



# The Spatiality of the Creative Digital Economy: Local Amenities to the Spatial Agglomeration of Creative E-Freelancers in China

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## Abstract

The digital transformation of contemporary economy has led to an increasing number of new forms of occupation, such as the creative e-Freelancers. These self-employed individuals, in general, in design-oriented sectors, enjoy a highly flexible mode of business operation regarding their location choice of workplace; which reflects the implications of digital technologies on the spatiality of the creative economy. However, it was observed by recent literature that the space of the creative digital economy has not become more dispersed, but appeared to be another sort of agglomeration economy. In order to unfold the agglomeration mechanism of creative e-Freelancers, and shed further light on the spatial reconstruction process of economic geography in the digital era, the paper at hand empirically investigates the spatiality of creative e-Freelancers in China following an amenity-based approach. The findings suggest that the creative e-Freelancers in China tend to gather in some metropolises, while a strong rebalancing force has been noticed in reshaping the existing urban and economic system. The creative e-Freelancing workforce is significantly driven by local amenities, such as richness of human capital (e.g., college students), entrepreneur-friendly milieu for e-Business, a high quality of life supported by easy accessibility to leisure facilities and public transport, as well as affluent cultural heritages. Some second-rank cities particularly benefit from this phenomenon.

**Keywords** Creative occupations · Digital economy · E-Freelancers · Local amenities

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## Introduction

In today's global economy, the internet and mobile technologies are increasingly utilized in production and distribution systems, as well as in social media; this results in a marked digital transformation in business environment and management (Li, 2020; Rêgo et al., 2021). Largely due to the attributes of having instant and frictionless access to digital technologies made possible through connecting a variety of electronic devices (i.e., computers, smartphones, servers, and cloud), there are a number of newly emerging forms of digital economies, including e-Commerce, e-Payment, and online finance, as well as new forms of occupation such as e-Freelancers, online writers, and internet celebrities. The instance of the COVID-19 pandemic in recent years further boosted the digital turn of businesses and working models, leading to the rapid rise of work-from-home groups all around the world (Mukherjee & Narang, 2022).

While digital economy has permeated traditional economic forms such as retail businesses, and given rise to dozens of multinational e-Commerce giants such as Amazon, eBay, JD.com, and Alibaba, it has also moved deeply into the new economy in areas such as cultural and creative industries. This is particularly true for the pioneer countries of internet technology, where an increasing number of online-based creative occupations has been observed (Horton, 2010). In the USA for instance, individuals engaged with internet freelancing are termed "elancers" (Aguinis & Lawal, 2013); similarly, they are well known as "witkey" in China (*weike* in Chinese). Both terms refer to new types of freelance-oriented occupations that provide knowledge-intensive services, and design related goods through online platforms. They include, but are not limited to, a wide range of sectors in creative industries, including industrial design, branding, advertising, media and animation production, fashion design, gaming, photography, styling, etc.

Nevertheless, recent scholarships have rarely addressed the fast rise of the creative digital economy, especially from an economic geography perspective. After searching through the Scopus scientific dataset using keywords such as "the digital economy," "the creative economy," and "creative occupations," we found two parallel branches of literature in the specific field of economic geography. First, there is a large body of literature focusing on the nature of digital space (Ash et al., 2018; Graham, 2013; Kinsley, 2014; Kitchin, 1998; Zook & Graham, 2007), materiality of cyber-geography (Malecki & Wei, 2009; Zhen et al., 2015), and implications of digital technology for social and economic geography (Graham & De Sabbata, 2015). The other thread of scholarship regarding the field of urban and economic geography is concerned with the rapid rise of the creative economy (Pratt, 2000; Scott, 1997), creative class (Florida, 2014; Hansen & Niodomysl, 2008; Markusen, 2006), and creative cities (Evans, 2009; Landry, 2008). Unfortunately, these two branches of academia are scarcely conversant with each other, which leaves a research gap regarding the spatiality of the creative digital economy, in particular, the location choice of creative e-Freelancers. As a matter of fact, freelancers and other forms of self-employed individuals are currently playing a crucial role in fostering

innovation and providing new knowledge for the creative economy (Baitenizov et al., 2019; Dabic et al., 2017; Lee & Drever, 2013). Accordingly, ignoring the spatial dynamics of this newly emergent occupation could lead to unexpected consequences in the practice of digital transformation for both entrepreneurship and territorial development (Héraud, 2021; Li, 2020). Moreover, given that digital transformation in the modern economy is permanent, there would be profound impacts on matters such as economic and urban systems which remains, by all means, relatively underexplored (Zook & Graham, 2007).

Therefore, this paper intends to investigate the location drivers of creative e-Freelancers by employing an amenity-based approach that has been widely utilized in explaining the clustering process of creative talents carried out in particular regions by the previous creative class literature (Argent et al., 2013; Florida, 2014; Wojan et al., 2007). With the basic hypothesis that creative e-Freelancers are more likely lured by local amenities (since digital technologies provide them a more flexible environment to conduct remote operations of business and employment), a reconfiguration process of space, e.g., recentralization or rebalance, is then expected in the current urban hierarchy. Empirically, the paper is focused on China, the country that has the largest population of internet users throughout the world (CNNIC, 2020), and has been experiencing dramatic growth in both its digital economy and creative economy over the past decade. Two research inquiries are raised regarding the spatiality of digital creative economy: first, it aims to explore the spatial pattern of creative e-Freelancing in China, that is, which locations (cities) are prolific in terms of creative e-Freelancing workforce. Accordingly, it goes on to interrogate whether local amenities serve to give impetus to the spatial agglomeration of creative e-Freelancers in particular cities. If yes, then what are these specific amenities for digital creative economy. By addressing these questions, this research provides a pioneering work on the newly emerging creative occupations in digital economy, which shed further light on the reconstruction process of economic geography in the digital era.

The remainder of this paper is organized as follows: The second section presents a theoretical review on the digital creative economy, spatial drivers of agglomeration of creative industries, and determinants of location taken into account by creative e-Freelancers. The third part demonstrates an empirical case analysis of the creative e-Freelancers in China based on an online community of e-Freelancers (zbj.com). Finally, the paper ends with a conclusion on the contributions of this paper and a proposition for the future research agenda.

