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Creative Industries Agglomeration, Regional Innovation and Productivity Growth in China

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Abstract: This paper falls into the broad area of economic geography and economics of creativity, and it presents an alternative approach to explain why total factor productivity (TFP) growth is different across China′s regions. It establishes an empirical model to estimate the spatial agglomeration effects of creative industries on regional TFP growth, using China′s provincial panel data during the period of 2003 to 2010. We found that the creative industries agglomeration (CIA) has significant and positive impact on regional TFP growth. The result also implies that the CIA can facilitate regional TFP growth through promoting regional innovation instead of improving regional efficiency. Therefore, we argue that policy makers should take some measures to retain and establish more creative zones.

Keywords: creative industries; spatial externality; creativity industries agglomeration (CIA); total factor productivity (TFP); economic growth

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1 Introduction

As our society moves into a so-called post-industrial age, the creative sectors are growing rapidly, concentrated in some metropolitans such as Hollywood, Silicon Valley, the design and advertising cluster of London. The literatures of creative industries and the creative class generally support the argument that the agglomeration of these industries and talents has a positive effect on the growth of local productivities and employments. The combination of these production factors will contribute to overall economic growth (Yusuf and Nabeshima, 2005; Cooke and Lazzeretti, 2008). Such studies on agglomerations are mainly based on the advanced economies.

It is argued that China′s economic development is mainly dependent on huge international market and low costs, particularly in manufacturing. However, scholars noted that China′s productivity growth has also been driven by the rise of creativity clusters and its development of creative industries and talents (Wei and Hao, 2011; Hong and Yu, 2012). There are significant differences of creative industries agglomeration (CIA) across regions in China. The creative industries zones in the coastal provinces (e.g. Beijing 798 Art Zone, Shanghai Zhangjiang Hi-Tech Park) are rapidly growing, while in the interior provinces the abilities to attract or retain the creative industries are limited. The spatial structure of

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agglomeration economy may lead to variations in productivity improvement and regional growth (Krugman, 1991; Rosenthal and Strange 2001; Zhang *et al*., 2012).

Research on creativity as a driver for economic growth has increased along with the work of Florida (2002). It is argued that an open, tolerant and diversified atmosphere can make an area more attractive to talents, high-tech firms and innovative organizations that are very important indicators for regional innovation and future economic success (Florida, 2002; Florida *et al*., 2008). The idea of the creative class, however, has attracted considerable controversy (Markusen, 2006; Clifton, 2008; Hansen and Niedomysl, 2009). Some provide the empirical evidence (or lack thereof), while others focus on the theoretical basis and policy recommendations (Asheim and Hansen, 2009). Recently, some research has focused on creativity based on the creative industries rather than people in specific professions (Gordon and Beilby-Orrin, 2007; Lazzeretti *et al*., 2008). Lange *et al*., (2008) explored governance of the creativity of the creative industries by public administration, while Kathrin *et al*. (2009) shed light on the contributions of creative industries to urban dynamic and regional development. It is recognized that the creative industries are highly concentrated in some regions (Cooke and Lazzeretti, 2008; Molina *et al*., 2012). Recently, some scholars have investigated how the knowledge spillovers happen in creative industries cluster regions and initiated different approaches to measuring these externalities (Chapain *et al*., 2010).

In this context, regional innovation and growth effects of the geographical dispersion of creativity play an increasingly important role in the analysis of creative industries (Yusuf and Nabeshima, 2005; Stam *et al*., 2008). Research indicates that the CIA in space can result in regional productivity growth (Chapain *et al*., 2010). The productivity growth effects of the agglomerations of economic activities in manufacturing can be realized by many approaches, such as localization externalities (Marshall, 1890), pecuniary externalities (Krugman, 1991) and competitive advantage of clusters (Porter, 1998). The CIA in space, as a new form of industry development, can promote regional productivity growth like manufacturing agglomeration. There are two alternative approaches used to explain why the CIA can produce regional productivity growth. First, in the CIA regions there are numerous of creative workers who are generally self-employed and have stayed in work (Baines and Robson, 2001). They sell their ideas, skills and talents (such as in music or video industries) and make great efforts to produce and diffuse innovations in a shared enterprise, resulting in labor productivity growth (Florida, 2002). Second, it is easier to communicate and exchange ideas by interactions and promote tacit/sticky knowledge diffusion in the CIA regions, which helps to reduce the risks of market uncertainty and facilitate the production of creativity and productivity growth (Andersson *et al*., 2005; Rantisi *et al*., 2006).

According to the literature review, on the one hand, empirical studies mainly focus on economic growth effects or innovation effects (Cooke and Lazzeretti, 2008; Boschma and Fritsch 2009; Olfert and Partridge, 2011). On the other hand, Chinese creative industries have developed rapidly, especially in the coastal provinces of China. It is evident that, however, this development is under-documented in literatures in China, particularly in empirical research.

In this paper, we attempt to make two contributions. First of all, this paper is the first attempt (to our knowledge) to empirically analyze the productivity growth effects of the CIA. Second, the model provided in this research facilitates to investigate the ways in which the CIA may influence total factor productivity (TFP) growth. Furthermore, we shed light on two research questions in the paper. First, how big are the differences of CIAs between the coastal provinces and the interior provinces in China? Second, how does the variation in CIA lead to the difference in regional TFP growth? This research would present a new perspective in explaining why different regions possess different TFP growth across China. It would also have some implications for the transformation of China′s economic growth from being efficiency-driven to innovation-driven, providing an alternative approach to explain why the TFP growth has differences across regions.

