International Journal of Geo-Information

MDPI

Article

Research on the Spatial Features of the E-RetailingEconomic Linkages at County Level: A Case Study for Zhejiang Province, China

Wei Shen, Yaochen Qin * and Zhixiang Xie

College of Environment and Planning/Key Laboratory of Geospatial Technology for Middle and Lower Yellow River Region, Henan University, Kaifeng 475004, China

* Correspondence: qinyc@henu.edu.cn; Tel.: +86-371-2388-1858

Received: 16 May 2019; Accepted: 23 July 2019; Published: 25 July 2019



Abstract: Quantitatively evaluating the spatial characteristics of regional e-retailing economy linkages is of great significance for clarifying the spatial organization of regional e-retailing economies, and promoting regional coordinated development. However, due to the lack of study data, it is difficult toconduct quantitative research on these regional e-retailing economic linkages. Taking advantage of emerging new data sources, the depth and breadth of related research cannow be improved. This paper considers 64 county-level economic areas in Zhejiang Province as network nodes. A revised gravity model was used to measure the intensity of the e-retailing economic linkage in 2016, based upon the e-retailing data provided by the Department of Commerce of Zhejiang Province, China. On this basis, the geographic information system (GIS) tool, a model-potential method and a social network, were used to analyze the spatial features of the e-retail economic linkages at the countylevel in Zhejiang Province. The results showed that the spatial polarization of the economic linkage pattern emerged as prominent, with the overall difference and east-west gradient difference between counties proving significant. In addition, the major linking partners of most regions were relatively singular, and a problem of vulnerability in e-retail economic development was shown.Secondly, the southwest region of Zhejiang Province was an important obstacle in the integration process of regional e-retail economy, through analyzing the connection scope of e-retailing economics. Thirdly, the central Zhejiang subgroupwas a key plate connecting east and west, which plays an importantlinking role in the development of regional equalizationwhen we analyzethe cohesive subgroup pattern. Inspired by this, we hypothesized that a microscopic analysis results of Zhejiang Province could provide some enlightenment for the balanced and integrated development of China's regional e-retailing economy.

Keywords: e-retailing economic linkages; gravity model; social network analysis; Zhejiang province

1. Introduction

In recent years, e-retail has grown immensely in most parts of the world. The e-retail industry is becoming an important industry that affects social and economic development. With the continuous development of e-commerce technology, relying on the world's largest consumer market, China has become the world's fastest growing e-retail market.In 2014, the e-retail share of total retail sales in China (10.6%) overtook that in the United States (9.5%). In 2016, the market size of e-retailing was ¥ 2.6 trillion (≈US$0.41 trillion) in the United States, but e-retail sales approached ¥4.7 trillion (≈US$0.74 trillion) in China, nearly doubling the size of the retail sales in the United States [1]. China's e-retail market has now therefore become the largest in the world.

With the rapid development of e-retailing, it has become the focus of many scholars. Visser and Lanzendorf [2] defined the concept and scope of e-retail: That is, e-retail mainly refers to

internet-based transactions, while the e-retail industry mainly consists of Business-to-Consumer (B2C) and Consumer-to-Consumer (C2C) electronic commerce (EC). Some scholars have studied e-retailing from the perspective of economics, Stranahan and Kosiel [3] explored patterns in e-retail spending across different demographic groups in order to predict which households are the most frequent shoppers and highest spenders.Ha and Stoel [4] studied the motivation and the behavioral intention of online shoppers, and find that the convenience-oriented leisure shoppers and technology-oriented shoppers are the most attractive target customers of e-retailers. Colton et al. [5] studied the driving factors of the performance of international online retailers, and they find that brand strength and supplier relationship are very important. Siddiqui and Khan [6] analyzed the impact of the demography of online customers on e-satisfaction, as well as on the determinants of e-satisfaction operating in e-retailing space in India. Some scholars have begun to study e-retailing from the perspective of geography. Park [7] analyzed the spatial impact of business-to-business (B2B) e-commerce on the metropolitan and regional economy of Korea. The results also suggest that the B2B EC contributes to increased long-distance transaction networks, but these networks converge only into selected innovation centers or dominant industrial clusters. Gorman [8] studied the spatial distribution and diffusion of e-retailing shops. Farag et al. [9,10] analyzed the impact of online retail on traditional retail and shopping travel. Anderson et al. [11] discussed the influence of the development of e-retailing upon the spatial distribution of economic activities, including the influence on retailing, transportation and the economy. Weltevreden and Rotem-Mindali [12] analyzed the potential impact of B2C and C2C e-commerce in the Netherlands on personal and freight travel. The survey results showed that personal travel in the Netherlands decreased only slightly due to shopping online, while freight increased slightly. Huang et al. [13] explored the relationship of temporal and spatial evolution between the development of e-commerce and an economical chainstore hotel, and concluded about the effect mechanism of e-commerce with respect to economical chainstore hotels. In addition, some scholars have also begun to pay attention to the location selection mechanism of e-retailers [14] and the infiltration factors of space development [15].

