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Conference Paper

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56th Congress of the European Regional Science Association: "Cities & Regions: Smart, Sustainable, Inclusive?", 23-26 August 2016, Vienna, Austria

Provided in Cooperation with:

European Regional Science Association (ERSA)

Suggested Citation: Liu, Jingjing; Nijkamp, Peter (2016) : Inbound tourism as a driving force of the regional innovation system: An impact study on China, 56th Congress of the European Regional Science Association: "Cities & Regions: Smart, Sustainable, Inclusive?", 23-26 August 2016, Vienna, Austria, European Regional Science Association (ERSA), Louvain-la-Neuve

This Version is available at:

<https://hdl.handle.net/10419/174664>

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Inbound tourism as a driving force for regional innovation: a spatial impact study on China

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Abstract:

Tourism has turned into a major development driver for many nations and regions. This study focusses on the influence of inbound tourism on regional innovation. The spatial network structure and the heterogeneous demand elements, as well as the mediating effect of regional absorptive capacity, are addressed in this paper. Data from 30 Chinese provinces for the years 2003-2012 are used for the empirical analysis, using a spatial panel data model. In addition, in our study, the Tourism-Led Growth (TLG) hypothesis is also revisited, with regional innovation as a mediating variable. The results show that inbound tourism may be a new and powerful driving force of innovation. The tourism effect on technological innovation appears to be weaker than that on social innovation; and the impact of inbound tourism on innovation tends to be stronger in the richer and more internationally-oriented provinces of China.

Key words: Inbound tourism, Regional innovation, Absorptive capability, Tourism Led-Growth, Spatial panel data analysis, China.

1. Introduction

Nowadays, tourism is playing an increasingly important role in regional development. Clearly, its positive and negative influence cover a wide field, ranging over social-cultural, economic and environmental aspects (Almeida-García, 2016), but most strategic interest in inbound tourism can be found in the context of the regional economy. In many regions, tourism is resurrecting idle resources, and is giving birth to new growth poles, while it is often also even reversing the prevailing development trend. Nowadays, tourism is also treated as an important means of economic-political diplomacy in China, because of its flexible and profound positive effect on the spread of soft power and on business

cooperation. In the 1960s, especially since Balaguer and Cantavella-Jorda (2002) put forward the Tourism-Led Growth (TLG) hypothesis, a hot topic in the literature has been whether and how tourism development, especially international tourism, promotes national and local economic growth (Katircioglu, 2009). Although economic welfare, market scale, industrial status of tourism, and other regional characteristics can impact the importance of tourism for the economy (Gunduz and Hatemi-J, 2005; Albaladejo et al., 2014), the interaction between tourism and economic development is well acknowledged in past impact studies.

According to Endogenous Growth Theory, innovation - conceived of as the generation, acceptance and implementation of new ideas, products, processes or services (Hjalager, 2010; Expósito-Langa et al., 2011) - is regarded as the fundamental driving force of economic growth (Solow, 1957; Grossman and Helpman, 1991; Jones, 1995), including the modern tourism industry. Along with the globalisation and information-economic epoch, international knowledge spillovers play a key role in regional development (Kuo and Yang, 2008), as the interacting knowledge generation and exploitation subsystem linked to global, national and regional innovation systems has become more and more comprehensive and open-ended (Cooke, 2004). As a nexus of the destination and external resources, tourism - especially inbound tourism - brings many kinds of social resources for the development of the host region. Mutual learning between the host and guest culture will enrich the knowledge, information and culture of the destination region. This interaction may contribute to a higher level of cognitive proximity and absorptive capability. As a service-intensive industry composed of heterogeneous agents and activities scattered in time and space (Aldebert et al., 2011), tourism essentially engenders a large-scale exchange of ideas and information among people (Dieke, 2003); in particular, face-to-face contacts will, more or less, improve innovation by promoting the informal knowledge spillovers within and between different sectors (Krugman, 1991; McCann, 2007). What is more, the distinct demand of foreign tourists will encourage more commercial creativity (Boissevain, 1996), while the hedonism of tourists and the leisure trend of a tourism destination will result in more entrepreneurship (Chaperon and Bramwell, 2013), which in turn may shape more positive political support (Wilson, 1997; Smith, 2009) and a liberal atmosphere for innovation.

A great deal of research has focussed attention on the influence of innovation on the development of the tourism industry, but only a few studies have considered the impact of tourism on innovation in host regions. These studies argue that tourism can reveal and induce ongoing innovation, and has been one of the main drivers of Internet use in the tourist destination (Werthner and Klein, 2005; Maskell et al., 2006). In fact, the tourism industry itself can be defined as a sectoral system of innovation and production (Malerba, 2002; Aldebert et al., 2011). Empirical analysis from China has shown that both domestic and inbound tourism can improve the technical efficiency in the country (Mao and Zhao, 2014). Therefore,

inbound tourism may have a potential great influence on innovation, and innovation may be another new approach to interpreting the impact of inbound tourism on the economy. Clearly, the mechanism of both these relationships needs further exploration.

This study focusses on the influence of inbound tourism¹ on regional innovation. The effects of innovation types and regional innovation preconditions are also taken into consideration. The research questions of this study are: (1) What is the mechanism by which inbound tourism impacts regional innovation? And will absorptive capacity play a decisive mediating role in the above relationship?; (2) Can regional innovation improvement act as a new approach to explain the TLG hypothesis?; (3) What are the effects from inbound tourism on different types of innovation?; (4) Will the performance of inbound tourism differ depending on levels of regional development and openness?

The novel contribution of this study may be described as follows. Firstly, the theoretical framework and empirical study of the potential influence of inbound tourism on regional innovation will lead to more in-depth insights into not only the interaction between tourism development and innovation, but also the more system-wide impact of tourism. Secondly, the influence of inbound tourism on regional innovation will be a new approach to interpret the TLG hypothesis and will offer a new perspective to analyse the long-term impact of tourism development. Thirdly, our study is a meaningful complement to previous studies on the relationship between immigration, cultural diversity and innovation, especially in the context of developing regions. With regard to the underlying impact mechanism, the previous studies on the impact of immigration on innovation tend to ignore the dynamic benefits from knowledge exchange, inflows of capital in an open economy, greater product variety, and consumption externalities (Ottaviano and Peri, 2006; Longhi et al., 2010), which are the main mechanisms of how inbound tourism acts on innovation. Moreover, since Jacobs (1961, 1969) has argued that there will be more innovation in more diverse cities, the research on this topic has mainly focussed on an American or European context (Ozgen et al., 2012). Nevertheless, in order to explore the influence of cultural diversity on innovation, especially in developing countries or regions, inbound tourism is a more practical and appropriate way to do this than immigration. The paper aims, therefore, to assess the impact of inbound tourism on regional innovation in the context of China.