2 Geographic Distribution of China′s Creative Industries Agglomeration

2.1 Definition of creative industries in China

There are different ways to measure creative industries. Some researchers or organizations suggest the concrete criteria to classify an industry as creative. Throsby (2003) defined the cultural industries as those creative

activities taking place. Others specified classifications that the creative industry refers to. European Commission (2006) suggested that the creative industries can be subsumed by four general approaches: the creative industries approach, experience economy approach, copyright industries approach and sector specific studies. Towse (2003) took creative industries to be the evolution of traditional cultural industries, while Lorenzen and Frederiksen (2008) focused on new technologies (such as media and software) by analyzing the changes regarding to Information Communication Technology. DCMS′ report (1998) considered 13 subsectors as creative industries: including advertising, architecture, arts and crafts, designer fashion, broadcast media, film, games, music, performing arts, publishing and printing, software and computer service. Due to absence of a standard, the DCMS′ definition is used as a starting point in much of literature (Brinkhoff, 2006; UNCTAD, 2008).

In this study, based on the definition of DCMS (1998) and other studies (Gordon and Beilby-Orrin, 2007; UNCTAD, 2008; Beijing Municipal Statistics Bureau, 2011; Shanghai Municipal Statistics Bureau, 2011), we propose that creative industries include five major subsectors whose data can be attained from *China Statistical Yearbook* (National Bureau of Statistics of China, 2004–2011). These five domains include science research and technology services (research and development, professional and technical services, technology exchange, technology commercialization), business services (design, advertising, intellectual property services, tourist service and related services), software and computer services (software development, computer service, information transmission and data processing), resident service and related services (designer fashion, performing arts and related services), culture, sports & recreation (broadcast media, film, games, music, cultural arts, sports and entertainment). Such definition is adopted in our empirical analysis.

2.2 Provincial distribution of creative industries agglomeration in China

In order to analyze the provincial distribution of creative industries, we construct an indicator for the empirical study to denote the level of CIA. It is suggested that the location quotient (LQ) provides a clear and comparable measure of agglomeration economies. Similar measurements are applied by other scholars for studies on the agglomeration of creativity (Markusen, 2006; Asheim and Hansen, 2009; Lazzeretti *et al*., 2012). The CIA index (measured by LQ indicator) is defined as:

$$CIA=\frac{C_{ij}/C_i}{C_j/C} \tag{1}$$

where C_{ij} is the number of employees in the creative industry i in province j; C_i is the total number of employee in the creative industry i; C_j denotes the employment in province j; and C denotes the total employment in China. Therefore, the *CIA* index is established to represent the concentration level of creative industries. If the *CIA* index exceeds 1, it indicates that the degree of CIA in province j is more than the national average level, so that the provincial labor system in the creative industries is more specialized.

Figure 1 shows the provincial distributions of CIA and its potential determinants. It illustrates that the values of the *CIA* index in the coastal provinces are higher than in the interior provinces, particularly in Beijing (4.9), Shanghai (2.3), Tianjin (1.6) and Zhejiang (1.3). It implicates the concentration level of creative industries as distributed unevenly across regions from the east to the west of China. As a matter of fact, the coastal region experiences higher economic growth, innovation capacity, and labor productivity than the interior region. This may reflect the consistent geographic distribution of CIA with provincial economy development and productivity growth (i.e. the provinces with higher clustering of creative industries may experience higher growth).

3 Methodology

3.1 Data

Our analysis applied China′s provincial panel data over the period 2003–2010 based on the official statistics. The reason why the starting period begins with 2003 is that the creative industries were first officially counted at national level in 2003. The data of provincial investment in fixed assets and its price index (the price deflator is based on the year of 1990), GDP per capita, provincial employment (including the whole industries and creative industries), foreign direct investment (FDI), secondary industry output, tertiary industry output all come from *China Statistical Yearbook* (*2003–2010*) (National Bureau of Statistics of China, 2004–2011).

