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Carbon tax, tourism CO_2 emissions and economic welfare

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ABSTRACT

This paper, using a computable general equilibrium model, presents a simulation study of the changes in carbon emissions and economic welfare which could be brought about through a carbon tax policy in China's tourism industry. Our results clearly indicate that a carbon tax policy could have a remarkable impact on tourism-related carbon emissions and economic welfare. In addition, we find those impacts would be significantly different at different times. Also, the impacts of different carbon taxes on the different sectors of the tourism industry are also quite different. Furthermore, our analysis highlights three key managerial recommendations that are relevant for Chinese tourism policy-makers. Our results also have a certain reference value for the management of other low-carbon tourism destinations.

Introduction

The general public accepts that carbon dioxide (CO_2) emissions are causing global climate change (Cox, Betts, Jones, Spall, & Totterdell, 2000; Figueroa, Fout, Plasynski, Mcilvried, & Srivastava, 2008; Friedlingstein et al., 2006). In response to this climate change, numerous countries and regions have introduced climate-related policies that influence legislation, taxation, and the market. The carbon tax has been considered as an effective instrument to contain the increasing CO_2 emissions and to prevent economies from becoming locked in carbon-intensive pathways (Calderón et al., 2015; Dulal, Dulal, & Yadav, 2015; Pereira, Rui, & Rodrigues, 2016). In the current context that suggests carbon tax implementation as a tool to curb climate change, tourism and the tourism economy face a novel challenge. Consequently, this study uses the tourism power China as a case study to investigate the impacts of carbon tax on the tourism-related CO_2 emissions and economic welfare. The main research method employed for this study is a computable general equilibrium model (CGE), which is widely used in policy simulations. The main contribution of this study is the presentation of a first attempt to simulate the impacts of different carbon taxes on tourism-related CO_2 emission levels. This study simultaneously considers both the overall and specific tourism economic welfare changes in respect of added value and employment. In addition, this study investigates carbon tax impacts at different times and under different carbon tax scenarios. This enables a more flexible policy and results in a more thorough empirical research.

The Davos Declaration estimate tourism to contribute approximately 5% of the global CO_2 emissions (World Tourism Organization (UNWTO) and United Nations Environment Program (UNEP), 2008). As such, tourism is also expected to be at the forefront of the global response to climate change (UNWTO, 2007). Consequently, the entire tourism industry has become an important component of greenhouse gas emissions, energy conservation, and emission reduction. Therefore, the tourism industry has obtained important significance in achieving global emission reduction targets and a large number of studies have focused on reducing tourism-related CO_2 emissions. These studies have been conducted from different perspectives, all of which can be summarized to deal with the following aspects of CO_2 emission reductions: technical developments (Jones, 2013; Walz et al., 2008),

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voluntary approaches (Eijgelaar, 2011; Gössling et al., 2007; Horng et al., 2014; Mair, 2011; Scott, Peeters, Gössling, Scott, & Becken, 2010), comprehensive framework discussions (Horng, Hu, Teng, & Lin, 2012; Hu, Jeoushyan, Teng, & Shengfang, 2013; Peeters, Gossling, & Williams, 2006; Zhou, Wang, Yu, Chen, & Zhu, 2016), and policy implementations. In terms of policy implementations, several studies have extended our understanding of the impacts of carbon tax on tourism CO_2 emissions.

For example, Mayor and Tol (2007) explore the impacts of carbon tax on aviation carbon emissions and visitor numbers under different scenarios. Cranenburgh, Chorus, and Wee (2014) suggest the ongoing debate regarding aviation carbon taxes as a viable measure to reduce aviation carbon dioxide emissions. The authors further evaluated the effects of high aviation carbon taxes on tourism-related CO_2 emissions. Due to the significant amount of CO_2 emissions caused by air transportation, scholars generally tend to focus more on the impact of carbon taxes on air transport-related emissions (e.g. Cranenburgh et al., 2014; Mayor & Tol, 2007). However, few studies have contributed to an understanding of the comprehensive impact of carbon taxes on the tourism industry as a whole.