Social network analysis is a research method to analyze the relationship between social activity subjects. It establishes a relationship model by quantifying the "relationship data" among various actors in the network. Furthermore, we can analyze how the "structure" of the relationship among actors in the network affects the nature of individual behaviors or systems [16,17]. At first, social network analysis was widely used in geographical studies pertaining to urban economy linkage [18–20], the spatial structure of urban networks [21], and so on. Later, this method gradually extended to research on tourism economy linkage [22], the spatial structure of the energy consumption network [23], and the urban innovation network [24]. It can be concluded from the above literatures that social network analysis has great advantages in quantitative spatial linkage analysis. Therefore, this study attempts to introduce the social network analysis method in order to conduct a detailed analysis of the spatial linkage characteristics of the regional e-retailing economy, so as to reveal the spatial organization of the regional e-retailing economy, and thus to clarify the spatial development direction of regional and urban entities.

Overall, the existing research on e-retail in the perspective of geography is still insufficient. Research on the spatial linkage characteristics of the regional e-retailing economy, at the macro level especially, has not received much attention. However, it is of great theoretical and practical significance to carry out the research on the regional e-retailing economy linkage to enrich the theoretical research and the application research of e-retailing. In recent years, Zhejiang has witnessed a rapid development in its e-retail industry. The statistics of the China E-commerce Research Center and the Department of Commerce of Zhejiang Province show that sales in China's network market amounted to 5.3 trillion yuan in 2016, among which 19.45%, (approximately 1.03 trillion yuan), occurred in Zhejiang. Zhejiang Province has thus become a leader in China's online retail economy.

Meanwhile, the e-retail economy at the county level is gradually increasing, presenting a pattern of collaborative development in prefecture-level, central urban areas, and in counties and county-level

cities at the provincial level, whereby counties have become an important carrier of the development of Zhejiang's e-retailing economy. Based on this, we established Zhejiang Province as a study area, and the county-level economic regions as the study units. This research adopted a revised gravity model to measure the intensity of the economic links in e-retail across 64 network nodes in 2016. The study uses the GIS tool and the potential method, as well as social network analysis, so as to clarify the spatial organization of the regional e-retailing economy and to provide a scientific reference for the development of regional integration.

Specifically, in this paper, we address the following research questions: (1) What are the spatial characteristics of the e-retailing economy linkage? (2) What are the similarities between the macro pattern of the e-retailing economy in Zhejiang Province and China? What enlightenment can the analysis results of Zhejiang Province provide for the coordinated development of China's e-retailing economy? (3) What are the driving forces beneath the spatial patterns and linkages of the e-retailing economy?

The rest of the paper is structured as follows: In Section 2, we introduce the literature review. In Section 3, we introduce research methods and data sources. In Section 4, we analyze the spatial characteristics of e-retailing economic linkages. Finally, in Section 5, we summarize this paper and discuss the shortcomings of the research.