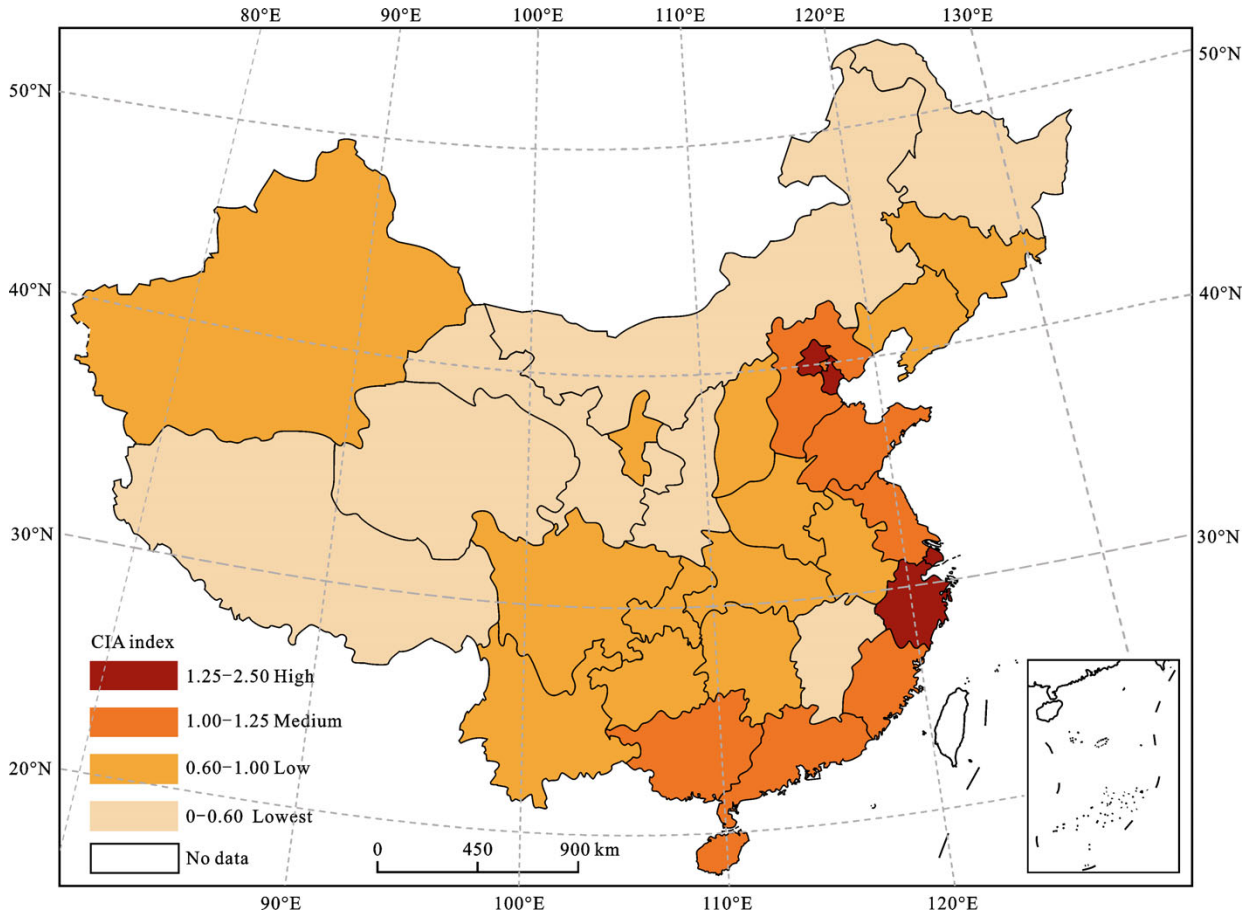

Fig. 1 Provincial distribution of creative industries agglomeration (CIA) in China (the data of Hong Kong SAR, Macau SAR and Taiwan Province are excluded due to data missing; the provincial values of CIA index are taken average of 8 years respectively during the period of 2003 to 2010)

The data of gross industrial output value and the number of industrial firms are from *China Statistical Yearbook on Science and Technology* (*2003–2010*) (National Bureau of Statistics of China, 2004–2011). The sample is sourced from China′s provincial panel data from 2003 to 2010 of 30 provinces. Chong Qing, Hong Kong, Macau and Taiwan are excluded from our sample due to data missing.

It is necessary to note that the data of provincial capital stock (1990–2005) refers to Wu′s research work (Wu, 2007). Furthermore, the data from 2006 to 2010 were calculated by perpetual inventory method (Goldsmith, 1951) and real investment was calculated by deflating the gross fixed capital formation by the price index of investment (2006–2010). The depreciation rate was assumed to be different for each of China′s provinces (Wu, 2007), and generally the rate of depreciation was higher in more developed regions, and lower in less developed regions (i.e. the higher rate of depreciation in the coastal provinces than that in the interior provinces).

3.2 Model

The aim of our empirical research is to identify the impacts and the impact mechanism of the CIA on TFP growth. The model of creative industries clustering, which potentially impacts on TFP growth, can be specified as:

$$\begin{aligned}\mathrm{Ln}(y_{it}) = c_t + \lambda \mathrm{Ln}(CIA_{it}) + \alpha_1 \mathrm{Ln}(FDI_{it}) \\ + \alpha_2 \mathrm{Ln}(FSS_{it}) + \alpha_3 \mathrm{Ln}(ISC_{it}) + \mu_{it}\end{aligned} \quad (2)$$

where y_{it}, the dependent variable, denotes technological progress (TP), technical efficiency change (TEC), and TFP change respectively in province i and period t; CIA_{it} represents the clustering of creative industries in province i and period t, which is measured by CIA index according to Equation (1); FDI_{it}, FSS_{it} and ISC_{it} denote FDI level, firm size structure (FSS) and industrial structure change (ISC) respectively in province i and period t, which are widely used in the studies of growth effects (Cingano and Schivardi, 2004; Hong and Sun, 2011); λ, α_1, α_2 and α_3 are the coefficients corresponding to inde-

pendent variable and controls impacting on dependent variable as mentioned above; c_t is the constant term; μ_{it} is the stochastic error term.

3.3 Variables

The TFP index, TP index, and TEC index are all applied as dependent variables. There are many ways to measure TFP, but the method applied in this paper is the output-oriented model of Data Envelopment Analysis-Malmquist (Färe *et al*., 1994), which allows breaking TFP down into two components: technological progress and technical efficiency change. The estimate of China′s Malmquist productivity index is based on the China′s provincial panel data, where output is measured by real GDP deflated by the implicit deflator that is provided by *China Statistical Yearbook* (*1990–2010*) (National Bureau of Statistics of China, 1991–2011), and input is measured by the employment figures and capital stock.

Figure 2 illustrates the annual change in China′s TFP growth and its components at the national level. In 1990–2010, the average annual TFP growth rate appears to fluctuate to some extent and is approximately 2.41% in China. This finding is consistent with the range reported in most research and is much closer to the figure reported by Young (2003) and Wu (2008). Technological progress grows at 2.26% per annum, while technical efficiency change is only around 0.16% per annum. It seems that the China′s TFP growth has been driven more by its technological changes than efficiency changes since 1995. This result is also obtained in other researches (Wu, 2000; Wei and Hao, 2011). It is clear that China′s economic reform has resulted in significant improvements in technical efficiency, while the potential in efficiency improvement was almost exhausted by the 1990s, giving way to the technological innovation (Wu, 2000).

The CIA index is used as an independent variable that can be calculated by Equation (1) at the provincial level. Unsurprisingly, the regions with the more development of CIA tend to exhibit higher TFP growth. This positive correlation between CIA and TFP growth can also be shown clearly in the scatter diagram (Fig. 3) However, this speculation has been not confirmed empirically and its impacting mechanism (i.e., by improving TP and/or TEC) is still unknown. This issue will be further investigated in our research.

Three factors, FDI, FSS and ISC, are controlled in our model. Specifically, FDI level is measured by the share of FDI to GDP (with yuan terms). The ratio of gross value of industries output to the number of enterprises is used to measure the control variable of FSS. The last control is the industrial structure which is measured by the proportion of tertiary industry output in the total, controlling the role of ISC in TFP change.

