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Analysis on the carbon emission of tourism industry in Hubei of China

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Abstract. Using the bottom-up method and Tapio model, we calculated the tourism energy consumption (EC) and corresponding carbon emission (CE) in Hubei of China, and analyzed the decoupling between the CE and tourism economy. The results showed the tourism CE was 111.84×10^4 t in 2001, and increased to 376.04×10^4 t in 2015, with the annual growth amount of 18.87×10^4 t and rate of 9.05%, respectively. This denoted Hubei's tourism was being thoroughly developed on the whole from 2001 to 2015. Then, the share of tourism transport CE was always not less than 62% during 2001-2015, which indicated tourism transport sector should be paid more attention to and be given more of corresponding mitigation countermeasures. Furthermore, tourism activities' CE was always becoming larger and larger, with the increases of people's living standard and leisure time. Thus, it was necessary to study on how to improve the efficiency of energy use, especially in the progress of tourism activities. Last, an overall weak decoupling relationship between tourism economy and the corresponding CE existed within Hubei in 2001-2015. Thus, the economic development mode of Hubei's tourism industry was transforming to the low-carbon pattern expected by us, but it still needed to be continually strengthened.

1. Introduction

Global warming or climate change brings a great challenge to people around the world [1]. This leads to a phenomenon that the relationship between economic growth and carbon emission (CE) has become more and more attractive in recently [2]. Thus, the "low-carbon economy" strategy was put forward for us to realize the goal of energy savings and emission reductions. The United Nations World Tourism Organization (UNWTO) found that tourism industry contributed about 4.9% to the total CE, and this tourism CE grew up in the past, with an annual growth rate of 2.5% [3]. Therefore, the energy consumption (EC) and corresponding CE of tourism had been becoming more and more important, which should be paid much more attention to and studied more deeply.

Gössling (2013) discussed the whole tourism CE of a country and the related policy designs [4]. Ng *et al* (2015) analyzed the CO₂ emissions' drivers from Malaysia's tourism industry by using a decomposition analysis method [5]. In addition, the energy use associated with different travel choices



from tourism industry's perspective were also studied in 2003 by Becken *et al* [6]. Last, taking the island's tourism as an example, Kuo and Chen (2009) quantified the energy use, CE, and other environmental loads of the tourism industry by adopting a life cycle assessment approach [7].

However, taking the central region of China as an example, the related researches on the tourism EC and corresponding CE were still rare. Thus, in this article, we choose Hubei, an important province of central China, as a case, to conduct the related study, which has certain innovation significance. The innovation here is not only reflected in the case of a new region, but also in the introduction of a new research method like the Tapio decoupling analysis model.

2. Data and method

2.1. Data sources

The data are collected from the Yearbook of Hubei Statistics (2002-2016), the Yearbook of China Tourism Statistics (2002-2016), the sample survey information of inbound tourists and China's domestic tourism (2002-2016), and China's tourism statistical bulletin (2002-2016).

2.2. Method

The bottom-up approach used in this study is from Chen *et al* (2018), and the Tapio decoupling analysis model used in this paper is from Paramati *et al* (2016).

3. Dynamics of tourism EC and CE in Hubei province

The dynamics of total tourism EC and CE in Hubei province were shown in Figure 1. Figure 2 indicated that the proportions or shares of the three sectors (tourism transport, tourism accommodation and tourism activities, respectively) in total tourism CE in 2001-2015. We could easily find that the tourism EC in Hubei was 177.9×10^8 million joule (MJ) in 2001, and it increased rapidly to 688.22×10^8 MJ in 2015, with the annual growth amount of 36.45 MJ and rate of 10.15% (Figure 1). The total EC in 2015 was nearly 3.87 times more than that in 2001. This denoted that Hubei's tourism industry was being fully and thoroughly developed on the whole during 2001-2015. Similarly, the tourism CE in Hubei was 111.84×10^4 tonnes (10^4 t) in 2001, and it increased rapidly to 376.04×10^4 t (3.36 times) in 2015, with the annual growth amount of 18.87×10^4 t and rate of 9.05%. It should be noteworthy that both the tourism EC and the CE were all showing the declining change trend from 2008 to 2009. They were 430.22×10^8 MJ and 266.42×10^4 t in 2008 and 426.07×10^8 MJ and 266.09×10^4 t in 2009, respectively, which might be arising from the influence of the global financial crisis broke out just in 2008. The financial crisis brought the economic recession and negative impact to the tourism industry (including Hubei). Namely, the tourism-related transport, accommodation and activities were restrained and cut down by the macro-economic recession, to some extent.

