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Addressing the competitiveness effects of taxing carbon in China: domestic tax cuts versus border tax adjustments

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ABSTRACT

This study focuses on the international competitiveness effects of levying a carbon tax in China. Based on a computable general equilibrium model, this study analysed the impacts of a carbon tax on different sectors from the aspect of changes in market shares of domestic producers in the domestic markets and changes in exports. The effects of different measures, including domestic tax cuts and border tax adjustments, in alleviating the unfavourable competitiveness impacts were also analysed and compared, as were the impacts of different tax schemes on the macro-economy, sectoral profits and carbon emissions. The results show that without any complementary measures, a carbon tax would negatively shock the domestic market shares and exports of almost all tradable sectors and the profits of almost all sectors. As for cushioning the unfavourable effects, the domestic tax cuts are able to ease the negative impacts on the domestic market shares and exports of almost all tradable sectors. Moreover, the unfavourable impacts of domestic tax cuts on both the macro-economy and the sectoral profits are obviously smaller than those of the other schemes, regardless of the use of the same tax rate or emission reduction amount. Among the border tax adjustment measures, the best performance in general corresponds to the measure purely implementing adjustments on exports.

1. Introduction

In recent years, global climate change has been attracting more attention, with the competitiveness effects of unilateral emission reduction activities being one of the hot issues. Any emission reduction activities are inevitably accompanied by corresponding costs. When these activities are performed unilaterally in a country, such additional costs could increase the relative prices between the goods produced domestically and the counterparts produced abroad, which is therefore likely to shock the competitiveness of the domestic producers. Given the importance of production activities on the economic development of a country and the crucial impacts of enterprise acceptance on the political feasibility of a policy, competitiveness issues receive much concern in the discussions for emission reduction activities.

The competitiveness issues require special attention in the context of China. Despite having no binding reduction obligations, as the current largest CO_2 emitter in the world, China has been actively addressing climate change and has announced a series of voluntary reduction targets, including reducing its carbon intensity by 17% from the 2010 levels by the year 2015 and by 40–45% from the 2005 levels by the year 2020. Along with these voluntary mitigation targets, however, the status quo in China is that on the one hand, its economic development is still in the stage of heavy and chemical industry, with the energy- and emission-intensive sectors such as metallurgy, chemical and building materials playing key roles in the economic growth. On the other hand, China's degree of openness, regardless of the trade volume or intensity, has been constantly increasing. Therefore, it is reasonable to pay special attention to the impacts of China's unilateral mitigation efforts on its international competitiveness.

Among various mitigation measures, considering the advantages of the policy itself and the feasibility of being implemented in the near future, this study focuses on carbon tax. Carbon tax is a tax levied on fossil fuels (such as coal, oil, natural gas) according to their carbon content or their carbon emissions during combustion, for the purpose of reducing carbon dioxide emissions and mitigating global warming. As an incentive-based instrument, carbon

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tax has been frequently recognized as cost-effective and advocated as one of the most popular emission reduction policies, and has attracted wide-ranging academic discussions since early 1990s.

Aware of the importance of environmental evaluation for any kind of climate mitigation measures (Ferreira et al., 2014a, 2014b; Lee et al., 2015), the environmental effects of a carbon tax has always been a major concern, including its impacts on carbon emissions (Allan et al., 2014; Bruvoll and Larsen, 2004; Lin and Li, 2011b), other greenhouse gases (Bruvoll and Larsen, 2004; Choi et al., 2010) and its co-benefits of reducing local environmental emissions (Burtraw et al., 2003; Shakya et al., 2012; Hanaoka et al., 2014). Among other multifarious studies besides environmental evaluation, considering that the introduction of a new tax implies a new distortion to the economic system, the socio-economic impacts of carbon tax is attracting high attentions and invoking many studies focused on a country/region (Fang et al., 2013; Kamat et al., 1999), on carbon-intensive production sectors (Chao, 2014; Hossain Mondal and Sadrul Islam, 2012), and on households (Brännlund and Nordström, 2004; Liang and Wei, 2012; Liang et al., 2013). Among these studies, competitiveness effects is an important research focus. To date, there have been many studies about the competitiveness effects of a carbon tax, which addressed two broad questions: what type of effects there would be and how to mitigate the unfavourable effects.