## Theoretical Framework and Literature Review

### The Creative Digital Economy and E-Freelancers

Over the past decades, the emergence of the creative economy, more often termed as creative industries, has drawn great attention worldwide. Although there is no consensus on the exact definition of “creative industries” across different organizations, the proposition by the *UK Government Department for Digital, Culture, Media and*

*Sport (DCMS)* is widely recognized in academic literature. It refers to “the industries which have their origin in individual creativity, skill, and talent, and which have a potential for wealth and job creation through the generation and exploitation of intellectual property” (DCMS, 2001). Unlike the traditional sectors that are based on material goods or immediately consumable services, creative industries are at the crossroads of arts, culture, business, and technology, and strongly rely on individual creativity, skills, and talents (UNCTAD, 2010). In the wide range of creative sectors, the core group of creative industries commonly consists of six sectors, including content (e.g., film, online games, journalism, music, performing arts), design (e.g., arts and crafts, design and fashion, graphic design), software (e.g., programming and computer services), advertising (e.g., planning, market research, advertising services), and publishing (e.g., newspapers and other printed matter) (DCMS, 2001; Müller et al., 2009). Creative industries are of great importance to today’s economy, not merely due to their contribution on wealth creation and entrepreneurship, but more importantly, owing to their externalities to other economic sectors by adding new ideas, innovative products and services, as well as their enthusiastic embrace of new technologies (HKU, 2010; Lee & Drever, 2013; Müller et al., 2009).

More recently, there has been increasing interest in the rapid rise of the digital economy. It is estimated that the digital economy has a double-digit annual growth rate around the world, and even faster in the Global South (WEF, 2015). Thanks to the fast development of information and communication technologies (ICTs), modern economy is fundamentally “digitalized,” including the embedding of connected sensors into more and more objects (the Internet of things), new end-user devices (mobile phones, smartphones, tablets, netbooks, laptops, 3D printers), new digital models (cloud computing, digital platforms, digital services), growing intensity of data usage through the spread of big data, data analytics, and algorithmic decision-making, and new automation and robotics technologies (OECD, 2015). According to Bukht and Heeks (2017), the digital economy can be narrowly defined as the economic activities “that are part of the economic output derived solely or primarily from digital technologies, with a business model based on digital goods or services.”

Digital transformation occurs not only in the traditional sectors, but also in the emerging sectors of creative industries, giving rise to a variety of new forms of creative activities such as online literature, e-Art, digital music, and e-Sports. Here, we term this incorporation of the digital economy and creative industries as the *creative digital economy*. Following the definition presented by Bukht and Heeks (2017), the creative digital economy can then be defined as the creative activities that are part of the economic output derived solely or primarily from digital technologies, with a business model based on digital goods or services. Notably however, not all of the creative sectors are equally digitalized. The digital platform helps the creative sectors in optimizing its industrial ecology and maximizing its market reach, but presents limitations in digitalizing some specific sectors of creative industries, such as experience-based services and performing arts, which are less likely to be replaced by virtual contacts. Therefore, the creative digital economy is in the juxtaposition between traditional creative industries and the economy of online platforms.

Moreover, the creative digital economy is significantly featured by a growing tendency of flexible production and employment. In some particular sectors, such as design and photography, the workforce is even dominated by freelance and self-employment (Baitenizov et al., 2019; Horton, 2010). The newly emerged group of creative e-Freelancers is highly engaged with temporary labor contracts based on network and remote operation of businesses, though which are usually unstable and lack social welfare (Merkel, 2019). The rise of creative e-Freelancers is largely attributed to a lower accessibility to market through online platforms for the grassroots and marginalized groups (e.g., students and beginners); but, it is also believed to be a part of the consequence of the current global economic recession and subsequent austerity policies, since companies might be forced to cut their cost for full-time labor contracts and social responsibilities (McRobbie, 2015; Merkel, 2019). As a result, creative e-Freelancers play a key role in the process of creative production underpinned by digital platforms.

### The Spatiality of the Creative Digital Economy

A predominant proposition regarding the impacts of the digital economy on space asserts that the increasing use of internet and mobile technologies would ultimately lead to “the death of distance” (Batty, 1993; Breathnach, 2000; Friedman, 2007). Superficially, this assumption is plausible since the Internet and other telecommunications are fundamentally characterized by decentralization and diversification, and are usually of a *person-to-person* or *agent-to-agent* mode. The tendency toward decentralization is also underpinned by the observation that daily activities are increasingly engaged with cyberspace, such as online conferences, cyber games, social software, e-Business platforms, etc.

Nevertheless, many empirical studies tend to argue against the forecast of the coming of a dispersed spatial economy; instead, they suggest that agglomeration economies and the polarization of urban systems are observably enhanced in both developing and advanced societies (Gibson, 2003; Graham, 2002; Malecki & Wei, 2009; Scott & Storper, 2015). Concerning the space of creative industries in particular, a large number of creative enterprises and talents are concentrated in a small number of metropolises and global cities, such as London, New York, Los Angeles, and Shanghai (Florida, 2014; Glaeser, 2011; Scott, 2010). This spatiality of creative industries primarily results from the fact that infrastructures (e.g., ICTs) are unevenly distributed over the space, especially in underdeveloped regions, where the digital divide between urban and rural, highly populated and remote, and rich and poor communities, grows wider along with the advancement of digital technologies (Graham & De Sabbata, 2015; Kinsley, 2014). Further, digital technologies may facilitate the remote interactions and operation of businesses; yet, it remains impossible to replace real social interactions such as having face-to-face contacts. Thus, the Internet serves not to renovate geographical divergence, but rather to explore more location differences (Kitchin, 1998; Morgan, 2004). However, this does not mean that digital technologies have no impact on the spatiality of the creative economy. In fact, a strong rebalancing force was observed in reshaping urban

and regional systems under the influences of the digital economy (Castells, 2002; Mukherjee & Narang, 2022). Some marginal cities benefit from the emergence of this new economy for their rich amenities in order to creative talents and knowledge-intensive enterprises (Dijkstra et al., 2013; Meijers et al., 2016). That is to say, although the uneven spatial pattern of creative industries remains unchanged in general, an evident reconfiguration process is taking place as digital transformation provides some smaller cities and periphery regions with an additional leverage to rebalance their economic power. However, what the main drivers are that facilitate spatial reconfiguration is still an underexplored issue in the academic realm.