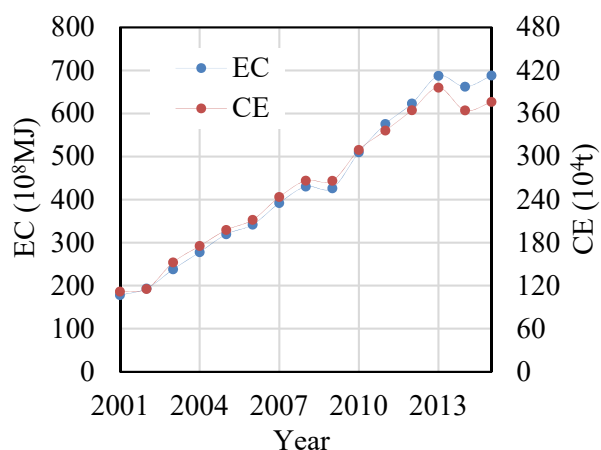


Figure 1. Total tourism EC and CE

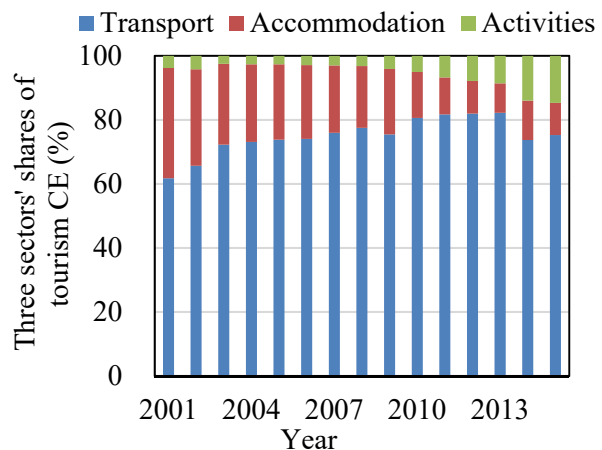


Figure 2. Three sectors' shares of tourism CE

However, all the two indicators were, once again, showing the declining change trend from 2013 to 2014. They were 687.43×10^8 MJ and 395.98×10^4 t in 2013 and 662.04×10^8 MJ and 364.40×10^4 t in 2014, respectively. The reason might be arising from the policies measures related to low-carbon development mode propelled by the local government, not from the economy situation. These countermeasures were mainly used for guiding people to protect environment, save energies and reduce emissions, and so on. For example, the Hubei's government published the saving goals of energy consumption and carbon emissions were 3% and 3.4%, respectively, in 2014. Therefore, it could be concluded that both the governmental policies and economic development itself had the important influences on the EC and the CE of tourism industry.

From three sector's perspective of tourism CE, we could easily see that tourism transport accounted for the majority proportion or share of the total CE in Hubei (Figure 2). The share of CE from the tourism transport was always not less than 62% during the period of 2001-2015. It could also be easily found that, during 2001-2013, the share of tourism accommodation CE was always more than that of tourism activities CE. However, during 2014-2015, the share of tourism accommodation CE was less than that of tourism activities CE. The specific shares were 12.31% and 10.05% for tourism accommodation, and 14.01% and 14.70% for tourism activities, respectively, from 2014 to 2015. Thus, we could conclude that the tourism transport sector should be paid more attention to and be given more of the corresponding mitigation countermeasure to cut down the EC and the CE. In addition, it should be explained that the tourism activities CE was not big enough, but it was always becoming more and more prominent (Figure 2). This reason was mainly arising from the increases of people's living standard and leisure time. Thus, study on how to improve the efficiency of energy use in the progress of tourism activities was also an important subject should be paid more attention to.

4. Decoupling analysis

Tapio decoupling model was introduced to analyze the relationship between the tourism economy and the tourism CE. The specific decoupling index between the tourism CE and the tourism economy and the detailed tourism revenues of Hubei were illustrated in Figure 3. Figure 4 showed that the change rates of the tourism revenues and the tourism CE.

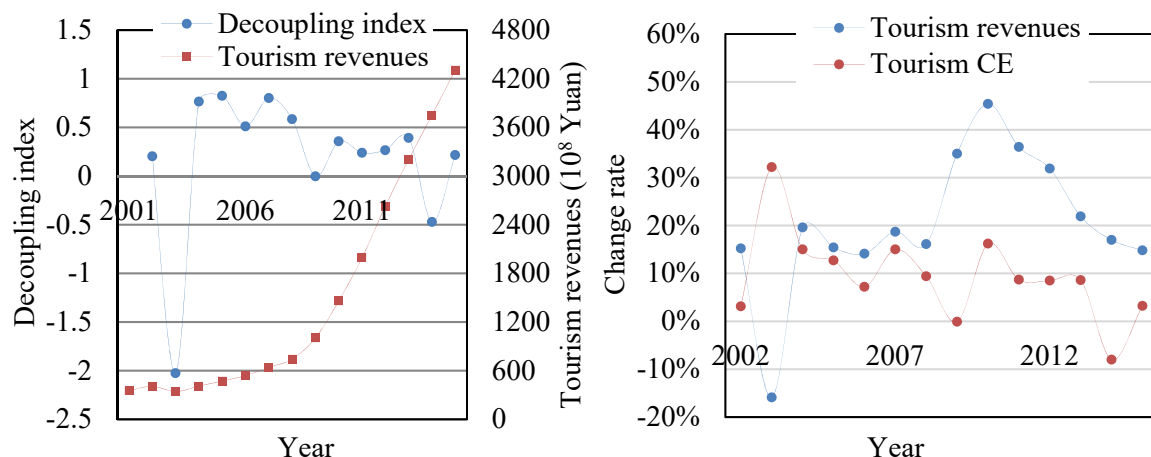


Figure 3. Decoupling index and tourism revenues Figure 4. Change rates of CE and tourism revenues