Finally, the relative creative industries employment density (CIED) is introduced as an instrumental variable (IV) of the *CIA* index for robustness analysis. We use the following *CI* index to measure it:

$$CI=\frac{C_{it}}{C_i/30} \tag{3}$$

where C_{ij} is the number of employees in the creative industry i in province j; C_i is the total number of employees in creative industries i; $C_i/30$ represents average employment in the creative industries of Chinese 30 provinces. The *CI* index is established to denote relative

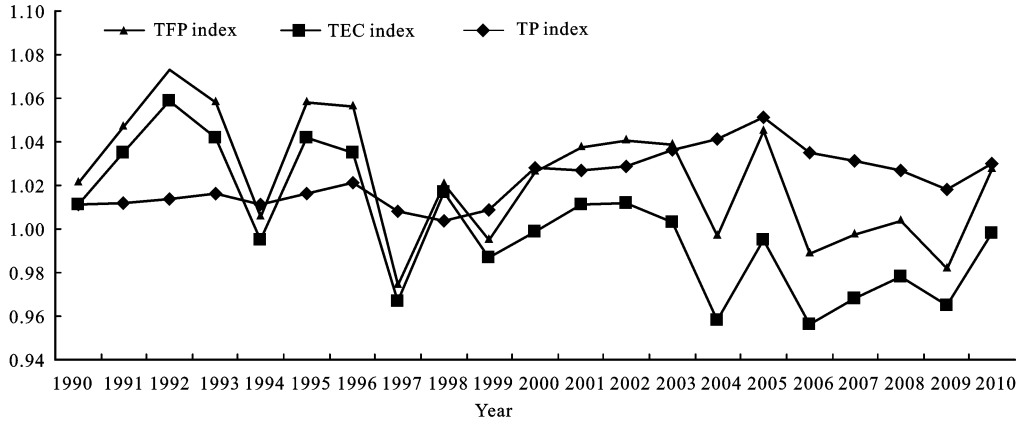

Fig. 2 Total factor productivity (TFP) index, technology efficiency change (TEC) index and technology progress (TP) index in China (1990–2010)

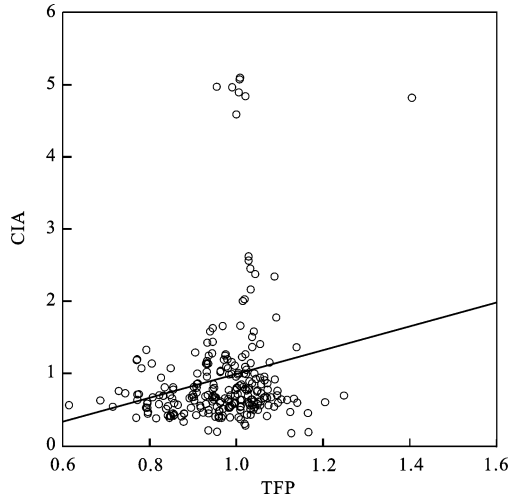

Fig. 3 Correlation between creative industries agglomeration (CIA) and total factor productivity (TFP) growth

CIED which is strongly associated with the CIA index. Meanwhile, it has no multicollinearity with other variables to great extent. Table 1 summarizes descriptive statistics for all variables applied in our models. The data show that the standard deviation of all variables is relatively small due to the ratios data, which facilitates to the reduction of heteroscedasticity, and to the consistent estimation.

4 Results and Discussion

4.1 General empirical results

Due to two considerations, in this paper, we use the fixed effect model rather than the random effect model to estimate the TFP growth effects of the CIA. First, the development of China′s CIA and economic growth are distributed unequally across the country. The fixed effect model may facilitate to reflect the individual effects of different provinces. Second, the Hausman test (at the significance of 1% level) implicates that the fixed effect model is statistically acceptable.

The estimation results are reported in Table 2. First, Model 1, where the TFP index is used as the dependent variable, illustrates that the coefficient of creativity clustering is both significant and positive. This result implies that the CIA has the potential to significantly improve regional TFP growth. The coefficient of TFP is 0.044, indicating that the CIA can increase TFP growth by an average of 4.4%. By contrast, the coefficient of TFP growth caused by China′s manufacturing agglomeration is only 0.007 in the research of Zhao and Zhang (2008). It suggests that the CIA has much more effect on TFP growth than manufacturing agglomeration in China. To analyze the impacting mechanism (i.e., the ways in which the CIA may affect TFP growth), we used the TP index and TEC index as the dependent variable in Model 2 and 3, respectively (Table 2).

In Model 2, we found the clustering of creative industries has a significant and positive impact on TP growth at the 1 per cent level. The finding implicates that China′s regional innovation can be improved extensively in regions where creative industries are very concentrated. Indeed, this result can be confirmed by other similar works (Kathrin *et al*., 2009; Chapain *et al*., 2010; Hong and Yu, 2012). They propose that the spatial concentration of creative industries has significant positive impacts on regional innovation, then on labor productivity growth. In Model 3, the coefficient of the CIA index seems to have negative but insignificant effect. In other words, the spatial agglomeration of creative industries has not significant effects on regional changes in technical efficiency, such as management efficiency, organization efficiency even the economies of scale.