### Determinants of the Spatial Agglomeration of Creative E-Freelancers

There are a variety of factors that may influence the location choice of skilled talents, ranging from the external environment (e.g., economic and institutional advantages), to personal needs and motivations (Faggian & Royuela, 2010; Glaeser, 2008; Liu & Shen, 2014; Tung & Lazarova, 2006). Regarding the specific group of creative talents, amenity has been particularly emphasized in the current literature of economic geography (Florida, 2014; Gottlieb, 1994; Hansen & Niodomysl, 2008; Waltert & Schlapfer, 2010; Zheng, 2016). Among them, Florida put forth a prevalent, yet controversial theory, namely *the creative class theory*. He did this by highlighting the close relevance between the presence of the creative class and place quality to creativity (Florida, 2005, 2014; Florida et al., 2010). This theory asserts that local amenities may play a decisive role in attracting and retaining free-spirited creative talents, enterprises, and human capital. The creative class, made up of scientists, engineers, artists, musicians, designers, and knowledge-based professionals, is lured by certain local metrics of creativity, including people's attitude and behavioral patterns, social tolerance, cultural diversity, urban landscape, and quality of life (Florida, 2005). These amenities are crucial for the creative economy as they are part of the inspiration necessary for creativity, and the booster for establishing bohemian-oriented communities, especially among homosexual communities (Florida, 2014). Thus, urban policy needs to invest greatly in building urban facilities such as theaters, libraries, galleries, museums, and street-level music venues that are favored by creative talents. A worldwide interest was sparked within scholarly and political domains shortly after the *creative class theory* was proposed.

However, the creative class theory was critically interrogated for that creative people might not necessarily be different from other traditional professionals, as they are not essentially footloose as declaimed by the proponents of the creative class theory (Audretsch et al., 2021; Faggian et al., 2013; Hansen & Niodomysl, 2008; Markusen, 2006). To respond to this debate, we propose creative e-Freelancers as *an alternative group* to the creative class, since the former is highly featured by a flexible working pattern which blurs the boundaries between workplace, and leisure or family spaces (Eikhof et al., 2007; Horton, 2010; Neff et al., 2005). Theoretically, creative e-Freelancers, such as freelance artists, designers, and music workers, are released from fixed working places and even employers. Thereby, they might be more movable and footloose compared to traditional creative producers. Thus, we

believe that creative e-Freelancers are an ideal research object for reflecting the spatiality of the creative digital economy, and testifying the amenity-based approach.

Previous amenity-based studies have been concerned with various factors that may affect the location decision of creative talents, including natural and environmental amenities (e.g., humidity and temperature), landscapes, cultural diversity (e.g., foreign-born rate), social tolerance (e.g., homosexuality rate), and other socioeconomic factors (e.g., social welfare and entrepreneurship) (Florida, 2014; Gottlieb, 1994; Hansen & Niedomysl, 2008; Lee et al., 2004; Waltert & Schlapfer, 2010; Wojan et al., 2007). Also, considering the aforementioned features of creative e-Freelancers, we adopted five types of indicators to explain the distribution of creative e-Freelancers in China, namely *natural amenities*, *educational amenities*, *entrepreneurial amenities*, *cultural amenities*, and *life quality amenities* (see Table 1). Among them, natural amenities refer to the local conditions of weather and air quality, which are widely recognized as crucial local attractions for the new economy, e.g., *temperature in January* and *annual sunshine hours* are regarded as important factors for the agglomeration of high-tech industries in the Sun Belt region of the USA (Glaeser, 2008; Goetz & Rupasingha, 2002). Meanwhile, since some cities in northern China have been suffering from *air pollution* over past years, we expect to observe a negative effect that this index has on the distribution of e-Freelancers. The educational amenities under study here are equivalent to human capital, which is believed to be highly associated with urban economic growth and the flourishing of cultural industries (Storper & Scott, 2009). Besides, prior research

**Table 1** Amenity variables for the spatial agglomeration of E-freelancers

Local amenities	Independent variables	Description
Natural amenities	Jan_temperature	January temperature (Centigrade)
	AQI	Air quality index
	Sun_time	Annual sunshine time (hours)
Educational amenities	Col_students	College students per 10,000 inhabitants
	Edu_level	College graduates per 10,000 inhabitants
	Edu_investment	Per capita education investment (RMB)
Entrepreneurial amenities	New_birth_enterprises	Number of newly established enterprises per million inhabitants
	Lis_companies	Number of listed companies per million inhabitants
	E-Commence	Total turnover of e-business per GDP
Cultural amenities	Cul_heritages	Number of national cultural heritages per million inhabitants
	Cul_facilities	Number of museums, theaters, and libraries per million inhabitants
	Cul_diversity	Foreign-born residents' rate (%)
Life quality amenities	Lei_facilities	Number of cafés, KTVs, and bars per 10,000 inhabitants
	Pub_transportation	Volume of public passenger transport per million inhabitants
	Per-capita income	Per-capita income of inhabitants



has illustrated that student entrepreneurs are expert in building informal networks by using digital technologies with the purpose of enhancing their competitiveness in business (Scuotto & Morellato, 2013). Thus, we utilized three indexes, namely, *college students*, *college graduates*, and *educational investment*, to present the regional provision of educational amenities. Similarly, entrepreneurial amenities are considered as an essential indicator that denotes the local business environment for the digital economy in particular. This item includes indexes such as *startups*, *listed companies*, and *turnover of total e-Commerce*. Cultural amenities, in terms of cultural diversity and facilities, are part of the local milieu that enhance creativity (Wojan et al., 2007), and are assumed to be an important urban asset in incubating the creative economy. We employed three indexes to measure the regional provision of cultural amenities: *cultural facilities* (e.g., museums, theaters, and libraries), *cultural diversity* (foreign-born population), and *cultural heritages*. Further, life quality amenities are commonly highlighted as an important attraction for the creative class who may favor a vibrant urban climate of entertainment such as having access to social networking opportunities, music atmosphere, and nightlife venues (Florida, 2005). Lastly, we assume that a high standard of life quality in cities should be supported by having access to public transportation, and certainly making a respectable income. Thus, three indexes are adopted to measure the life quality amenity, which are *leisure facilities*, *public transportation*, and *per-capita income*. Notably, although a wide range of the determinants of e-Freelancers' spatiality are included here, some factors such as policy and government incentives for digital economy development are not considered in the discussion. This is not only due to the limitation regarding data availability for such factors, but because the paper is specifically focused on the relevance between spatial agglomeration and local amenities.