It could be easily seen that Hubei's tourism revenue was only 35.364 billion Yuan in 2001 (Figure 3). However, the revenue increased rapidly to 430.876 billion Yuan in 2015, with the average annual growth amount of 28.25 billion Yuan and rate of 19.55%, respectively. These data indicated that the tourism industry of Hubei was fully and thoroughly exploited, as a whole, which was consistent with the text above. Based on the Tapio model, we could clearly see that an overall weak decoupling relationship between the tourism economy and the corresponding CE existed within the Hubei province in 2001-2015. During this studied period, the average annual growth rate of tourism revenues in Hubei reached 20.4%, and the average annual growth rate of tourism CE only reached 9.4%. So, the

growth rate of tourism revenues was significantly higher than the growth rate of tourism CE, which guaranteed the overall weak decoupling relationship between the tourism economy and the corresponding CE. First, the overall decoupling index was 0.20 during 2001-2002, which indicated that the tourism CE had a “weak decoupling” relationship with the tourism economy (revenues). Then, the decoupling index decreased sharply to be -2.03 during 2002-2003. This result indicated that the tourism CE had a “strong negative decoupling” relationship with the tourism economy, which could also be easily seen from the change rates of the two factors (tourism revenues and CE in 2003 in Figure 4). Next, the decoupling indexes were 0.83 and 0.80 during 2004-2005 and 2006-2007, respectively, which showed that the tourism CE had the “expansive coupling” relationship with the tourism economy. Namely, a same change trend existed between the tourism economic and the overall tourism CE. Both two factors influenced each other. So, it could be easily concluded that the development pattern of low-carbon economy of Hubei’s tourism industry was not ideal during 2003-2007. The reason might be mainly arising from the influence of the Severe Acute Respiratory Syndromes (SARS), which broke out in 2003. Due to the SARS, people might spend more time in the diet health and security, thus ignoring the development of energy saving and low-carbon economy in the following years. So, people produced a lot of tourism CE at the same time of tourism-related progress. However, after the global financial crisis which broke out in 2008, people realized soon the importance of saving energy and reducing carbon. Thus, the relationship between the tourism economy and corresponding CE showed, once again, an overall weak decoupling situation. The only two exceptions were in 2008-2009 and 2013-2014, when their decoupling indexes were -0.003 and -0.471, respectively, showing a strong decoupling.

5. Conclusions and Discussion

Taking Hubei, an important province of central China, as an example, we calculated the tourism EC and the corresponding CE during 2001-2015. Then, by introducing the Tapio model, we analyzed the decoupling relationship between the CE and tourism economy. The results showed the tourism EC in Hubei was 177.9×10^8 MJ in 2001, and it increased rapidly to 688.22×10^8 MJ in 2015, with the annual growth amount of 36.45 MJ and rate of 10.15%, respectively. Similarly, the tourism CE in Hubei was 111.84×10^4 t in 2001, and it increased rapidly to 376.04×10^4 t (3.36 times) in 2015, with the annual growth amount of 18.87×10^4 t and rate of 9.05%. These results denoted that Hubei’s tourism industry was being fully and thoroughly developed on the whole during 2001-2015.

Then, tourism transport accounted for the majority proportion or share of the total CE in Hubei. The share was always not less than 62% during the period of 2001-2015. Thus, we could conclude that the tourism transport sector should be paid more attention to and be given more of the corresponding mitigation countermeasure to cut down the EC and the CE.

Furthermore, tourism activities’ CE was not big enough, but it was always becoming more and more prominent. This reason was mainly arising from the increases of people’s living standard and leisure time. Thus, study on how to improve the efficiency of energy use especially in the progress of tourism activities was also an important subject should be paid more attention to.

Last but not least, an overall weak decoupling relationship between the tourism economy and the corresponding CE existed within the Hubei province in 2001-2015. Thus, the economic development mode of Hubei’s tourism industry was transforming to the low-carbon pattern, but it still needed to be continually strengthened. It should be noteworthy that the development pattern of low-carbon economy in Hubei’s tourism industry was not ideal during 2003-2007. The reason might be mainly arising from the influence of the SARS broke out in 2003. However, after the global financial crisis broke out in 2008, the relationship between the tourism economy and corresponding CE showed the overall weak decoupling situation expected by us.

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References

- [1] Chen L, Thapa B and Yan W 2018 *Sustainability* **10** 2118
- [2] Paramati S R, Alam M S and Chen C F 2016 *J. Travel Res.* **56** 712-24
- [3] Castellani V and Sala S 2010 *Tourism Manage.* **31** 871-80
- [4] Ng T H, Lye C T and Lim Y S 2015 *Int. J. Sustain. Dev. World Ecol.* **23** 266-77
- [5] Gössling S 2013 *Energy Policy* **59** 433-42
- [6] Becken S, Simmons D G and Frampton C 2003 *Tourism Manage.* **24** 267-77
- [7] Kuo N W and Chen P H 2009 *J. Clean. Prod.* **17** 1324-30