Table 1 Descriptive statistics of variables

Variable	Definition	Observation	Mean	Max	Min	SD
TFP index	Total factor productivity index	240	1.011	1.406	0.615	0.102
TP index	Technology progress index	240	1.032	1.534	0.864	0.076
TEC index	Technology efficiency change index	240	0.978	1.114	0.655	0.090
CIA index	Location Quotient of employment in creative industries	240	0.932	5.093	0.166	0.846
CI index	Share of regional creative industries employment in total	240	1.017	5.948	0.057	0.957
FDI level	Ratio of FDI to GDP	240	0.484	5.849	0.054	0.632
FSS	Ratio of industries output to number of enterprise	240	1.259	2.941	0.066	0.530
ISC	Share of service industry output to GDP	240	34.649	75.100	18.329	9.213

Table 2 Effect of creative industries agglomeration on total factor productivity growth in China

Variable	Model 1	Model 2	Model 3	Model 4	Model 1[a]	Model 2[a]	Model 3[a]	Model 4[a]
CIA index	0.044*** (3.603)	0.048*** (2.628)	–0.013 (–1.566)	0.0407*** (3.241)				
CI index					0.091** (2.093)	0.191** (2.156)	–0.066 (–1.638)	0.087*** (2.355)
FDI level	0.029*** (2.820)	0.027** (1.981)	–0.000 (–0.035)	0.036*** (2.949)	0.029** (2.587)	0.022** (1.935)	0.008 (0.599)	0.034** (2.191)
FSS	–0.088*** (–2.986)	–0.081** (–2.200)	–0.002 (–0.266)	–0.102*** (–3.831)	–0.093*** (–6.477)	–0.082*** (–4.851)	–0.009 (–0.816)	–0.105*** (–3.688)
ISC	–0.085* (–1.767)	–0.116 (–1.301)	–0.009 (–0.443)		–0.071 (–1.148)	–0.109 (–1.393)	–0.015 (–0.481)	
Constant	0.317* (1.813)	0.395 (1.238)	0.056 (0.811)	0.029 (1.259)	0.283 (1.339)	0.406 (1.331)	0.072 (0.706)	0.040 (1.572)
R^2	0.603	0.569	0.268	0.597	0.599	0.564	0.239	0.596
Adjust R^2	0.540	0.500	0.150	0.535	0.535	0.495	0.117	0.534
Observation	240	240	240	240	240	240	240	240

Notes: All variables are natural logarithms; The Hausman test in all above models is significant at 1% level; ***, ** and * represent statistical significance level at 1%, 5% and 10%, respectively; the data in the parenthesis is the value of t-test; Model 1[a], 2[a], 3[a] and 4[a], corresponding to Model 1, 2, 3 and 4, report the second stage regression results of the Two Stage Least Squares (with instrumental variable of CI index)

Enquiring into why there are potential negative effects on efficiency improvement, we found two reasons. First, although the regional creative parks or zones are developing rapidly in China, the related ′hard′ or ′soft′ amenities to support the creative industries are highly under developed in the CIA regions (Zhang, 2010). Lake of expenditure on local amenities may directly lead to lowering the efficiency of the concentrated creative industries and may have negative impact on regional TEC. Second, the negative coefficient of the CIA index may relate to the declining role of China′s efficiency change in TFP growth. As shown in Fig. 2, China′s technological efficiency has been declining over time and its effect on TFP growth is being replaced by China′s innovation improvement, although the overall level has increased. Therefore, the negative estimates may indicate that TFP growth is adversely, albeit insignificantly, affected by the low efficiency of development of Chinese creative industries and the decline in TEC. This result is supported by Rantisi *et al*., (2006) who suggest the clustering of creativity provides traditional agglomeration advantages of transaction cost reductions as well as knowledge spillovers but may limit effectiveness in creating specialized labor pools or meaningful business alliances.

The regressions imply that the local development of CIA can increase TFP growth by the way of technological improvement rather than efficiency change. This finding is significant for the transformation of China′s economic growth from being efficiency-driven to innovation-driven. China is now facing the challenge of economic transition. The development of clustering in creative industries may promote China′s traditional industry upgrading and facilitate the boost of productivity driven by innovation.

The coefficients of FDI are significant and positive in the models. Such result confirms that China′s FDI still has strong externalities on TFP growth. It is also consistent with the research of Madariaga and Poncet (2007) and Hong and Sun (2011). The control of firm size is found to have significant but negative effects on TFP and TP growth. Unexpectedly, it implicates that innovation and productivity effects in smaller enterprises are more than those in the bigger ones. Bigger enterprises such as China′s state-owned enterprises own stronger innovative capacities. However, as economic reform continues, particularly after world financial crisis in 2008, a lot of small and medium-sized creative firms are spilling over, resulting in more innovation which in turn significantly effects economic growth. Similar results were also observed by Fu and Gong (2011). Another control of industrial structure is found to have negative but insignificant effects. It suggests that the development of Chinese service industries is not in favor of TFP growth and TP. These findings are not consistent with similar research from developed countries (Stam *et al*., 2008). The reason may be that the secondary industries in China, particularly manufacturing, are more developed than other industries and have become impetus for regional economic growth. In contrast, productivity in

the services industry is still low, because traditional and low productivity services still account for a large share. However, the control of industrial structure lacks of significance in the models. In order to further check the reliability of the insignificance, we remove the industrial structure from the model and re-estimate with the TFP index as dependant variable (see Model 4 in Table 2). The result reported in Model 4 is consistent with that in Model 1, which shows that the control of industrial structure is insignificant indeed. In addition, all controls are not significant in Model 3. This may be due to the declining role of China′s efficiency improvement in TFP growth.

To address the possible endogeneity and selection problems of the CIA, we employ the fixed effect estimation methods and Two Stage Least Squares (TSLS). The CIED (i.e. CI index) is used as an instrument for CIA index. We only report the second stage regression results in Table 2, where Model 1^a, 2^a, 3^a and 4^a corresponds to Model 1, 2, 3 and 4. The TSLS estimation results are similar to those in Model 1, 2, 3 and 4, suggesting that our findings are robust to different estimation methods.