## Empirical Research Design

### The Rise of Creative e-Freelancers in China

Currently, China has the largest e-Business market over the world, accounting for 40% of the global turnover, while this proportion was only 1% 10 years ago (CNNIC, 2020). The rapid progress of e-Development in China is closely associated with strong financial investments and policy stimulations carried out by state governments in establishing ICT infrastructures and e-Devices, as well as an enthusiastic embrace by the emerging e-Society in different forms such as e-Government, e-Working, e-Commerce, and e-Networking (Wang & Loo, 2017). This dramatic digital turn makes China a paradise for the experimental practice of new businesses and entrepreneurship such as e-Freelancing. E-Freelancers engaged with cultural production and services such as logo design, fashion, media production, game development, animation, and other knowledge-based services, are well known as *Witkey* (*weike* in Chinese) in China (Ma, 2013).

Since the beginning of twenty-first century, an increasing number of e-Freelancing websites have emerged in China, including *zbj.com*, *epwk.com*, *k68.cn*, *vsochina.com*,



and *72swk.com*. It is estimated that there are approximately ten million e-Freelancers, who have an annual output value of over 100 thousand RMB per person, working full-time or part-time as creative e-Freelancers in China. This group is highly dominated by young people who are in their early stages of entrepreneurship (Ma, 2013). Similar to e-Freelancing workers in western countries (who work through sites such as *eLance.com*, *freeLancer.com*, and *guru.com*), the creative e-Freelancers in China are employed online, usually via a website, to complete a certain type of task (Aguinis & Lawal, 2013). There is a marketplace between the clients and the creative e-Freelancers, which functions as an intermediary agent and warrantor to ensure the contract will be appropriately implemented by both sides. The potential employer may be a corporation, firm, or individual, while the creative e-Freelancers may be individuals or groups of people who work as a team. Creative e-Freelancers serve as the core players in the creative digital economy, and help in reshaping the spatiality of the urban and economic systems in China.

## Methods and Data Collection

In terms of the study methodology, we adopted a quantitative approach based on secondary data collected from a Chinese online platform for e-Freelancers (*zbj.com*). To explore the impacts of the above-mentioned amenity factors on the spatiality of creative e-Freelancers in China, the spatial error regression model (SEM) is employed. SEM is a typical spatial econometric model that has been widely employed in economic research to estimate the panel data with evident spatial correlation and spatial heterogeneity (Anselin, 1988; Fotheringham et al., 2003). Unlike other spatial econometric models such as the spatial lag model (SLM) and the spatial Dobbins model (SDM), SEM hypothesizes that the spatial autocorrelation results from the presence of spatial error correlation (Baltagi et al., 2003). This is owing to the fact that the distribution of creative occupation is highly dependent on place, with the great likelihood of being influenced by its adjacent regions (spatial correlation) (Alfken et al., 2015; Boschma & Fritsch, 2009). Thus, SEM is believed to be more suitable for our empirical study on spatial agglomeration of creative e-Freelancers.

The location quotient (LQ) index was used as the dependent variable in the model due to the fact that it eliminates the size effect of cities. Before running the spatial regression model, a test of spatial autocorrelation is commonly involved to make sure that the distribution of the dependent variable is not randomly done across different regions. Here, we utilized the Global Moran Index (Global Moran's  $I$ ) to measure the significance of spatial autocorrelation. Given a set of features and an associated attribute, Global Moran's  $I$  evaluates whether the pattern expressed is clustered, dispersed, or random. When the z-score or p-value indicate statistical significance, a positive Moran's  $I$  index value indicates tendency toward clustering, while a negative Moran's  $I$  index value displays tendency toward dispersion. The formula of Global Moran's  $I$  is expressed as follows:

$$I = \frac{n \sum_{i=1}^n \sum_{j=1}^n w_{ij} (x_i - \bar{x})(x_j - \bar{x})}{\sum_{i=1}^n \sum_{j=1}^n w_{ij} \sum_{i=1}^n (x_i - \bar{x})^2} \quad (1)$$

where  $x_i$  is the LQ of e-Freelancers for city  $i$ . The value of Global Moran's  $I$  is ranged within  $-1$  and  $1$ ; while the Moran's  $I > 0$ , and the  $P$  value is small ( $< 0.05$ ), it means that there is a strong spatial correlation of the dependent variable, and is suitable for running the SEM. The SEM can be expressed as:

$$y = \beta X + \mu, \quad \mu = \lambda W \mu + \varepsilon, \quad \varepsilon \sim N(0, \sigma^2 I_n) \quad (2)$$

where  $\mu$  is the disturbance term,  $\lambda$  is the spatial regression coefficient,  $W$  is the spatial weight matrix, and  $\varepsilon$  is the random error.