¹ It is well known that inbound tourism refers to visitors to a given country who come from foreign countries. It should be noted that in China, because of the special currency system and historical-political reasons, the statistics for inbound tourism include tourists not only from foreign countries, but also from Hong Kong, Macao and Taiwan. According to the statistics of the China National Tourism Administration, tourists from Hong Kong, Macao and Taiwan account for about 80% of the inbound tourists. Clearly, because of the frequent commercial and cultural exchanges between mainland China and these regions, the effect of this part of tourism on innovation will be much less distinct than of foreign tourists. Therefore, in agreement with international practice, inbound tourism in our study refers to foreign tourists, excluding tourists from Hong Kong, Macao and Taiwan.

2. Analysis framework

Rather than through an increase of innovation expenditure (or other direct ways), the mechanism by which inbound tourism impacts regional innovation is through the improvement of the foundation of innovation and the catalytic effect of the market. As the process of knowledge transfer occurs in regional innovation networks, innovation may be stimulated by network structure expansion and heterogeneous demand elements, which are activated by inbound tourism development. Moreover, innovation can be improved by inbound tourism through the improvement of regional absorptive capacity. In addition, given the innate property of different types of innovation and the region-specific factors of different areas, the impact of such moderating effects also deserves attention.

2.1 The influence of inbound tourism on regional innovation

2.1.1 The spatial network structure approach

In a regional context, innovation takes place in a regional innovation system (Cooke et al., 1997), which is a kind of social network consisting of actors, resources, and activities (Little, 1987). There are strong ties and weak ties among the inter-actors and intra-actors, while the structure of networks affects the flow and quality of information (Granovetter, 2005). Various studies have argued that most of the innovations are generated in cooperation, rather than solely by internal accumulation (March and Simon, 1958). Therefore, rather than the strong ties, the weak ties or structural holes are significantly important to cross-border knowledge transfer and acquisition of diverse external knowledge (Hansen, 1999; Burt, 2004). What is more, bridging social capital, stimulated by the ties among the diverse horizontal actors (Putnam, 2000), will give birth to more positive interaction and novel information (Kallio et al., 2010). This means that the potential of the externalities and networking in a regional innovation system is stronger (Cooke et al., 1998).

The development of inbound tourism cannot be separated from the process of internationalisation and mobility (Lanfant, 1980; Hall, 2004), which provides a great opportunity for the international destination to build more links to the outside world. The integration of local actors into international knowledge flows will give birth to an efficient regional innovation system (Fritsch and Graf, 2011). Furthermore, the enhanced motivation of regional marketing can also improve the information and digitisation of the tourism destination. New weak ties and structural holes help to create more opportunity for the innovation system to gain more by bridging social capital with more actors and resources for innovation activities; and the uncertainty and short-cut ties will bring more diverse and non-redundant information to the innovation activity (Aarstad et al., 2015). Consequently, the expected yield of the investor will be higher in an area which has greater international influence; the perceived quality of life and career development

opportunity of the employee will be better in areas with a sounder production and recreation system. A study of the Global Power City Index shows that artists and researchers, as the important individuals and even ‘technological gatekeepers’ (Allen, 1977) of regional innovation, prefer international destination cities, such as Paris, London and New York (Institute for Urban Strategies, 2014). The participation of high level intellectual capital will undoubtedly improve innovation in the destination area; and mobility of this group of people can also benefit the spillover of knowledge and innovation to neighbouring areas.

To sum up, inbound tourism may improve the regional innovation network through attracting more institutions and resources, thus expanding the regional innovation network, and bringing more resources for regional innovation.

2.1.2 The heterogeneous demand mechanics

The systemic approach to innovation argues that innovation is the result of collaboration and interaction between firms and a variety of actors, including customers, governmental institutions, public research organizations, and subcontractors, etc. (Fischer, 2001; Andersson and Karlsson, 2004). Besides the elements on the ‘supply-side’, the external requirement from the demand side can be the driving force of innovation (Schmookler, 1966). The diversity or heterogeneous market demand will improve the technological evolution, especially in the early technological development stages (Adner and Levinthal, 2001). Moreover, what foreign tourists can bring to the destination is a dynamic demand environment.

Because of the development of inbound tourism, the destination faces a compound demand system, which consists of both the residents’ and the tourists’ demand. Obviously, these demands are different in nature. Firstly, the tourism demand system is always distinct from the local demand system, especially where it concerns international tourists. It is not surprising that the local souvenirs which are treasured by the foreign tourist may be regarded as worthless for the resident. The demand of tourists is orientated towards leisure and hedonism (Fodness, 1994), but these interests are not shared by local residents (Canavan, 2016). Secondly, the different cultural background of international tourists results in a different consumption preference compared with the residents, even when faced with a purchase decision relating to the same commodity (Moon et al., 2008). Thirdly, people’s desires will be more fully realized during the trip than in normal life, and, as a result, the value they attach to the pursuit of new experiences, which the local market has satisfy, will be stronger.

The most apparent effect of the heterogeneous demand is the recovery and boom of the existing culture and products, such as traditional crafts and cultural-creative activities, which are always the basis of tourism development (De Kadt, 1979). To satisfy the demands of foreign tourists and gain more economic benefit, suppliers may try their best to adapt to the heterogeneous demand. The interaction between tourism and many other industries will enhance this effect, and there will be more extensive commercial innovation. Nevertheless, a more profound impact of the heterogeneous demand is the

stimulation of entrepreneurship and economic diversity. Moreover, diversification of the product system is not only one of the important sources of tourism competitiveness (Benur and Bramwell, 2015), but also an endogenous requirement of the leisure-oriented development of urban agglomerations. Therefore, novelty will become an important social demand, thus making product life cycles shorter, and the pace of product evolution faster. Along with the production and trade of new products, economic value will be created. The wide environment and social benefits of tourism development will give the related innovation actors a better bargaining power when intervening policy making (Hall and Allan, 2008). It is thus clear that creativity and innovation activities will gain wider recognition and more political encouragement in an area which benefits more from international tourism development (Canavan, 2016).