2. Literature Review

2.1. Research Theory

The current research is mostly based upon economics and marketing, and is rarely focused on geography. Eroglu et al. [25] systematically researched the nature and effectiveness of online retailing. A conceptual model that examines the potential influence of the atmospheric qualities of a virtual store is proposed. Visser and Lanzendorf [2] defined the concept and scope of online retail. They pointed out that online retail mainly refers to internet-based transactions.The online retail industry mainly includes B2C and C2C e-commerce parts. Stranahan and Kosiel [3] explored patterns in e-retail spending across different demographic groups, and predicted which households contained the most frequent shoppers and the highest spenders.The study found that male, Hispanic, college-educated, and younger consumers, are more willing to purchase from unfamiliar online stores. Chung et al. [26] defined five attributes of online retail, namely shopping convenience, product selection, information quantity, price and customized service. Acimovic and Groaves [27] found that the online retail supply chain is fundamentally different from the one that supports traditional physical stores, and verified the spillover effect of online retail. Chenavaz et al. [28] analyzed the pricing strategy of online retail, and the research results emphasized the role of convenience, providing a new idea for online retail pricing.

In addition, Cullinane [29] theoretically explained the impact of online retail upon transportation and environment, but did not conduct empirical research. Yeung and Ang [30] analyzed how the online retail channel extends to physical stores based on retail geography, and they confirmed the importance of physical space for the accumulation and transfer of tacit knowledge. Tolstoy et al. [31] analyzed the influence of a retail firm's geographic scope of operations on its international online sales, specifically demonstrating that strategic considerations which are related to the geographical scope of operations are likely to have significant effects on their international sales performance.

In summary, existing theoretical researches are mostly based on the theories and methods of economics and marketing, such as the transaction cost theory and the consumption value theory. In addition, they focus on consumer psychology. However, the existing research rarely uses the theories and methods of geography to research e-retailing, such as the spatial interaction theory, growth pole theory, and core-periphery theory. Using these theories to analyze the spatial characteristics of regional e-retailing economy linkage will promote the integrated development of the regional e-retailing economy. Therefore, we need to do further research.

2.2. Research Means

Tamimi et al. [32] found through research that the quality of e-retail can be significantly improved by providing the ability to translate into multiple languages, displaying security policies more conspicuously, and offering multiple payment options. Souitaris and Balabanis [33] empirically assessed the impact of a number of possible differentiation strategies on the satisfaction and loyalty of each shopper segment. The results show that differentiation based on customization, product assortment and website design, are more effective when directed at the experiential shopper. Edwards et al. [34] used corporate data and telephone interview data to compare the carbon footprint of traditional and online retail. The results showed that any home delivery operation is likely to generate less CO_2 than the typical shopping trip. Shi et al. [35] focused upon overall and sub-process supply chain efficiency and supplier performance evaluation in China's e-retailing industry, using data from a B2C company.

To sum up, the existing research methods of the e-retail literature consist mainly of qualitative analysis, while quantitative research is still rare, but it is gradually increasing. Quantitative analysis will help us to conduct more detailed research on e-retail.

2.3. Research Perspective

Ahn et al. [36] used a questionnaire on 942 users of Web-based online retailing to study the effect of playfulness on the user acceptance of e-retailing, and tested the relationship between Web quality factors and user acceptance behavior. The results showed that playfulness plays an important role in enhancing user attitude and their behavioral intention to use a site. Wang and Lu [37] considered the case of Dangdang.com, which is one of the largest Chinese-language online retailers, and explored its spatial organization and the spatial dynamics of market extension. The results showed that geographical factors play very important roles in the development of e-commerce. Griffis et al. [38] used an archival database of actual purchases and returns history provided by a moderately-sized online retailer, and examined the relationship between a customer's experience of product returns and their subsequent shopping behavior. Subramanian et al. [39] attempted to study the impact of customer satisfaction and the Chinese electronic retailers' (E-retailers') competitiveness, using quality factors. This study used both exploratory and confirmatory factor analysis, and suggests that, to be competitive, Chinese e-retailers have to focus more on the delivery of products (logistics), compared to other intangible service quality factors. Shi et al. [14] studied the location selection mechanism of e-commerce from a micro perspective. They found that both time and distance play key roles in the location development of the O2O businesses. The main factors that encourage an e-commerce business to open a physical outlet include demands from the consumers and the suppliers on reducing time-related costs, and the convenience of ICT.

To sum up, in the past, scholars have mostly focused on e-retailing from a micro perspective of consumers and online retailers. However, few scholars study the regional e-retailing economic linkage from a macro perspective. Research on the spatial characteristics of the regional e-retailing economy linkage from a macroscopic perspective can promote the coordinated development of the regional e-retailing economy.