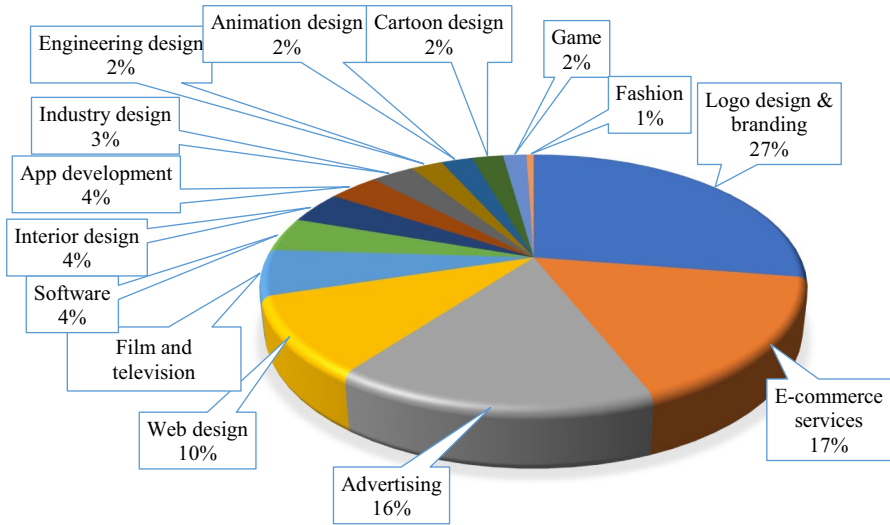
The data source of this paper is provided by the flagship e-Freelancing platform *zbj.com*. This website provides accessible information about all e-Freelancers registered on the website, including their location information (cities), type of services, income, comments from clients, and tags. However, in order to get authorization of using this data, users have to make an agreement on ethical items, e.g., non-commercial utilization of the data and protecting the anonymity of registers. Following this agreement, a process of anonymization was conducted by replacing all the names on the registers with numerical coding before the data was accessible by our research team.

We adopted *zbj.com* as the data source for e-Freelancers, largely due to its dominance in the field of creative e-Business in China, sharing over 70% of the national market in China (Ma, 2013). Although most of the e-Freelancers on the *zbj.com* website were engaged with creative production, there were some e-Freelancers who only provide traditional services such as editing assistance, health care and house-keeping services, etc. Furthermore, some accounts were out of service or had not yet started to provide their services. Thus, we eliminated the data for non-creative e-Freelancers, as well as those invalid accounts from the dataset. In total, 621,428 creative e-Freelancers in China were documented for the study with the assistance of the Python data mining tool. The dataset includes data for all prefecture-level cities of China (385 in total). The data for local amenities were primarily collected from the *City Statistic Yearbook* (NBS, 2018), and the *Sixth National Census* (2010), which were the latest available sources for the education statistic data at prefecture-level cities in China. Meanwhile, we also utilized the air quality data from *China Environment Bulletin*, 2018, and the POI data of cultural facilities from *Baidu Maps API* (Application Program Interface).

## Results and Discussions

### Distribution of Creative E-Freelancers in China

Figure 1 illustrates the sectoral distribution of over 600,000 creative e-Freelancers in China. It is illustrated that the majority of these e-Freelancers are concentrated in design sectors, in which the quarters of logo design, e-Commerce service,

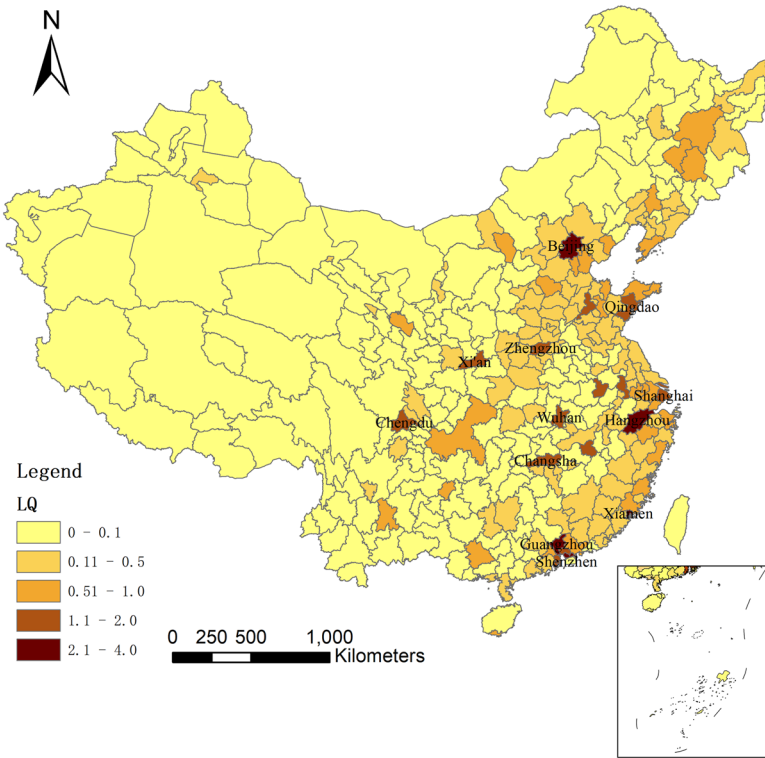


**Fig. 1** Sectorial distribution of creative E-freelancers in China

advertising, web design, and film and TV production are the core branches of creative e-Freelancing, and together account for over 76% of the e-Freelancers. This spectrum of creative e-Freelancing occupations differs from the traditional structure of offline creative industries. It indicates that the creative digital economy is specialized in some particular sectors, such as design and media production, while experience-based sectors such as performing arts are not common in creative e-Freelancing.

Meanwhile, the LQ index of creative e-Freelancers in China demonstrates a highly concentrated spatial pattern, more precisely, appearing to be polycentric (Fig. 2). This matter declines the hypothesis that digital technologies tend to eliminate geographic differences (Batty, 1993; Breathnach, 2000; Friedman, 2007). Metropolitan areas, such as Yangtze Delta and Pearl River Delta, are densely-populated with creative e-Freelancers. Given that distance is not a restriction for potential e-Freelancers when it comes to registering on a website, this evidence suggests that internet-based creative production is not dispersed, but rather represents another type of agglomeration economy (Graham & De Sabbata, 2015; Kitchin, 1998).

However, this does not necessarily mean that the distribution of creative e-Freelancers follows the existing hierarchy of urban system, unlike the high-tech workers in the USA who tend to gather most in mega cities (Glaeser, 2011). Instead, when relating the LQ index with city sizes by population (see Fig. 3), it is obviously suggested that several second-rank cities, such as Shantou (Guangzhou province), Hangzhou (Zhejiang province), Zhengzhou (Henan province), Changsha (Hunan province), and Jinan (Shandong province) benefited from having a denser e-Freelancing workforce compared to some first-tier cities, such as Beijing and Shanghai. Statistically, the relationship between the LQ index of creative e-Freelancers and city size is rather weak (see Fig. 3).