Therefore, environmentally-friendly factors, including market and political regulations (Mowery and Rosenberg, 1979), will generate more entrepreneurship and innovation. As a result of self-selection, entrepreneurs tend to be more risk-taking, full of energy and ability, and often younger, which will greatly benefit regional innovation (Kloosterman and Rath, 2003). At the same time, entrepreneurship stimulates economic diversity. Along with cultural diversity, the destination will develop as an attractive pole which accumulates a variety of services and information, which will benefit regional innovation (Ottaviano and Peri, 2006; Ozgen et al., 2012, 2015; Tavassoli and Carbonara, 2014). Thanks to the reduction of transaction costs both within and across production sectors (Glaeser et al., 1992), the return of physical and human capital will be higher (Quigley, 1998), thus attracting more entrepreneurship.

Accordingly, the development of inbound tourism leads to a dynamic and diverse demands system, thus stimulating more entrepreneurial and commercial innovation. Generally speaking, the expansion of the spatial network structure and the evolution of the heterogeneous demands system caused by inbound tourism development will drive the local innovation system to proceed and continue. Therefore, we can formulate the following research hypothesis:

H1: Inbound tourism development has a significant positive influence on regional innovation.

2.2 The influence of inbound tourism on regional absorptive capacity

From the perspective of knowledge and learning theory, innovation activity is a process of knowledge exchange and integration (Nooteboom, 2000); the flow of knowledge is composed of acquisition, communication, acceptance, assimilation, applications and transfer (Gilbert and Cordey-Hayes, 1996). As the ability to identify, assimilate and exploit external knowledge (Cohen and Levinthal, 1989), the absorptive capacity can aid knowledge transfer into the regional innovation system (Kallio et al., 2010). By managing external knowledge flows more efficiently, the absorptive capacity can promote external collaboration (Fabrizio, 2009), thus helping the innovation system to benefit more from the external

knowledge and technology spillovers (Cohen and Levinthal, 1989; Mancusi, 2008; Kuo and Yang, 2008), and stimulating innovation performance (Escribano et al., 2009; Expósito-Langa et al., 2011).

Since the actors of innovation activities are engaged in collective learning systematically based on the institutional 'milieu' (Morgan and Cooke, 1998; Kallio et al., 2010), the absorptive capacity of the innovation system depends on the combination of different cognitive dimensions. Lack of cognitive proximity will reduce knowledge transfer between different networks or actors (Nooteboom, 2000). A sound foundation of shared language and values, as well as a well-structured community, will all benefit knowledge exchange (Lawson and Lorenz, 1999; Kallio et al., 2010), while cognitive closeness can stimulate dynamic efficiency and benefit innovation (Caragliu, 2015). Therefore, a particular level of cognitive proximity is necessary for knowledge exchange, absorptive capacity, and regional innovation (Ejeremo and Karlsson, 2006; Boschma and Iammarino, 2009).

International tourism activities are accompanied by the exchange of different cultures and values, which stimulates the evolution and co-option of culture (Cohen, 1988), thus making a multicultural and tolerant social environment. At the same time, as a kind of non-standard export (Brida et al., 2016), inbound tourism development can promote the openness level of the destination region to the whole world. The mobility, connectivity, and internationalisation caused by inbound tourism will help the regional innovation system to gain more external social capital, thus promoting the exploration of knowledge and the potential absorptive capacity (Kallio et al., 2010). A diverse and complementary knowledge background will help to create a suitable level of cognitive proximity (Boschma, 2005), which is necessary for an efficient innovation system, and will also benefit the regional absorptive capacity. Accordingly, we can formulate the following two hypotheses:

H2: Inbound tourism development has a significant positive influence on the absorptive capacity of the destination.

H3: The absorptive capacity has a significant mediating effect in the relationship of inbound tourism and regional innovation.

2.3 The role of innovation in the TLG model

The argument of the TLG hypothesis is based on several approaches, one of which is based on the assumption of the Export-driven Economic Growth Hypothesis. The mechanism through which this works are: the economies of scale effect, the competition-derived efficiency improvement effect, and the foreign investment effect (Nowak et al., 2007; Soukiazis and Proenca, 2008; Arslanturk et al., 2011). Another approach is the Tourism Specialisation effect, which argues that tourism specialisation will improve the demand for non-tradable goods, thus impacting the international trade environment and economic growth (Lanza and Pigliaru, 2000). In addition, other studies also underline the effect of

tourism development on economic convergence (Sequeira and Maçã Nunes, 2008). Meanwhile, the debate in this field makes it clear that tourism performance varies under different economic and resource backgrounds (Castro-Nuño et al., 2013). Nevertheless, based on related studies, as a developing country, China's economic growth could be improved by inbound tourism. We therefore propose the following hypothesis:

H4: Inbound tourism has a significant positive influence on regional economic development.

Innovation, which may be influenced by inbound tourism, can also impact the economic competitiveness of a region (Chen, 2007), thus leading to a new approach by which we can explain the TLG hypothesis in a potential new way. Given the approaches based on previous studies, we therefore propose the following hypothesis:

H5: Regional innovation has a mediating effect in the relationship of inbound tourism and regional economic development.

2.4 The effect of different innovation types

Innovation takes place in a variety of sectors. Besides technological innovation, there is also social innovation, e.g. in the field of distribution communication and cooperation (Gardner et al., 2007). Dynamic management, flexible organisation, and networking between organisations are all social innovation, which is regarded as complementary to technological innovation (Pot and Vaas, 2008). Different types of innovation activities are shaped by their particular knowledge base (Asheim and Coenen, 2005). Technological innovation activities are mainly based on analytical knowledge, which requires formal and professional collaboration between research organisations; but social innovation is highly related to synthetic knowledge, which is always incremental innovation based on the interactive learning and novel integration of existing knowledge (Asheim and Gerlter, 2005).

Accordingly, to achieve technological innovation, a relatively long period of professional skill and the necessary equipment is required; but, with regard to social innovation, the dependence on investment, long-term research, and professional skill is much lower. The absorptive capacity in the field of technology is difficult to improve by short-term and superficial interaction. Generally, the network and demand approach cannot work without large-scale professional intellectual capital investment. However, social innovation can benefit more from cultural diversity or cognitive proximity; the effect of the network and demand will emerge over a much shorter term. What is more, by considering the relationship of the inbound tourism industry and a wide range of other industrial sectors, we can discover that the linkage of tourism with culture, creativeness, and other kinds of commercial industries is strong, but that the interaction of the tourism industry with the technological sectors is apparently less strong. Given the

approaches of how inbound tourism can improve regional innovation, we can infer the following hypothesis:

H6: The effect of inbound tourism on social innovation is stronger than that on technological innovation.