3. Methodology and Data Source

3.1. Methodology

3.1.1. The Gravity Model

The spatial linkage of a regional economy can reflect the radiation and influence of the regional economic center on its neighboring areas, as well as the amount of radiation received by the surrounding areas from the economic center [40]. The gravity model in the theory of space interaction is derived

from the law of gravity in classical mechanics, and is widely used to measure the intensity of economic linkages between regional cities [41–43].

Due to the non-equivalence of the economic linkage intensity between these nodes, and with reference to existing studies [44], the gravity model was revised for the purposes of this paper, with the followingresulting formula and relevant expressions:

$$F_{ij} = k_{ij}\frac{\sqrt{P_i G_i}\cdot\sqrt{P_j G_j}}{D_{ij}^b}\ (i, j = 1, 2, \cdots, n \cap i \neq j) \tag{1}$$

$$k_{ij} = \frac{G_i}{G_i + G_j} \tag{2}$$

$$E_i = \sum_{j=1}^{n} F_{ij} \tag{3}$$

$$I_{ij} = \frac{F_{ij}}{E_i} \tag{4}$$

In the above formula, F_{ij} stands for the intensity of e-retail economic linking between region i and region j; E_i denotes the potential of region i, i.e., the total linking intensity between region i and other regions; I_{ij} represents the ratio of the lining intensity between region i and region j to the total linking intensity between region i and other regions, which is the membership degree; P_i and P_j refer to the permanent resident population of the regions i and j, respectively; G_i and G_j denote the e-retail sales of regions i and j, respectively; D_{ij} is the shortest traffic distance between region i and region j; b refers to the distance friction coefficient, which is generally 2 [17,44]. Taking into account the non-equivalence of the economic linkage intensity between two regions in reality, in this study the constant k_{ij} was modified through the contribution rate of the e-retail economy, i.e., k_{ij} stands for the contribution rate of region i to the combination of region i and region j.In particular, the linkages calculated by the gravity model are not real economic links, but are potential links simulated by the gravity model.

3.1.2. Social Network Analysis

The method of social network analysis offers a new perspective and analysis tool for the study of the spatial structure of a regional economic linkage network, which can visually display the structure of this network via relevant software [44]. As such, this paper analyzes the spatial features of the e-retailing economic linkages at county level in Zhejiang Province by means of network density, node centrality and a network cohesive subgroup analysis. In the network measure, the average value of the linking intensity between all of the nodes was selected as the minimum threshold, and the number of effective linking pairs was determined according to this minimum threshold.

(1) Network density. This refers to the ratio of the number of linking pairs in the linking network in existence to that maximum number in theory, indicating the opening degree of the linking network and the linking degree between the nodes. The larger the network intensity, the more intensive the linking network. The formula is as follows:

$$D = \sum_{i=1}^{n}\sum_{j=1}^{n} d\left(m_i, m_j\right)/n(n-1) \tag{5}$$

D is the network density with a value range of (0, 1); $d\left(m_i, m_j\right)$ refers to the number of effective linking pairs between network nodes m_i and m_j; n is the number of network nodes.

(2) Network centrality. This can be divided into absolute degree centrality and relative degree centrality, the latter usually adopted to represent network centrality. This indicator is used to measure the centrality of each node in the network based on the number of linking pairs

in the regional linking network; the larger the value, the stronger the centrality of each node. The formula is as follows:

$$C_D(m_i) = \frac{\sum_{j=1}^{n} d_{ij}}{n-1} \quad (6)$$

Here, $C_D(m_i)$ denotes the relative degree centrality of node m_i, and $\sum_{j=1}^{n} d_{ij}$ is its absolute degree centrality, representing the number of effective network linking pairs between node m_i and other nodes.

(3) Network cohesive subgroup. The cohesive subgroup is a method to cluster the regional economic connection network according to the similarity and difference among the nodes in the complex network model, which can be measured from the reciprocity, proximity or accessibility, frequency, and closeness of the relationship among the members of the subgroup [45,46]. This method is, essentially, a clustering analysis method, which studies the overall structure features of a regional economic linkage network at the position level.