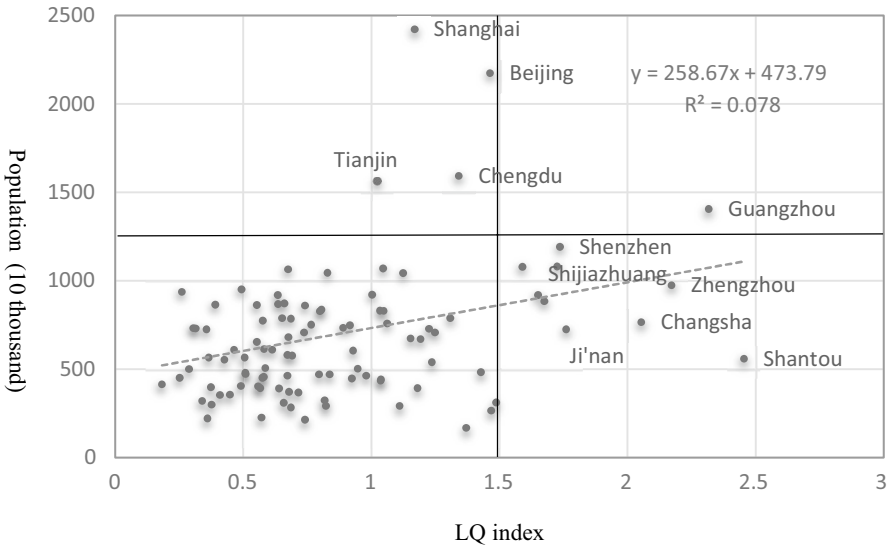


**Fig. 2** Spatial pattern of creative E-freelancers in China

This result thus echoes the findings of some previous studies; believing that second-rank cities are outperforming first-rank cities as national economic drivers in the new economy (Dijkstra et al., 2013), and that digital technologies are indeed reshaping the contemporary economic geography in the form of decentralization. This rebalancing process of urban and regional economy largely results from the two important driving forces of the digital economy. First, the digital economy is highly characterized by a close connection with non-local markets and global value chains (Asian Development Bank, 2021), which makes the demand of the local market less important. Second, the core players in the digital economy are comprised of a large number of individuals, in particular, creative e-Freelancers. As addressed previously, because creative e-Freelancers are released from place-fixed employment, they may enjoy a high degree of freedom to move to these small cities with lower living costs, but rich in urban amenities.

### Explanations Regarding the Spatial Agglomeration of Creative E-Freelancers in China

A spatial regression analysis was employed to explain the location dynamics of the creative e-Freelancing workforce in China. Table 2 displays the descriptive statistical



**Fig. 3** Relationships between the LQ index and city sizes by population

result for the variables used in the spatial regression. It is indicated that the variance inflation factors (VIF) of these 15 amenity variables are less than 10, which means there is no significant collinearity among the explanatory factors. However, two

**Table 2** Descriptive statistics of the dependent and independent variables

	Min	Max	Mean	VIF
<i>Dependent variable</i>				
LQ	0.08	2.45	0.88	–
<i>Independent variables</i>				
Jan_temperature	–17.00	17.80	4.61	2.07
AQI	2.130	10.67	5.87	1.24
Sun_time	942.30	2841.90	1921.72	1.75
Col_students	17.11	1397.20	380.00	1.48
Edu_level	0.10	1479.80	125.64	2.18
Edu_investment	1810.85	6898.52	3285.71	2.54
New_birth_enterprises	10.58	330.00	54.41	2.01
Lis_companies	0.16	18.47	3.32	<b>9.32</b>
E-Commence	40.00	375.00	93.40	<b>9.40</b>
Cul_heritages	2.00	87.00	16.32	2.92
Cul_facilities	9.00	429.00	51.21	4.18
Cul_diversity	0.02	0.13	0.04	1.04
Lei_facilities	0.66	10.24	4.19	5.34
Pub_transportation	1.00	1.72	1.42	2.19
Per-capita income	4170.00	53,087.00	10,019.38	2.34

**Table 3** Matrix of correlations

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
(1) Jan_temperature	1.000														
(2) AQI	0.188	1.000													
(3) Sun_time	-0.625	-0.080	1.000												
(4) CoL_students	0.017	-0.043	0.043	1.000											
(5) Edu_level	-0.016	-0.113	0.058	0.481	1.000										
(6) Edu_investment	0.164	-0.075	-0.098	0.172	0.418	1.000									
(7) New_birth_enterprises	0.276	0.090	-0.122	0.109	0.288	0.456	1.000								
(8) Lis_companies	0.112	-0.034	-0.075	0.218	0.478	0.718	0.539	1.000							
(9) E-Commence	0.103	-0.054	-0.085	0.183	0.423	0.769	0.517	<b>0.913</b>	1.000						
(10) CuL_heritages	-0.017	-0.247	0.013	0.228	0.447	0.560	0.380	0.617	0.735	1.000					
(11) CuL_facilities	0.205	-0.148	-0.157	0.320	0.542	0.676	0.591	0.704	0.724	0.650	1.000				
(12) CuL_diversity	-0.055	0.090	0.061	-0.048	-0.119	-0.075	-0.016	-0.048	-0.039	-0.053	-0.088	1.000			
(13) Lei_facilities	0.248	0.025	-0.100	0.215	0.449	0.724	0.656	<b>0.847</b>	<b>0.812</b>	0.549	0.735	-0.073	1.000		
(14) Pub_transportation	-0.148	0.048	0.162	0.488	0.612	0.329	0.271	0.456	0.411	0.310	0.455	-0.002	0.445	1.000	
(15) Per-capita income	0.198	-0.031	-0.137	0.287	0.502	0.559	0.407	0.598	0.577	0.448	0.713	-0.091	0.634	0.451	1.000

variables, namely *listed companies* and *e-Commence*, are reported with relatively large VIF ( $> 9$ ). Thus, a further diagnose of collinearity is necessary. Table 3 reports the matrix of correlations among independent variables. It can be found that there are three pairs of variables with significant correlations ( $> 0.8$ ), which are *listed companies* and *e-Commence*, *listed companies* and *leisure facilities*, and *leisure facilities* and *e-Commence*. In this case, it is necessary to run the regression model separately for these three correlated variables.