When measuring the competitiveness effects, the indicators frequently used include changes in profits and domestic market shares (Bassi et al., 2009; Dissou and Eyland, 2011), relative prices between domestic and foreign goods (Rivers, 2010; Lin and Li, 2011a), exports (Kee et al., 2010; Zhao, 2011), and outputs (Fischer and Fox, 2012). Most of these studies indicated that levying a carbon tax would indeed lead to competitiveness losses of domestic sectors (Rivers, 2010; Zhao, 2011; Kee et al., 2010). Based on a review of empirical studies on existing carbon/energy taxes, Zhang and Baranzini (2004) concluded that the competitive losses are generally not significant and definitely less than often perceived. However, they also claimed that, given the ultimate objective of the Framework Convention, future carbon taxes could have higher rates than those already imposed and that the resulting economic impacts could thus be more acute. Alexeeva-Talebi et al. (2007) indicated that the magnitude of sectoral competitiveness effects is sensitive to the selection of competitiveness indicators. They found that given an emission reduction target of 30%, the competitiveness losses in energy-intensive sectors was 10% when calculated using Revealed Comparative Advantages and Relative World Trade Share and more than 100% when calculated using Relative Trade Balance.

In addition to measuring the effects, various complementary policies have been suggested to alleviate the potential adverse impacts, such as relieving or exempting a carbon tax in some sectors (Böhringer and Rutherford, 1997; Liang et al., 2007; Rivers, 2010), recycling carbon tax revenues (Bassi and Yudken, 2011; Liang et al., 2007; Rivers, 2010), implementing output-based rebating (Rivers, 2010; Fischer and Fox, 2012), and implementing border tax adjustments (BTAs) (Dissou and Eyland, 2011; McKibbin et al., 2008). Existing studies show that there is no a uniformly recognized best measure. The pros and cons of different complementary measures depends on the economic situation of a country, the specific setting of the mitigation policy, etc. The final selection of the complementary measure needs to consider and weigh the competitiveness loss of various industries. For example, Rivers (2010) evaluated the effectiveness of several design mechanisms in mitigating the negative competitiveness impacts associated with a unilateral climate change policy in Canada and found that except for the revenue recycling strategies that use revenue raised from carbon pricing to cut labour and capital tax rates, the other mechanisms can all preserve the international competitiveness of energy-intensive Canadian manufacturing sectors, but there is not a clearly optimal policy. Fischer and Fox (2012) considered four policies that could be combined with unilateral emissions pricing to counter the effects on international competitiveness, including a border charge on imports, a border rebate for exports, full border adjustment, and domestic output-based rebating, with simulations for the energy-intensive sectors of the United States, Canada and Europe. They found that all of these policies can support competitiveness, with full border adjustment usually being most effective while output-based rebating for key manufacturing sectors achieving many of the gains.

Currently, related studies focussing on China are mainly qualitative. Of the few quantitative studies, most indicate that a carbon tax will bring unfavourable impacts on the sectoral competitiveness of China. For example, using the terms of import and export intensity as indicators, Wang et al. (2011) found that when the carbon tax rate was high (100 yuan/ton CO_2) the competitiveness of some sectors would indeed be highly affected and certain compensatory measures may be necessary, while no significant competitiveness impacts at the sector level would be generated when the carbon tax rate was low (10 yuan/ton CO_2). Su et al. (2011) also found that levying a carbon tax would decrease the outputs and exports of energy-intensive sectors, and such unfavourable effects would increase with time and with the carbon tax rate. As for the complementary measures, the current quantitative studies mainly focused on domestic policies and, in general, prefer using carbon tax revenue to cut other taxes. For example, based on a computable general equilibrium model, Liang et al. (2007) compared the impacts of different carbon tax schemes and found that the scheme that exempts the energy- and trade-intensive sectors and subsidizes the un-exempted sectors performs best not only in alleviating the negative impact on the macro-economy but also in protecting energy- and trade-intensive sectors. Lu et al. (2010) also found that reducing indirect tax while imposing a carbon tax would help to reduce the negative impacts on production and competitiveness. As for border adjustment measures, current studies have mainly focused on the effects of imposing BTAs by foreign countries on the economy of China. Only a few studies have analysed the effects of imposing BTAs by China, and the focus was usually placed on the export-side. For example, Li et al. (2012) investigated the economic rationale of taxing direct CO_2 emissions of exports in China under different policy scenarios and found that the effect on the export structure is significant: the exports of major energy-intensive products decreased while the exports of labour-intensive or higher value-added sectors increased. Their result also revealed that redistributing tax revenue to stimulate consumption is an optimal choice.

This study aims to analyse the effects on sectoral competitiveness of levying a carbon tax in China and to compare the effects of different complementary measures, including both domestic tax cuts and BTAs. This study contributes to existing studies by comparing the effects of domestic alleviation and border adjustment measures on a uniform platform. This study also contributes by taking into account the effects of BTAs imposed by China on its competitiveness and by considering BTAs in a detailed manner from the aspects of both import and export. We will not discuss in this study whether the BTAs are compatible with WTO rules, but we focus instead on the question that even if the BTAs were compatible, would they really be superior to domestic tax cuts in protecting sectoral competitiveness and overall economic growth?

The rest of the paper is organized as follows. Section 2 introduces the model and data source. The setting and modelling of different carbon tax schemes is illustrated in Section 3. Major