3.2. Data Sources and Processing

In this paper, the Zhejiang Province of China is taken as the research area. Its location is shown in Figure 1. The total sales of Zhejiang's county-level e-retail were drawn from the website of the Department of Commerce of Zhejiang Province. The statistics of e-retail sales of the whole year consist of three parts: Statistics from third-party platforms such as Tmall, statistics from self-built platformsand statistics from WeChat business (based on the mobile Internet space, with the help of social software used as a people-centeredtool thatserves as a link to the new business.).Data pertaining to the permanent resident population were taken from the Zhejiang Statistical Yearbook 2017, and the minimum distance between counties or cities was measured using Baidu Map (while air and railway transport are in operation, road transport is still the dominant mode in Zhejiang, and the point-to-point road network is more complete than the air and railway transport). Taking 2016 as the study year, the sample consisted of 64 county-level regional economic units in Zhejiang, including central urban areas of the 11 prefecture-level cities, 34 counties, 19 county-level cities. It should be added that, due to the integrity of the research objects, this study took the central urban areas of prefecture-level cities as complete regional economic units, and merged the urban districts subordinated to these central urban areas, for further analysis and for effective links with the relevant policies.

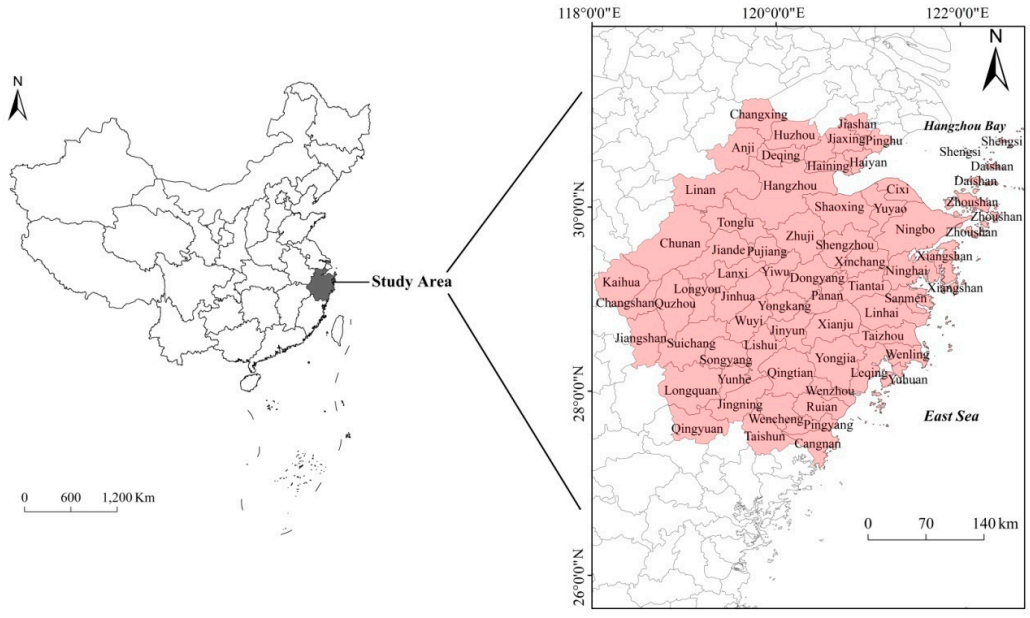


Figure 1. The study area of Zhejiang Province, China.

4. Spatial Analysis of E-Retail Economic Links at County Level in Zhejiang Province

4.1. Overall Pattern of E-Retail Economic Linkage

Based on the measured intensity of the economic e-retail links between county-level nodes, the potential of each node was calculated (Table 1) and then visualized hierarchically using the method of natural breaks (Jenks) in ArcGIS 10.3 (Figure 2). The main point-level spatial features of Zhejiang's county-level, e-retail economic linkage pattern in 2016 emerged as follows:

Table 1. Potential value of e-retail economic connections in Zhejiang Province.