4.2 Impact of creative industries agglomeration across regions

The development of Chinese economy is unequal across the developed eastern coastal regions, the developing central regions and western regions. In recent years, the governments have taken measures to deal with this problem, such as attracting talent and developing creative industry parks in the western and central China (Zhang, 2010). To identify the impact of the clustering of creative industries on TFP growth across regions, we classify the provinces into two regions based on their geographical location: coastal region and interior region. The coastal region covers 15 provinces or special administrative regions (SAR), referring to Hong Kong, Macau, Taiwan, Beijing, Tianjin, Hebei, Liaoning, Shanghai, Jiangsu, Zhejiang, Fujian, Shandong, Guangdong, Guangxi, and Hainan (Hong Kong, Macau and Taiwan are excluded from our sample due to data missing). The interior region covers 19 provinces, Shanxi, Inner Mongolia, Jilin, Heilongjiang, Anhui, Jiangxi, Henan, Hubei, Hunan, Chongqing, Sichuan, Guizhou, Yunnan, Shaanxi, Tibet, Gansu, Qinghai, Ningxia, Xinjiang (Chongqing is excluded from our sample due to data missing). This classification is preferred because there are significant differences in growth rates and the development of creative industries between coastal provinces and interior provinces.

The coastal estimation results are presented in Table 3, where TFP, TP and TEC growth are taken as the dependent variables in Model 5, 6 and 7 respectively. It shows that the results from coastal region are rudimentarily consistent with the findings of the general estimation (Table 2). Thus, it confirms that the development of CIA can significantly promote regional TFP growth through the path of technological change instead of technical efficiency growth. However, in the interior region, the coefficients of CIA are not significant in all

Table 3 Effect of creative industries agglomeration on total factor productivity growth in coastal region of China

Variable	Model 5	Model 6	Model 7	Model 5^a	Model 6^a	Model 7^a
CIA index	0.094** (2.391)	0.036* (1.870)	0.010 (0.602)			
CI index				0.065* (1.761)	0.253* (1.694)	–0.091 (–1.046)
FDI level	0.044* (1.716)	0.016 (1.575)	0.022** (2.264)	0.046*** (4.173)	0.002 (0.101	0.031** (2.191)
FSS	–0.173*** (–3.586)	–0.028** (–2.072)	–0.092*** (–2.76)	–0.134*** (–4.159)	–0.081*** (–2.839)	–0.081** (–2.555)
ISC	0.170 (1.471)	0.161*** (4.059)	–0.162*** (–2.737)	0.037 (0.691)	0.268*** (3.409)	–0.157** (–2.313)
Constant	–0.610 (–1.466)	–0.566*** (–4.009)	0.575*** (2.674)	–0.126 (–0.648)	–0.981*** (–3.421)	0.571** (2.403)
R^2	0.555	0.253	0.568	0.632	0.121	0.546
Adjust R^2	0.472	0.114	0.487	0.563	0.044	0.460
Observation	96	96	96	96	96	96

Notes: All variables are natural logarithms; the Hausman test in all above models is significant at 1% level; ***, ** and * represent statistical significance level at 1%, 5% and 10%, respectively; the data in the parenthesis is the value of t-test; Model 5^a, 6^a and 7^a, corresponding to Model 5, 6 and 7, report the second stage regression results of the Two Stage Least Squares (with instrumental variable of CI index).

models where TFP, TP and TEC growth are regarded as the dependent variable in Model 8, 9 and 10 respectively (Table 4), suggesting that the clustering of creative industries does not have significant role in promoting interior local productivity growth, efficiency change or innovation progress. This may be due to lagging development of CIA in the western and central regions. Although the interior provinces have initiated lots of policies concerning retaining and attracting creative zones or parks, the efficiency and productivity of creative industries clustering is still not significant, leading to synonymous insignificant effects on TFP growth. Another reason may be the insignificant growth of TFP in the inland region. According to our estimation and the research of Wei and Hao (2011), the TFP growth in the inland region is slow and falls far behind the coastal region. The control of industrial structure is similar to the general estimation (i.e. negative effect on TFP growth) in the central and western regions, while in the coastal region it has a significant and positive effect. This implicates that service industries in the eastern China are more developed than the central and western regions. The results of other controls are quite similar to theoe in the general model.

Overall, we found that the CIA affects regional TFP growth differently across regions. TFP growth in the coastal region significantly benefits from the CIA, while in the interior region, productivity growth is not significantly attributable to the development of CIA. To confirm that the results are not simply due to reverse causality, the IV estimation is used with the same instrumental variable as in general estimation, where Model 5^a, 6^a, 7^a, 8^a, 9^a and 10^a correspond with Model 5, 6, 7, 8, 9 and 10. This suggests that our previous estimations across regions were basically robust to different estimation methods.

5 Conclusions

This paper, based on China′s provincial panel data during the period 2003–2010, provides strong empirical evidence that creative industries are fast growing but unevenly distributed across regions in China. Our regression analyses clearly show that the agglomeration of creative industries has a positive effect on regional TFP growth by stimulating regional innovation instead of efficiency change. Therefore, the development of CIA is likely to be a successful transition in China from export-oriented manufacturing to a creative economy that is integrated with global systems and China′s unique cultures. In general, this work helps to give an interpretation of the results of TFP growth regressions and guidelines for future empirical work on creativity found in the previous literature.

Our empirical study provides strong evidence of the prominent role of CIA in productivity growth. To enhance productivity growth, China should further establish more creative clusters at regional levels. Due to the difference across regions in China, the policy on developing CIA also should be different. In the coastal region,

Table 4 Effect of creative industries agglomeration on total factor productivity growth in interior region of China

Variable	Model 8	Model 9	Model 10	Model 8^a	Model 9^a	Model 10^a
CIA index	0.046 (1.369)	0.085 (1.649)	–0.057 (–1.350)			
CI index				0.183*** (3.014)	0.140 (1.323)	–0.134 (–1.572)
FDI level	0.025 (1.293)	0.043* (1.729)	–0.028 (–1.006)	0.025 (1.209)	0.041** (2.271)	–0.026 (–1.130)
FSS	–0.061*** (–3.033)	–0.064* (–1.703)	0.001 (0.052)	–0.052** (–2.352)	–0.066** (–2.016)	–0.001 (–0.026)
ISC	–0.148** (–2.233)	–0.060 (–0.434)	–0.114 (–1.636)	–0.146** (–1.999)	0.023 (0.195)	–0.103 (–1.319)
Constant	0.531** (2.360)	0.246 (0.460)	0.350 (1.556)	0.599** (2.399)	–0.015 (–0.028)	0.274 (0.856)
R^2	0.588	0.530	0.292	0.554	0.119	0.263
Adjust R^2	0.517	0.449	0.171	0.477	0.094	0.137
Observation	144	144	144	144	144	144