Meanwhile, to ensure the suitability of employing the spatial regression model, we computed the spatial autocorrelation using the ArcGIS 10.0 software. It is reported that the Global Moran's  $I$  is 17.13, and its  $P$  value is less than 0.01, which means the distribution of creative e-Freelancers in China is highly clustered. This finding rejects the null hypothesis at a confidence level of 1%.

The results of spatial regression analysis of creative e-Freelancers in China, reported by Table 4, indicate an impressive performance by all of these three models. Although these three models are slightly different from each other,

**Table 4** Spatial error regression analysis results of the E-freelancers in China

Variables	Model 1	Model 2	Model 3
Constant	0.840*** (0.057)	0.847*** (0.054)	0.825*** (0.056)
Jan_temperature	0.114** (0.075)	0.116 (0.054)	0.042 (0.078)
AQI	0.053 (0.055)	0.040 (0.056)	0.053 (0.057)
Sun_time	-0.020 (0.067)	-0.022 (0.068)	-0.066 (0.070)
Col_students	0.457*** (0.108)	0.405*** (0.113)	0.368*** (0.113)
Edu_level	-0.090 (0.062)	-0.029 (0.065)	-0.057 (0.065)
Edu_investment	0.042 (0.051)	0.064** (0.053)	0.036** (0.054)
New_birth_enterprises	0.227*** (0.060)	0.275*** (0.061)	0.212*** (0.066)
Lis_companies	0.497*** (0.063)	-	-
E-Commence	-	0.430*** (0.076)	-
Cul_heritages	0.594*** (0.595)	0.527*** (0.070)	0.685*** (0.061)
Cul_facilities	-0.115 (0.090)	-0.122 (0.096)	-0.119 (0.097)
Cul_diversity	-0.025 (0.061)	-0.028 (0.642)	-0.028 (0.065)
Lei_facilities	-	-	0.401*** (0.078)
Pub_transportation	0.173** (0.071)	0.203*** (0.075)	0.179** (0.077)
Per-capita income	-0.106** (0.070)	-0.099 (0.720)	-0.090* (0.073)
Spatial error term	0.332*** (0.072)	0.258*** (0.755)	0.275*** (0.075)
Lagrange multiplier (lag)	2.664	1.236	0.631
Lagrange multiplier (error)	16.362***	8.600***	9.999***
$R^2$	0.743	0.716	0.711
Log likelihood	-281.691	-294.388	-297.123669
AIC	591.383	616.777	622.247

Robust estimates ( $z$  values in parentheses)

\*Statistically significant at the 10% level, \*\*statistically significant at the 5% level, \*\*\*statistically significant at the 1% level



they all possess considerable explanatory power with their  $R^2 > 0.7$ . Therefore, this proves that local amenities are of great significance in explaining the spatial agglomeration of the creative e-Freelancers in China. To further probe into the research question inquiring which local amenity factors serve as the location dynamics to the agglomeration of the creative e-Freelancers in China, we address their relevance respectively.

First, natural amenities were found to be limitedly related to the agglomeration of creative e-Freelancers, with only *January temperature* being statistically significant in models 1 and 2. The variables of *air quality* and *sunshine time* present no effect on the distribution of the creative e-Freelancers in China. Despite the fact that warm regions are more attractive to creative e-Freelancers (as indicated by the spatial regression analysis), natural amenities are seemingly NOT among the prioritized concerns for location decision taken into account by the creative e-freelancers in China. In particular, when the factor of *leisure facilities* is estimated while e-Commence is omitted in the model 3, all factors of natural amenities become non-significant. This finding is thus inconsistent with prior studies based in western societies, where exposure to sunshine is considered to be a crucial factor for the regional prosperity of high-tech industries and creative talents in the southern Sun Belt region of the USA (Aguinis & Lawal, 2013; Glaeser, 2008; Goetz & Rupasingha, 2002).

Second, educational amenities, specifically referring to the pool of college students, serve as an important location driver of the agglomeration of creative e-Freelancers in China. All of these three models report that the variable of *college students* is statistically significant. This result echoes the findings of previous studies that conclude college graduates, especially students engaged with “creative disciplines,” (who are also termed bohemian students), have been more likely to work as freelancers and part-time workers (Faggian et al., 2013; Scuotto & Morellato, 2013). Similarly, educational investment has a positive impact on the agglomeration of creative e-Freelancers when *listed companies* is omitted in models 2 and 3. By contrast, the educational level of citizens in general is irrelevant to the regional booming of the e-Freelance workforce, which once again reflects the fact that creative e-Freelancers are comprised of youth-centered people. These young students and graduates in their early career are more inclined to work as freelancers in marketplaces such as *zjb.com* in search of opportunities to practice creative production (Moos, 2016). Besides, young people are more likely to be engaged with e-Freelancing due to the fact that they are more skillful at using the Internet and joining virtual communities.

Third, as reported by these three models, entrepreneurial amenities in terms of *startup companies*, *listed companies*, and *turnover of e-Commence*, all present positive impacts on the agglomeration of creative e-Freelancers. This finding then strongly supports the previous study which revealed a significant relevance between the presence of creative talents and local entrepreneurship (Lee et al., 2004; Lee et al., 2010). Due to the booming of the internet-based economy over the past decade in China, some second-rank cities such as Hangzhou, Zhengzhou, Shantou, and Changsha benefit from their atmosphere of e-Business milieus, which is highly characterized by grassroots, private-ownership, bottom-up governance, and student entrepreneurship (Scuotto & Morellato, 2013; Shen & Tsai, 2016).

Entrepreneurship-oriented amenities are thus undertaking an increasingly important role in the creative digital economy.