2.5 The effect of territorial preconditions on innovation

Territorial preconditions and region-specific factors are significant for knowledge creation and innovation activities (Andersson and Karlsson, 2004; Fritsch and Slavtchev, 2010; Torre and Wallet, 2014). The performance and efficiency of regional innovation depend clearly on the intensity and frequency of the interaction among the system factors (Tripl, 2010). Thus, to achieve a good regional innovation performance, it is necessary to have favourable preconditions, such as relative infrastructure, intellectual property protection, and human resources. Consequently, we may assume that the preconditions for innovation (i.e. the innovation environment), for example, the context of economic development or the openness level, may have a moderating effect on the positive influence of tourism development on regional innovation.

Firstly, there will likely be an innovation leakage in the area which does not have a good innovation environment. Research has shown that a country far below the world technological frontier, although reached by advanced new knowledge produced by technological leaders, will be unable to benefit from it (Mancusi, 2008). In an underdeveloped area, a part of the achievement of research and development flows out to some transnational corporations or other foreign investors. For example, by the end of 2014, among the invention patents applied for in China, only 59.2% of the intellectual property belonged to Chinese enterprises or public bodies (State Intellectual Property Office of China, 2015). Similarly, some senior technical workers and researchers are choosing to emigrate to developed areas, which in turn aggravates the leakage effect. On the contrary, in a well-developed area, a good innovation environment will help to realise a more effective innovation system. Unfortunately, the inbound tourism may aggravate the situation. In a less developed area, especially a destination for ethnic tourism, there is an implicit economic inequality in the process of tourism trade. Most of the time, the dominant economic position of the main tourism origin region (North-American and European areas) makes tourists symbols of an advanced culture, which causes the intervention of cognition and even ideology. The demonstration effect is stronger in an underdeveloped area (Brunt and Courtney, 1999), and is also relatively high among young people (Murphy, 2013), which results in more skilled migration and resource outflows from the less developed area. Without proper guidance, the neo-colonialism trend (Lanfant et al., 1995) in tourism development will be much more profound.

Secondly, in a less developed area, the financial budget of the government and the ability to operate are limited. The government and the companies prefer to duplicate the successful operating model rather than create an original innovation; the introduction of external investment becomes the main approach to improve local economic development. Owing to lack of funds and management experience, tourism development always goes hand-in-hand with cross-border investment and brand extension. Taking innovation in the tourism field as an example, many of the tourism planners call for large amounts of money, but, nevertheless, some excellent tourism or recreational resources are located in relatively remote or less developed areas. As there is a wide range of industry associations, direct investment and service outsourcing will even spread to public services. The entrance of advanced innovation actors will cause a higher risk of innovation leakage in the future. But, in a more developed area, the adequate budget will lead to more autonomous policy and a higher possibility of innovation success (Cooke et al., 1997). Similarly, the existing funds and management experience are sufficient, so there is a higher level of respect for intellectual property and less possibility of innovation leakage. Therefore, we can formulate the following (sub) hypotheses:

H7: The effect of inbound tourism on regional innovation varies in destinations which have different innovation preconditions.

H7a : The effect of inbound tourism on regional innovation is stronger in higher-developed destinations.

The level of openness can also be another good proxy of a precondition. The benefits of international trade for mature economies will generate extensive and long-term capital accumulation, thus leading not only to groups of innovation actors with high quality of innovation ability, but also to more effective demand which helps to catalyse and diffuse innovation. What is more, the early open and reformed areas always have a more ordered market, a higher awareness of intellectual property protection, and a high willingness to cooperate, thus making the regional innovation system itself have a higher input-output rate.

In China, the goal of inbound tourism development used to be for the purposes of international diplomacy in the early years (Tisdell and Wen, 1991); to earn foreign exchange was the main strategic objective at the beginning of the marketisation of inbound tourism. Even now, inbound tourism is still being treated narrowly as just a means for poverty alleviation in the inland area where the level of openness is low, and the old business philosophy and development model is preventing the potential positive integration of the tourism industry in the local society. In view of path dependence, a particular region's own conditions may limit the positive effect of inbound tourism on regional innovation. Nevertheless, in a more international area, the high-level endowment of tourism development with cultural & creative, exhibition, real estate, financial and international trade industries will stimulate superior profit models and substantial added value. The emerging composite business forms of tourism

development are a source of regional intensive development and social innovation. In addition, it is clear that the international business tourism plays a remarkable role in the synergies of innovation actors within and across the regions.

In this case, in the area with more favourable innovation preconditions, the regional innovation will benefit more from inbound tourism development, while the marginal utility of inbound tourism in the economically self-sufficient area will be lower. From the discussion above, we can formulate the following sub-hypothesis:

H7b: The effect of inbound tourism on regional innovation is stronger in the destinations which have a higher level of openness.

To sum up, the comprehensive framework of the interaction between inbound tourism and regional innovation can now be mapped out in the following systemic archetypical scheme, which integrates the various drivers and impacts of tourism-led innovation (see Figure 1).

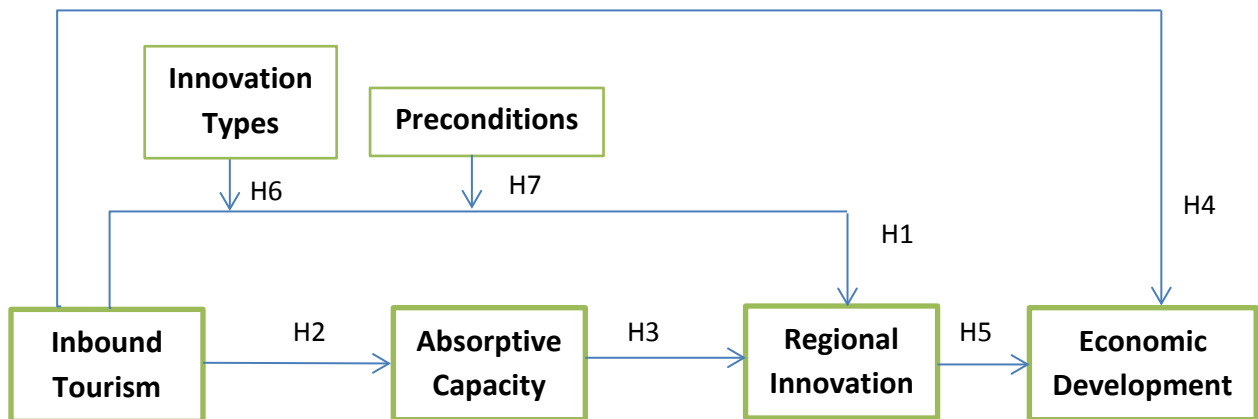


Figure 1 Interaction between inbound tourism and regional innovation

3. Research method

3.1 Measurement

The conceptual model from Figure 1 will now be tested in an operational way for Chinese regions. The data of this study comes from the Chinese Patent Statistical Yearbook, the Chinese Statistical Yearbook and the China Economic & Industry Data Database, ranging from 2003 to 2012 for 30 Chinese Mainland provinces (Tibet is excluded, because some of the important indicators are unavailable). The related data is deflated based on the Consumer Price Index of 2003.