Notes: All variables are natural logarithms; the Hausman test in all above models is significant at 1% level; ***, ** and * represent statistical significance level at 1%, 5% and 10%, respectively; the data in the parenthesis is the value of t-test; Model 8^a, 9^a and 10^a, corresponding to Model 8, 9 and 10, report the second stage regression results of the Two Stage Least Squares (with instrumental variable of CI index)

the policy makers should pay more attention on how to promote efficiencies of the CIA and developing various types of higher value-added creative industries, such as digital media and software development. While in the developing central and western regions, it should promote the agglomeration level of CIA and develop local preponderant types of creative industries, such as cultural tourism. Moreover, as industry convergence progresses, China should promote more innovation in manufacturing through the development of creative industries. This would facilitate China′s economic transition from the development of less creative industries to more creative industries and from being efficiency-driven to innovation-driven.

In the future study, first, it is necessary to both apply more micro data and understand deeper the meaning of ′creativity′ in industries, because the firm-level data rather than industry-level data may facilitate an understanding of the relationship between CIA and productivity growth more precisely. Second, in order to link the CIA more precisely to TFP growth, it should define creative industries more precisely, for example, to identify which firms are really creative instead of judging by industries or sectors that merely seem creative. Future studies could explore different types of creativity for the purpose of examining productivity growth effects precisely. Third, it is crucial to extend the TFP growth effects of creative industries to other sectors, and to check whether our insights can apply to other industries, particularly in the ′high-tech′ sector.

References

Andersson R, Quigley J M, Wilhelmsson M, 2005. Agglomeration and the spatial distribution of creativity. *Papers in Regional Science*, 84(3): 445–463. doi: 10.1111/j.1435-5957.2005.00049.x

Asheim B T, Hansen H K, 2009. Knowledge bases, talents and contexts: On the usefulness of the creative class approach in Sweden. *Economic Geography*, 85(4): 425–442. doi: 10.1111/j.1944-8287.2009.01051.x

Baines S, Robson L, 2001. Being self-employed or being enterprising? The case of creative work for the media industries. *Journal of Small Business and Enterprise Development*, 8(4): 349–362. doi: 10.1108 /EUM0000000006830 (Permanent URL)

Beijing Municipal Statistics Bureau, 2011. *Beijing Statistical Yearbook*, (*2010*). Beijing: China Statistics Press. (in Chinese)

Boschma R A, Fritsch M, 2009. Creative class and regional growth: Empirical evidence from seven European countries. *Economic Geography*, 85(4): 391–423. doi: 10.1111/j.1944-8287.2009.01048.x

Brinkhoff S, 2006. *Spatial Concentration of Creative Industries in Los Angeles*. DIPLOMARBEIT, Humboldt-Universität zu Berlin Geographisches Institut.

Chapain C, Cooke P, Propris L D *et al*., 2010. *Creative Clusters and Innovation*, NESTA Research report, London.

Cingano F, Schivardi F, 2004. Identifying the sources of local productivity growth. *Journal of the European Economic*, 2(4): 720–744. doi: 10.1162/1542476041423322

Clifton N, 2008. The ′Creative Class′ in the UK: An initial analysis. *Geografiska Annaler*: *Series B*, *Human Geography*, 90(1): 63–82. doi: 10.1111/j.1468-0467.2008.00276.x

Cooke P, Lazzeretti L, 2008. *Creative Cities*, *Cultural Clusters and Local Economic Development*. Cheltenham: Edward Elgar.

DCMS (Department of Media, Culture and Sport), 1998. *The Creative Industries Mapping Document*, London: HMSO.

European Commission, 2006. *Economy of Culture in Europe*. Brussels: DE Education and Culture. Available at: http://ec.europa.eu/culture/pdf/doc885_en.pdf

Färe R, Grosskopf S, Norris M *et al*., 1994. Productivity growth, technical progress, and efficiency change in industrialized countries. *The American Economic Review*, 84(1): 66–83.

Florida R, 2002. *The Rise of the Creative Class*. New York: Basic Books.

Florida R, Mellander C, Stolarick K, 2008. Inside the black box of regional development: Human capital, the creative class and tolerance. *Journal of Economic Geography*, 8(5): 615–649. doi: 10.1093/jeg/lbn023

Fu X, Gong Y, 2011. Indigenous and foreign innovation efforts and drivers of technological upgrading: Evidence from China. *World Development*, 39(7): 1213–1225. doi: 10.1016/j.worlddev.2010.05.010

Goldsmith R W, 1951. A perpetual inventory of national wealth. In: Gainsburgh M R (eds.). *Studies in Income and Wealth*. Princeton: Princeton University Press: 5–61.

Hansen H K, Niedomysl T, 2009. Migration of the creative class: Evidence from Sweden. *Journal of Economic Geography*, 9(2): 191–206. doi: 10.1093/jeg/lbn046

Hong E, Sun L, 2011. Foreign direct investment and full factor productivity in China. *Oxford Bulletin of Economics and Statistics*, 73(6): 771–791. doi: 10.1111/j.1468-0084.2011.00672.x

Hong J, Yu W, 2012. Creative industries cluster and regional innovation system: Upstream and downstream effects. In: *International Workshop on Regional*, *Urban*, *and Spatial Economics in China*, June 15–16, 2012, Guangzhou, China.

