CO_2 emissions, but the extra energy consumption of air-pollutant abatement can also bring about more carbon emissions. This suggests that given the current structure of climate and pollution-control policies, strengthening CO_2 targets and decisively carrying out command-and-control and market-based instruments on CO_2 can help harvest the co-control fruits, but the one-sided emphasis on air pollution control without coordinated climate polices may lead to negative spillovers to CO_2 emissions. This should draw special attention of the government and industry now when the country is determined to carry out massive measures and to regulate the iron and steel industry in order to fight against air pollution. The Chinese government has also recently issued the *China-US Joint Announcement on Climate Change*, declaring that China's total CO_2 emissions will reach its peak around 2030 (Tang, 2014). Even though the CO_2 emission intensity keeps falling in the iron and steel industry, policies and abatement technologies for mitigating its total emission should be highlighted to curb the soaring trend driven by investment and productivity advancement.

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