To examine our analytical framework, the key variables are measured based on the availability of data and the methodology of existing studies. Inbound Tourism (T_{it}) is measured on the basis of the foreign tourism reception and foreign tourism income. The innovation Capacity (IC_{it}) is used as a proxy for regional innovation, which is measured on the basis of the Innovation Input (Fix assets investment of R&D; R&D intensity; R&D expenditure; and Employees in R&D); Innovation Output (Patent granted per person; Applications for patent; and Technological market turnover); and the Innovation Environment (GDP per capita; Trade intensity; FDI intensity; Education rate; and University or college graduate students). Zahra and George (2002) divide the absorptive capacity into the potential absorptive capacity and the realised absorptive capacity, which refers respectively to the ability to acquire and assimilate external knowledge, and the functions of the transformation and exploitation of the acquired knowledge (Zahra and George, 2002). Given the research approach of Borensztein et al. (1998) and Caragliu (2015), our study measures Absorptive Capacity on the basis of the accumulation of human capital and granted patents (calculated by the Perpetual Inventory Method), which refers to both the potential absorptive capacity and the realised absorptive capacity. An Entropy Method was used when measuring Inbound Tourism (T_{it}), Absorptive Capacity (AC_{it}), and Innovation Capacity (IC_{it})².

Technological Innovation (Tin_{it}) and Social Innovation (Sin_{it}) were measured by the Patent Application of Invention (per 1000 persons) and the Total Patent Application of Utility Model and Design (per 1000 persons). Economic Development (GDP_{it}) was measured by the real GDP per capita. As economy and openness level are all strong related to tourism development, the moderating effect of regional preconditions cannot be tested by interaction variables. Therefore, the provinces in China were divided

² R&D intensity is measured by the proportion of R&D investment in real GDP; trade intensity is measured by the proportion of total imports and exports (based on the location of the companies) in the real GDP; FDI intensity is measured by the proportion of Foreign Direct Investment (investment from foreign-invested enterprises) in real GDP; education rate is measured by the proportion of people with a high school education level in the population above 6 years old.

Because there are seldom official statistics for income from foreign tourists at the province level (according to the China Economic & Industry Data Database, only Zhejiang and Jiangxi have the statistics for income from foreign tourists from year 2007), the data on foreign tourism income is calculated based on the inbound tourism income, number of foreign tourists, and number of inbound tourists of each province:

$$\text{foreign tourism income} = \text{inbound tourism income} \times (\text{number of foreign tourists} / \text{number of inbound tourists}).$$

According to the provisions of State Intellectual Property Office of the People's Republic of China (<http://www.sipo.gov.cn/zlsqzn/>), the examination and review of patent applications is a long process. With regard to an investment patent, it takes 3 years for an application to be granted; with regard to the utility model and design patent, the whole process can be completed within one year. On average, we assume that the innovation output of a particular year is reflected in the data on patents granted in the next year. So we use the data on granted patents in the year $t+1$ to measure the Granted Patent in the year t .

According to the research of Borensztein et al.(1998) and Caragliu (2015), the accumulation of human capital (hr_t) and granted patents (pg_t) are calculated as follows:

$$\begin{aligned} \text{accumulation of human capital: } hr_t &= hr_{t-1}*(1-\delta)+\Delta hr_t \\ \text{accumulation of granted patents: } pg_t &= pg_{t-1}*(1-\delta)+\Delta pg_t, \end{aligned}$$

where: δ is the average discount rate, and $\delta = 5\%$; hr is the higher education graduate; Δhr_t is admissions to higher education in year t ; pg is the granted patent, Δpg_t is the increase in the number of patent granted in year t .

into two groups according to the relative level of the real GDP per capita (eco_{it}) compared with the average level (eco_0). Inbound Tourism (T_{it}) was then divided into two variables, which are Inbound Tourism in provinces with a higher economic level (Teh_{it}), and Inbound Tourism in provinces with a lower economic level (Tel_{it}), where:

$$Teh_{it} \begin{cases} T_{it} , eco_{it} \geq eco_0 \\ 0 , eco_{it} < eco_0 \end{cases} \quad Tel_{it} \begin{cases} 0 , eco_{it} \geq eco_0 \\ T_{it} , eco_{it} < eco_0 \end{cases}$$

By the same method, we obtain Toh_{it} (Inbound Tourism in provinces with a higher openness level), Tol_{it} (Inbound Tourism in provinces with a lower openness level), $ACeh_{it}$ (the Absorptive capacity in provinces with a better economic basis), $ACel_{it}$ (the Absorptive capacity in provinces with an inferior economic basis), $ACoh_{it}$ (the Absorptive capacity in provinces with a higher openness level) and $ACol_{it}$ (the Absorptive capacity in provinces with a lower openness level).

3.2 Spatial autocorrelation tests

The Chinese regional system is an interconnected spatial system. Consequently, the data may show spatial autocorrelation characteristics, which may lead to biased estimates. The existing research finds that the spatial spillovers of innovation, economic development, and inbound tourism do exist in Chinese regions (Wu, 2006; Tian et al., 2010; Yang and Wong, 2012). The presence of spatial autocorrelation, measured by the Moran's I statistic, was therefore tested; the results for the key variables are listed in Table 1.

Table 1 Spatial autocorrelation tests^a of the key variables

Years	IC	AC	GDP	T	Tin	Sin
2003	0.079*** ^b	0.052***	0.129***	0.026**	0.099***	0.073***
2004	0.093***	0.053***	0.132***	0.018**	0.109***	0.095***
2005	0.103***	0.052***	0.140***	0.023**	0.085***	0.108***
2006	0.109***	0.052***	0.146***	0.030**	0.082***	0.118***
2007	0.106***	0.051***	0.144***	0.038**	0.068***	0.126***
2008	0.112***	0.051***	0.157***	0.059***	0.056***	0.137***
2009	0.112***	0.050***	0.152***	0.063***	0.050***	0.134***
2010	0.113***	0.052***	0.162***	0.062***	0.048***	0.146***
2011	0.112***	0.054***	0.155***	0.059***	0.054***	0.126***
2012	0.118***	0.058***	0.158***	0.063***	0.064***	0.109***

Note: a. Based on the inverse distance spatial weight matrix;

b. *** and ** refer, respectively, to significance at the 1% and the 5% level;

IC= Innovation capacity; AC= Absorptive capacity; GDP= real GDP per capita;

T= Inbound tourism; Tin=Technological innovation; Sin=Social innovation.