Kathrin M, Christian R, Johannes T, 2009. The role of creative industry in industrial innovation. *Innovation Management Policy & Practice*, 11(2): 148–168. doi: 10.5172/impp.11.2.148

Krugman P, 1991. Increasing returns and economic Geography. *Journal of Political Economy*, 99(3): 483–499. doi: 10.2307/2937739

Lazzeretti L, Boix R, Capone F, 2008. Do creative industries

cluster? Mapping creative local production systems in Italy and Spain. *Industry and Innovation*, 15(5): 549–567. doi: 10.1080/13662710802374161

Lazzeretti L, Capone F, Boix R, 2012. Reasons for clustering of creative industries in Italy and Spain. *European Planning Studies*, 20(8): 1243–1262. doi: 10.1080/09654313.2012.680585

Lange B, Kalandides A, Stober B *et al*., 2008. Berlin′s creative industries: Governing creativity? *Industry and Innovation*, 15(5): 531–548. doi: 10.1080/13662710802373981

Lorenzen M, Frederiksen L, 2008. Why do cultural industries cluster? Localization? urbanization, products and projects. In: Cooke P, Lazzeretti L (eds.). *Creative Cities*, *Cultural Clusters and Local Economic Development*. Cheltenham: Edward Elgar, 155–179,

Markusen A, 2006. Urban development and the politics of a creative class: Evidence from then study of artists. *Environment and Planning A*, 38(10): 1921–1940. doi: 10.1068/a38179

Madariaga N, Poncet S, 2007. FDI in Chinese cities: Spillovers and impact on growth. *The World Economy*, 30(5): 837–862. doi: 10.1111/j.1467-9701.2007.01025.x

Marshall A, 1890. *Principles of Economics*. London: Macmillan.

Molina B M, Oliver J H, Boix R *et al*., 2012. The importance of creative industry agglomerations in explaining the wealth of European Regions. *European Planning Studies*, 20(8): 1263–1280. doi: 10.1080/09654313. 2012.680579

National Bureau of Statistics of China, 1991–2011. *China Statistical Yearbook* (*1990–2010*). Beijing: China Statistics Press. (in Chinese)

National Bureau of Statistics of China, 2004–2011. *China Statistical Yearbook on Science and Technology* (*2003–2010*). Beijing: China Statistics Press. (in Chinese)

Gordon J C, Beilby-Orrin H, 2007. *International Measurement of the Economic and Social Importance of Culture*. OECD (Organisation for Economic Co-operation and Development) Statistics Working Papers. Available at: http://dx.doi.org/10.1787/5k92znx7sc30-en

Olfert M R, Partridge M, 2011. Creating the cultural community: Ethnic diversity vs. agglomeration. *Spatial Economic Analysis*, 6(1): 25–55. doi: 10.1080/17421772.2010.540032

Porter M, 1998. *On Competition.* Boston: Harvard Business School Press.

Rantisi N M, Leslie D, Christopherson S, 2006. Placing the creative economy: Scale, politics, and the material. *Environment and Planning A*, 38(10): 1789–1797. doi: 10.1068/a39210

Rosenthal S S, Strange W C, 2001. The determinants of agglomeration. *Journal of Urban Economics*, 50(2): 191–229. doi: 10.1006/juec.2001.2230

Shanghai Municipal Statistics Bureau, 2011. *Shanghai Statistical Yearbook* (*2010*). Beijing: China Statistics Press. (in Chinese)

Stam E, Jong J P J, Marlet G, 2008. Creative industries in the Netherlands: Structure, development, innovativeness and effects on urban growth. *Geografiska Annaler*: *Series B*, *Human Geography*, 90(2): 119–132. doi: 10.1111/j.1468-0467.2008.00282.x

Towse R, 2003. Cultural Industries. In: Towse R *et al*. (eds.). *A Handbook of Cultural Economics*. Cheltenham: Elgar, 170–177.

Throsby D, 2003. Cultural Capital. In: Towse R *et al*. (eds.). *A Handbook of Cultural Economics*. Cheltenham: Elgar, 166–169.

UNCTAD (United Nations Conference on Trade and Development), 2008. *Creative Economy Report 2008*. Available at: http://unctad.org/en/Docs/ditc20082cer_en.pdf

Wei Z, Hao R, 2011. The role of human capital in China′s total factor productivity growth: A cross-province analysis. *The Developing Economies*, 49(1): 1–35. doi: 10.1111/j.1746-1049.2010.00120.x

Wu Y, 2000. Is China′s economic growth sustainable? A productivity analysis. *China Economic Review*, 11(3): 278–96. doi: 10.1016/S1043-951X(00)00022-5

Wu, Yanrui. 2007. Capital stock estimates for China′s regional economies: Results and analyses. Working paper at Business School in University of Western Australian. Available at: http://www.uwa.edu.au/__data/assets/pdf_file/0005/98636/07_16_Wu_2.pdf

Wu Yanrui, 2008. The role of productivity in China′s growth: New estimates. *China Economic Quarterly*, 3(7): 827–842. (in Chinese)

Young A, 2003. Gold into base metals: Productivity growth in the People′s Republic of China during the reform period. *Journal of Political Economy*, 111(6): 1220–1261. doi: 10.1086/378532

Yusuf S, Nabeshima K, 2005. Creative industries in East Asia. *Cities*, 22(2): 109–122. doi: 10.1016/j.cities.2005.01.001

Zhang Pen, Yang Qingshan, Zhao Yichun, 2012. Relationship between social economic agglomeration and labor productivity of core cities in Northeast China. *Chinese Geographical Science*, 22 (2): 221–231. doi: 10.1007/s11769-012-0522-4

Zhao Jingcheng, 2010. *Chinese Creative Industries Report*. Being: China Economic Publishing House. (in Chinese)

Zhao Wei, Zhang Cui, 2008. Regional manufacturing agglomeration and total factor productivity increase in China. *Journal of Shanghai Jiao Tong University* (*Philosophy and Social Science*), 16(5): 52–56. (in Chinese)