Several studies have investigated how carbon tax (or carbon pricing policies) affect economic changes with respect to tourism or the tourism sectors. For example, Tol (2007) conclude that travel behavior would only be slightly affected by carbon taxation of aviation fuel. The number of tourists would significantly be affected by levying carbon-related air passenger duties (Mayor & Tol, 2007) and other climate policy instruments (Mayor & Tol, 2010). These studies all focus on the impact of carbon tax from the perspective of tourists, while the “economy” property is not prominent. Dwyer, Forsyth, and Spurr (2012) and Dwyer, Forsyth, Spurr, and Hoque (2013) explore the potential impact of a carbon tax on the Australian tourism economy; and Meng and Pham (2017) analyze the impact of a carbon tax on the Australian tourism economy. Dwyer et al. define tourism sectors based on the Tourism Satellite Account, while the study of Meng and Pham focus on input–output tables. Both studies apply different research methods and acquired different data, thus leading to significantly different simulation results.

In China, the contribution of tourism to the national CO_2 emissions of all industries in 2002, 2005, 2007, and 2010 were approximately 2.489%, 2.425%, 2.439%, and 2.447%, respectively (Meng, Xu, Hu, Zhou, & Wang, 2016). The indirect carbon emissions of the tourism industry (except for the transport sector) have been reported to be three to four times that of their direct CO_2 emissions (Meng et al., 2016). Compared to global levels, China's tourism-related CO_2 emissions account for a smaller proportion of overall industrial emissions. However, due to China's enormous level of carbon emissions (approximately 9.123 billion tons in 2016, accounting for 27.3% of the emissions of the entire world according to the BP Statistical Review of World Energy for June 2017), even if only approximately 2.5% of the overall proportion of emissions would be accounted for, this would still mean that the tourism industry is responsible for a considerable amount of CO_2 emissions (approximately 0.228 billion tons in 2016). Furthermore, the Chinese tourism industry is developing rapidly (with an average annual growth rate of the tourism revenue of approximately 21.57% from 2010 to 2016, according to the National Tourism Administration of the People's Republic of China (2017)). This in turn indicates that the CO_2 emissions of the Chinese tourism industry are increasing more rapidly than the average global level.

Despite not having been implemented so far, the carbon tax has also been advocated as an effective and efficient complementary measure, and could thus be implemented to support the future low-carbon development of China (Asian Development Bank, 2015; Chen & Nie, 2016; Dong et al., 2017; Liu & Lu, 2015). Zhang (2017) discusses the importance of a carbon tax for the development of low-carbon tourism destinations. Furthermore, the Climate Division of China's National Development and Reform Commission reported the launch of a study on the introduction of carbon taxes in 2020 (People.cn., 2016), thus making it is very likely that a levy tax will soon be introduced in China. Based on this, an increasing number of studies have been devoted to assessing the impact of such a Chinese tax on related CO_2 emissions (Dong et al., 2017; Fang, Tian, Fu, & Sun, 2013; Xiao, Niu, & Guo, 2016). In addition, reports have been published on the impact of Chinese economic welfare. For example, Lu, Tong, and Liu (2010) use a dynamic recursive general equilibrium model to explore the impact of carbon tax on the Chinese economy. Guo, Zhang, Zheng, and Rao (2014) quantify the impacts of different carbon emission reduction scenarios on the GDP, income, the price of labor, investments, and savings. The authors investigate changes in energy sector outputs and confirmed the potentially negative impact of a carbon tax on economic growth.

As a means of taxation, the carbon tax has significantly impacted CO_2 emissions and economic welfare. However, few studies explicitly investigate these effects for the tourism industry, nor for the Chinese tourism industry in particular despite its important economic role in China and worldwide. Recognizing the impact of a carbon tax policy on the Chinese tourism industry and understanding the management implications of such impacts deserves further study. Unfortunately, to date, few studies have examined changes of the Chinese tourism under different carbon tax scenarios; therefore, this is the focus of this paper. Furthermore, because China's carbon tax has not yet been levied and consequently, the tax rate has not been determined, it is important to investigate different targeted tax rates and compare the resulting impacts. It is also of practical significance to examine the resulting impacts at different points in time, since levying a carbon tax is a long-term dynamic process. For that reason, this paper proposes a comprehensive dynamic analysis framework to explore the impacts of different tax rates at different time points on China's tourism industry in terms of CO_2 emissions, carbon intensity, value added and employment. Relevant time points are i.e. the year 2020 (when carbon intensity must be reduced from 40 to 45%, relative to 2005 levels) and the year 2030 (when national CO_2 emissions will reach their peak).

The remainder of this study is organized as follows: Section “Methodology” presents the methodology drawing on the computable general equilibrium model (CGE), the Social Account Matrix (SAM), and the determination of tourism-related industries. Section “Results and discussion” provides the results and a thorough discussion of our findings. Our conclusions and policy implications are presented in Section “Conclusions and policy implications”, along with suggestions for future research.