The results show that a significant spatial autocorrelation exists among the key variables. The results are stable even with different kinds of weight matrix and a different distance cut-off point. Therefore, spatial panel data models were considered when testing the hypotheses of this study. The Spatial Durbin Model (SDM) is adopted as the initial model of the estimation. The results of the Lagrange Multiplier (LM) test, the Robust LM test, and the value of the Log Likelihood are all considered (Elhorst, 2014; Chen and Haynes, 2015) when choosing the final form for each model from the Spatial Error Model (SEM), the Spatial Lag Model (SAR), the Spatial Auto Correlation (SAC), and the Spatial Durbin Model (SDM). Given the fact that the inbound tourism level is sensitive to many economic and social elements, to achieve a more reasonable estimation of the models, and to avoid the negative effect of multicollinearity, only R&D Intensity ($INTEN_{it}$), FDI Intensity (FDI_{it}) and Population (above 6 years' old) of Uneducated ($UEDU_{it}$) were selected from the number of potential control variables when we tested the main relationships of inbound tourism and regional innovation. Similarly, FDI Intensity (FDI_{it}), Employees in R&D (per 1000 persons) (EMP_{it}), and R&D Intensity ($INTEN_{it}$) are controlled for when comparing the effect of inbound tourism on different types of innovation; Stock of cumulated Fixed Assets Investment (K_{it}) (The Perpetual Inventory Method was used with a discount rate of $\delta = 5\%$), and the Proportion of High Educated (EDU_{it}) are controlled for when testing the effect of inbound tourism and innovation on economic development.

4. Empirical research findings

4.1 Descriptive analysis

Based on the measurement above, the total amount of inbound tourism, regional innovation capacity, regional absorptive capacity, technological innovation, social innovation, and real GDP per capita of the 30 provinces in the year of 2003 to 2012 were calculated. The trends and the generally linear relationship of inbound tourism and other indicators were examined on the national level, so as to obtain a preliminary idea of the types of relationships. According to Figure 2, the level of innovation capacity, absorptive capacity, and inbound tourism all show continually increasing trends from 2003 to 2012. In 2007-2009, the rate of increase of inbound tourism was relatively low compared with other years, and so is the rate of increase of the absorptive capacity during 2007 and 2008.

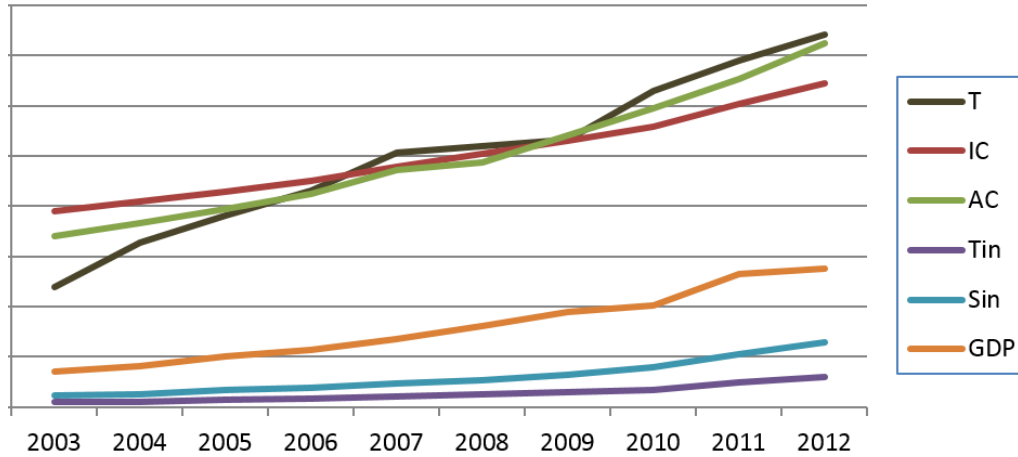


Figure 2 Trends of the indicators on the national level

Note: T=Inbound tourism; IC= Innovation capacity; AC= Absorptive capacity;
 Tin=Technological innovation; Sin=Social innovation; GDP= real GDP per capita.

Source: Authors' own calculation.

The linear trend lines of inbound tourism versus innovation capacity, absorptive capacity, technological innovation, social innovation and real GDP per capita are shown in Figure 3; each of them has an R-squared which shows a relatively high value. Therefore, there is an obvious interaction between inbound tourism and the other indicators.

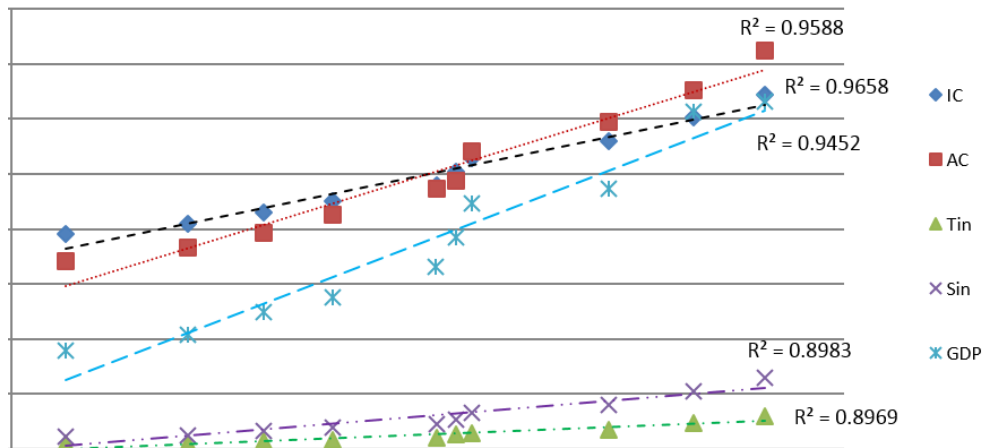


Figure 3 Linear relationship of inbound tourism with other indicators on the national level

Note: See Figure 2 for the explanation of the indicators.

Source: Authors' own calculation.

However, according to the unit-root test, the indicators above are not stable, thus making it impossible to consider the econometric relationship rigorously on the national level. But, the results of the Levin-Lin-Chu (LLC) and Pesaran and Shin (IPS) test of the panel dataset (30 provinces for the years 2003-2012)

reject the existence of a unit root. Therefore, further analysis was undertaken based on panel data in the following section.