Fourth, although the proportion of *foreign-born population* has been greatly stressed in creating a tolerant atmosphere for the unconventional life-style of the creative class (Florida, 2014), our spatial regression analysis suggests that foreign-born population is non-significant, nor is the index of *cultural facilities* (e.g., museums, theaters, and libraries). Instead, the index of *cultural heritages* is positively related to the agglomeration of the creative e-Freelancers in China. This might be due to the fact that the majority of creative e-Freelancers are specialized and skilled in design-oriented sectors, which heavily rely upon the local cultural landscape and historical asset (He et al., 2018; Scott, 2010). This piece of evidence can partially explain why some historical cities such as Xi'an and Nanjing are prosperous when it comes to creative e-Freelancing. Notably however, the irrelevance of foreign-born population does NOT mean that cultural diversity is no longer important for creative e-Freelancing, since the percentages of foreign-born population in Chinese cities are rather small compared to the rates in immigrant countries. This presents the limited reality of cultural diversity in this case. To measure the relevance of cultural diversity in China, an alternative index might be required.

Lastly, according to the spatial regression analysis, life quality amenities in terms of *leisure facilities* and *accessibility to public transportation* were estimated to be significantly associated with the distribution of the creative e-Freelancers in China (see Table 4). This outcome enhances the proposition that creative talents indeed favor such an urban milieu of abundant social networking places, for instance cafés, bars, and live music venues (Florida, 2014). Meanwhile, the findings are also in line with some previous studies that highlight the importance of creative workers having access to public transport in the urban areas of China (He & Gebhardt, 2014). Unexpectedly, *per-capita income* is estimated to be negatively related to the agglomeration of creative e-Freelancers, which indicates that the location choice of digital workers is less likely affected by wage and income concerns; in other words, there is a vanishing effect of economic-based agglomeration in the creative digital economy.

To sum up, the spatial regression analysis presents an impressive performance in explaining the spatial agglomeration of the creative e-Freelancers in China. In particular, geographical factors such as educational amenities (e.g., *college students* and *educational investment*), entrepreneurial amenities (e.g., *startups*, *listed companies*, and *e-Commence*), life quality amenities (e.g., *leisure facilities* and *public transport*), and *cultural heritages* are closely associated with the flourishing of local creative e-Freelancing workforces.

## Conclusions and Reflections

Over the past decades, China has been experiencing a dramatic shift toward the digital economy, which provides a paradise for experimenting new forms of economy and occupations, e.g., creative e-Freelancing. This type of occupation is highly dependent on the Internet and wireless technologies, and has released

operators from their fixed-place employment relationship. While the creative digital economy is playing an increasingly important role in the modern knowledge-based economy, the spatiality of creative e-Freelancers has largely been ignored in current literature. This ignorance may lead to unexpected consequences in the practice of digital transformation for both entrepreneurial and territorial development. The paper at hand is among the first researches to conceptualize the term “creative digital economy” and further question what the key drivers are to the spatial agglomeration and regional prosperity of the creative e-Freelancing workforce with an amenity-based approach. Underpinned by an extensive dataset collected from the flagship online e-Freelancing platform called *zbj.com*, the current paper empirically investigates the location dynamics of the creative e-Freelancers in China. The main contributions made by this paper are as follows:

Firstly, our findings suggested that the spatiality of the creative digital economy does NOT follow a dispersed pattern, as declared by technological utopianists (Batty, 1993; Breathnach, 2000; Friedman, 2007). Instead, it helps enhance the disequilibrium of regional economies (Graham & De Sabbata, 2015; Kitchin, 1998; Zook & Graham, 2007). However, a solid rebalancing force to urban and regional economy was observed. The rise of the creative digital economy benefits some second-rank cities in China (such as Hangzhou, Zhengzhou, Shantou, and Changsha), that are rich in urban amenities, while some megacities like Shanghai and Beijing are facing a declining rate of attraction for creative e-Freelancers. We believe that this spatial reconfiguration might just be the tip of the iceberg, bearing witness that digital technologies are reshaping the recent economic geography. It is foreseeable that the digital transformation of the contemporary economy enables an increasing number of creative individuals to release themselves from place-fixed employment, which provides some smaller cities with a leverage to re-develop their competitiveness in the digital era.

Secondly, the paper demonstrated that the amenity-based approach yields great explanatory power in the analysis of the location dynamics regarding the agglomeration of the creative e-Freelancers in China. This result is generally in line with prior research, believing that local amenities are essential factors for the success of creative talents (Alfken et al., 2015; Boschma & Fritsch, 2009; Florida, 2014; Wojan et al., 2007). The presence of creative e-Freelancers in various cities in China is closely associated with educational, entrepreneurial, and high quality of urban life amenities, particularly. Nevertheless, some particularities were found in this case study. For instance, creative e-Freelancers tend to pay less attention to local natural amenities (such as sunshine) and cultural facilities, which are believed to be highly associated with the development of high-tech industries in the Sun Belt region of the USA (Aguinis & Lawal, 2013; Glaeser, 2008; Goetz & Rupasingha, 2002). In addition, there is an unclear association between cultural diversity, and the presence of creative e-Freelancers due to the index of foreign-born population, which might present limited information regarding cultural variety in China. Thus, an alternative measurement ought to be involved in future studies. In conclusion, we are faced with the growing importance of local amenities to the creative digital economy, as the creative e-Freelancing workforce was significantly driven by regional properties, such as richness of human capital

(e.g., college students), entrepreneur-friendly milieu for e-Business, a high quality of life supported by easy accessibility to leisure facilities and public transport, as well as affluent cultural heritages.

Lastly, the paper also bears implications on the practice of creative digital economy. Above all, there is an increasing necessity to revisit the previous urban brain gain policy in the digital era, due to the fact that the creative digital economy is largely dependent on a group of free-spirited freelancers who pay great attention to local amenities, in particular, the pleasantness for life and entrepreneurship. Meanwhile, there is also a necessity to renovate the social welfare system based on full-time employment relationship, since an increasing number of e-Freelancers have been widely engaged with the practice of casualized and temporary employment. Such employees are NOT covered by the traditional social welfare system. Moreover, start-up freelancers and enterprises are also informed by this research with respect to their strategy on the location choice of workplace and residence among different cities. Finally, although the paper provides a better understanding of the spatial mechanism of the creative digital economy on a macro-level, we suggest that more attention be placed on the micro-level spatial behaviors of creative e-Freelancers in future research, concerning in particular the processes of knowledge learning and innovation in digital communities.

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