4.2 Hypotheses tests

The hypotheses formulated above were tested based on pooled regression, ordinary panel data regression and spatial panel data regression. Model 1 and Model 4 in Table 2 show that both absorptive capacity and innovation capacity may be impacted by inbound tourism. Based on the result of Breusch-Pagan Lagrange Multiplier test and Hausman's test, random effects models perform better than pooled models, and fixed effect models perform better than random effect models. Model 3 and Model 6 show that the impact of inbound tourism is significant but weaker when considering the spatial dependence: that is to say, the positive effect of inbound tourism is overestimated in the ordinary panel data regression models without considering the spatial spillover effect of innovation and absorptive capacity among the neighbouring provinces. Therefore, based on the related tests, the most suitable spatial panel regression models were chosen and listed in Table 2 and Table 3 to test the hypotheses.

Based on the method of Baron and Kenny (1986), the mediating effect of absorptive capacity can be tested based on Model 3, Model 6, and Model 7 in Table 2. The influence of inbound tourism becomes weaker but still significant, after controlling for the contribution of absorptive capacity to regional innovation capacity; therefore, the impact of inbound tourism on regional innovation capacity is partly mediated by absorptive capacity approach. According to Biesanz et al. (2010), the indirect and direct effect of inbound tourism on innovation capacity is 0.080 (0.306×0.261) and 0.144. Accordingly, H1, H2 and H3 are all supported. This conclusion supports not only the absorptive capability approach, but also the network structure and heterogeneous demand approaches. The interaction of diversity culture in the destination may reduce the cognitive obstacle and promote the ability to identify, assimilate and exploit external knowledge, which, in turn, improves the regional innovation activities. Simultaneously, the characteristics of the tourism industry can also benefit regional innovation.

Firstly, to promote the destination and improve the tourists' experience value, tourism enterprises and authorities have spared no effort to push and practice geographic informatisation, mobile electronic commerce, and many other kinds of social innovation directly. As a result, the decrease of information asymmetry enhances the linkage between the region and the outside world, thus helping to expand the regional innovation network. Secondly, as a kind of compounded subjective experience, favourable tourism activities strongly depend on co-production and customisation, thus making the tourism industries very sensitive to people's continually changing needs. Previously, American Express promoted the adaptation of credit cards by its tourism business (Hall and Allan, 2008); more recently, Airbnb and Uber and other tourism companies have led the business model innovation in the *Sharing Economy* era. Given

the wide industrial relevance of the tourism industry, the leading effect of the tourism industry in commercial innovation may be an increasingly positive externality to regional innovation. Thirdly, as a series of temporary consumption activities outside the everyday living area, the boom in the tourism industry and the universal use of mobile consumption applications have benefitted each other in recent years. The data on demand and behaviour preferences will create a better foundation for commercial practitioners to gauge consumer demands, especially when combined with Big Data technology and related statistical methods. Last but not least, the value of tourism resources value is a kind of additional value, which is either distinct or derived from the inherent resource value. For one thing, tourism can give a chance to be re-evaluated to the idle or fragmented resources, even those neglected or rejected by the traditional evaluation criteria. For another thing, the additional value endowed to the existing production sector by tourism activity, such as industrial tourism, especially the revival of traditional manual activity driven by tourism development, may benefit the brand value, customer citizenship behaviour and the cultural development of the organisation, thus promoting the innovation of processes and the exploration of new products. The collision and integration of different attributes of the resource can undoubtedly create new origins for the innovation activity.

The results of Model 3, Model 8, and Model 9 in Table 2 show that inbound tourism has a significant positive influence on the economy, which is partly mediated by innovation with the indirect effect as 0.072 (0.206×0.349). That is to say, inbound tourism can promote the economic boom indirectly through promoting the innovation activities, as well as benefit the growth of the economy directly. Therefore, H4 and H5 are supported.

According to Model 10 and Model 11, the impact of inbound tourism on technological innovation is weaker than that on social innovation, and therefore H6 is supported. The knowledge transfer related to technological innovation is more professional, part of which is even achieved in the enclave context. The dependence of technological innovation activity on the social environment is weaker than that of social innovation activities. However, tourism can be embedded with much better in various aspects of social activity; the network, demand, and absorptive capacity channels may work better when it comes to social innovation.

Table 2 Influence of inbound tourism on innovation and absorptive capacity

Dependent Variables:	IC _{it}			AC _{it}			IC _{it}	GDP _{it}		Tin _{it}	Sin _{it}	
	Model 1 Pooled	Model 2 FE	Model 3 RE SDM	Model 4 Pooled	Model 5 FE	Model 6 FE SDM	Model 7 FE SDM	Model 8 FE SDM	Model 9 FE SDM	Model 10 RE SAR	Model 11 RE SDM	
T _{it}	0.219***	0.249***	0.206***	0.385***	0.313***	0.306***	0.144***	0.115***	0.060**	0.027***	0.118***	
IC _{it}									0.349***			
AC _{it}							0.261***					
UEDU _{it}	-0.060***	-0.126***	-0.029**	0.155***	-0.428***	-0.385***	0.062***					
FDI _{it}	0.129***	0.124***	0.150***	-0.386***	-0.024	-0.004	0.148***			0.006	0.004	
INTEN _{it}	0.059***	0.095***	0.055***	-0.011	0.110***	0.084***	0.038***			0.002	-0.023***	
EMP _{it}										0.106***	0.227***	
K _{it}								0.222	-0.250			
EDU _{it}								0.116***	0.083***			
W* UEDU _{it}			0.118**			0.244	0.063					
W*FDI _{it}			-0.340***			-0.316	-0.213*					
W* INTEN _{it}			0.076***			0.066	0.050**					
W*K _{it}								1.462*	-1.301			
W*EDU _{it}								-0.073	-0.031			
W*T _{it}			-0.045			-0.135	-0.029	0.050	-0.229**			
W*IC _{it}			0.355**					0.473***	1.290***			
W*AC _{it}						0.323***	-0.106					
W*GDP _{it}									0.443***			
W*Tin _{it}										0.217***		
W*Sin _{it}											0.271**	
R ²	0.913	0.874	0.962	0.558	0.855	0.861	0.923	0.914	0.918	0.559	0.673	
Log-Likelihood			-675.62				-819.88	-592.71	-762.38	-746.72	-509.47	-717.56
LM test	0.000			0.000								
Hausman test		0.000	0.468		0.000	0.017	0.000	0.019	0.000	0.580	0.627	

Notes: FE= Fixed Effects; RE: Random Effects ; SDM= Spatial Durbin Model; LM= Breusch-Pagan Lagrange Multiplier;
 Values in the lines of the LM test and Hausman test are the significance level;
 ***, ** and * refer, respectively, to significance at the 1% , 5% and 10% level.

Table 3 shows that both the economic basis and the openness level may play a pivotal role in the relationship between inbound tourism and innovation. A better economic level and higher degree of openness may offer better conditions and a higher possibility not only for the successfulness of the innovation activity, but also for the realisation of its market value. Conversely, in a poor and self-sufficient area in China (or other developing countries), the situation of innovation leakage may be relatively severe. Model 1 and Model 4 show that the positive effect of inbound tourism on regional innovation is weaker and less significant in relatively poor or self-sufficient areas. Provided there is a mediating effect of absorptive capacity, inbound tourism in provinces with a lower economic level cannot benefit regional innovation directly (see Model 3). Model 6 shows that in an area where the openness level is relatively low, inbound tourism may benefit regional innovation to a lesser extent, either in a direct way or through the improvement of absorptive capacity. Actually, in order to look further into the

effect of inbound tourism on innovation in different sub-areas, the impact of inbound tourism on Innovation Efficiency (IE_{it}) was also investigated (see Models 7-8)³. The results show that innovation efficiency will benefit less from inbound tourism in the provinces where the level of economic basis and openness is lower, which is consistent with the results of Models 1-6, and can explain the effect of preconditions from the perspective of innovation efficiency. The T-test results show that the coefficient of each sub-area is significantly different. Therefore, we can conclude that H6a and H6b are all supported.

Table 3 Effects of preconditions and innovation types

Dependent Variables: Models	IC _{it}	AC _{it}	IC _{it}	IC _{it}	AC _{it}	IC _{it}	IE _{it}	
	Model 1 FE SDM	Model 2 FE SDM	Model 3 FE SDM	Model 4 FE SAR	Model 5 FE SDM	Model 6 RE SAR	Model 7 FE SEM	Model 8 FE SEM
Teh_{it}	0.228***	0.313***	0.138***				0.609***	
Tel_{it}	0.057*	0.108*	0.053				0.350**	
Toh_{it}				0.219***	0.316***	0.144***		0.603***
Tol_{it}				0.081**	0.119**	0.048*		0.294*
ACeh _{it}			0.252***					
ACel _{it}			0.173***					
ACoh _{it}						0.165***		
ACol _{it}						0.158***		
UEDU _{it}	-0.065***	-0.406***	0.015	-0.072***	-0.406***	-0.040***		
FDI _{it}	0.159***	0.012	0.155***	0.146***	0.004	0.157***	0.063	0.055
INTEN _{it}	0.046***	0.070***	0.029***	0.056***	0.078***	0.056***	0.061	0.06
EDU _{it}							0.143***	0.153***
W*IC _{it}	0.435***		0.367***	0.388***		0.312***		
W*AC _{it}		0.320**			0.316**			
R ²	0.907	0.870	0.930	0.900	0.870	0.963	0.652	0.652
Log-Likelihood	-616.26	-810.86	-580.93	-631.14	-809.95	-649.10	-1106.42	-1105.41
Hausman test	0.067	0.026	0.000	0.003	0.006	0.369	0.021	0.014
T-test	0.000	0.001	0.027	0.000	0.000	0.003	0.081	0.024

Notes: FE= Fixed Effects; RE= Random Effects; SDM= Spatial Durbin Model; SAR=Spatial Lag Mode; SEM=Spatial Error Model;
To avoid a cumbersome table, the spatial effect of the control variables are not listed here;
***, ** and * refer, respectively, to significance at the 1% , 5% and 10% level;
Values in the lines of T- test and Hausman test are the significance level.

³ Innovation Efficiency (IE_{it}) is defined as the marginal output of granted patents per person of the R&D intensity. There is spatial dependence among the Innovation Efficiency for the years 2003-2012. FDI Intensity (FDI_{it}), R&D Intensity ($INTEN_{it}$), and Proportion of High Educated (EDU_{it}) are the control variables when consider the effect of inbound tourism on innovation efficiency.

4.3 Sensitivity tests

According to the results above, all the hypotheses formulated above appear to be supported. To test the robustness of this conclusion, a number of different methods are used. Firstly, a new weight matrix based on the inverse squared distance was used to test the framework; the results all remain stable. Then, our sample was divided into two parts depending on the relative level of real GDP per capital or openness, so as to revisit H7; the (sub)hypotheses appear to be also all supported. Finally, an alternative way to measure the inbound tourism was used. The calculation of foreign tourism income based on number of foreign tourists, average days of stay of foreign tourists, and average expenditure per day of foreign tourists was used to replace the data of foreign tourism income in the empirical analysis above. Even though all the hypotheses are supported, the results also show that in the relatively poor and more self-sufficient area, inbound tourism may not benefit regional innovation significantly⁴. That is to say, although inbound tourism may play a positive role in regional innovation, the impact may not be valid under some geographic conditions.

5. Conclusion

This study has set up a framework to analyse the effect of inbound tourism on regional innovation by applying the approaches of the network structure, heterogeneous demand and absorptive capacity improvement. Given the basic interaction relationships, the moderating effect of a region's precondition and of innovation types is also considered. Our empirical analysis has clearly supported the theoretical hypotheses; the main conclusions of this study are: firstly, inbound tourism has both a direct and indirect impact on regional innovation, while absorptive capacity has a significant mediating effect in this relationship; secondly, the effect of inbound tourism on innovation can act as a new approach to interpret the TLG hypotheses; thirdly, the positive effect from inbound tourism on social innovation is stronger than it is on technological innovation; and, finally, both the economic and the openness level may form the bottlenecks for the validation of the impact from inbound tourism on regional innovation.

Clearly, the present research has some limitations. And future studies may be conducted to remedy these limitations. Firstly, restricted by the availability of data, we are not able to distinguish business tourists and leisure tourists at the province level, when performing a panel analysis in the context of China. Time series analysis on the effect of inbound tourism on the national innovation system may be carried out based on the statistics of inbound tourists with different motivations. By considering the different effects and mechanisms of international business travel and leisure activities, our theoretical framework

⁴ If we consider the effect of total inbound tourism, the effects may turn to be negative in the relatively poor and more self-sufficient area, although all the hypotheses are still supported.

can be extended. Secondly, although the economic basis and openness level are also potential impact factors of regional innovation, they are not controlled directly in our empirical models because of the strong correlation between these factors and inbound tourism. Therefore, further empirical case-study research may focus on particular regions, which may be a good alternative to perform a more thorough analysis of the relationships between inbound tourism and regional innovation. Thirdly, given the comparability of regions, this study only considers the provinces of mainland China. More extensive analysis of regions in other developing or emerging countries is needed, so as to test the reliability and generality of the conclusions above.

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