County	PV	County	PV	County	PV	County	PV
Hangzhou	710.09	Taishun	0.12	Jinhua	19.23	Taizhou	46.43
Tonglu	2.25	Cangnan	21.46	Lanxi	4.00	Linhai	13.20
Chunan	0.92	Huzhou	23.92	Dongyang	12.43	Wenling	17.58
Jiande	1.59	Deqing	3.05	Yiwu	170.77	Yuhuan	1.53
Linan	2.63	Changxing	2.10	Yongkang	50.10	Tiantai	11.50
Ningbo	114.18	Anji	3.43	Pujiang	9.05	Xianju	1.13
Yuyao	18.40	Jiaxing	81.28	Wuyi	6.86	Sanmen	2.85
Cixi	46.24	Jiashan	8.52	Panan	0.45	Lishui	1.93
Ninghai	4.03	Pinghu	11.85	Quzhou	5.39	Longquan	0.39
Xiangshan	0.42	Haiyan	3.29	Longyou	2.14	Qingtian	1.46
Wenzhou	193.88	Haining	100.14	Jiangshan	1.51	Yunhe	0.47
Leqing	22.91	Tongxiang	58.78	Changshan	0.39	Qingyuan	0.20
Ruian	80.06	Shaoxing	41.18	Kaihua	0.31	Jinyun	3.35
Yongjia	30.85	Zhuji	13.23	Zhoushan	0.71	Suichang	0.37
Wencheng	0.16	Shengzhou	14.06	Daishan	0.02	Songyang	0.39
Pingyang	22.64	Xinchang	3.35	Shengsi	0.01	Jingning	0.31

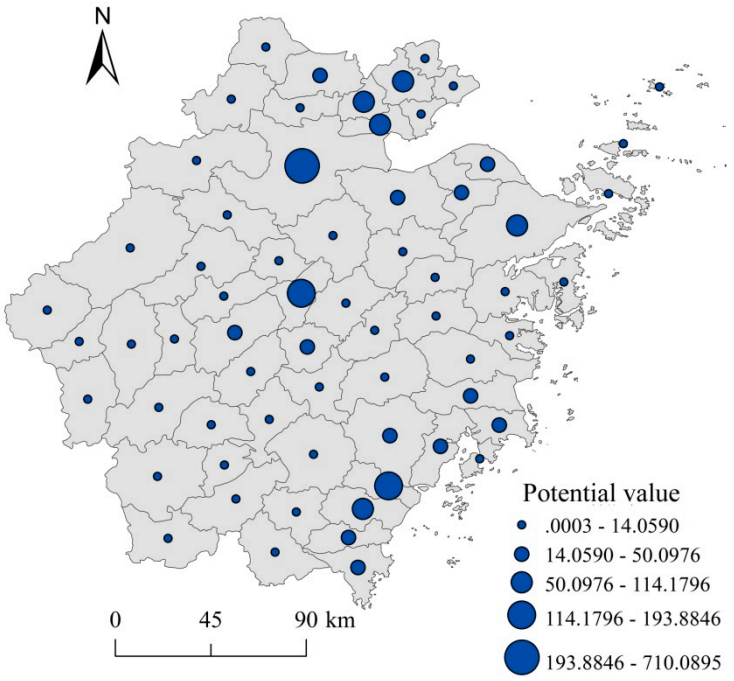


Figure 2. Spatial distribution of the potential value of the e-retail economy in Zhejiang Province.

(1) The results show that spatial polarization is prominent, and that the regional overall difference is significant. Table 1 and Figure 2 show that the urban area of Hangzhou has the highest potential (710.09), while Shengsi County has the lowest, at less than 0.01, indicating that intra-regional spatial polarization is extremely prominent. Counties and cities with a high potential are

concentrated in the central and northeast part of the province, as well as the southeast costal region. These areas have a rather high variable coefficient of 2.98, and are in a highly variable state.

(2) The east-west gradient difference is remarkable. In line with Zhejiang's economic development and regional characteristics, and with reference to relevant geographical zoning standards [47], the province was divided into four areas—Northeast Zhejiang (Hangzhou, Ningbo, Jiaxing, Huzhou, Shaoxing, and Zhoushan), South Zhejiang (Wenzhou and Taizhou), Central Zhejiang (Jinhua), and Southwest Zhejiang (Quzhou and Lishui)—so as to comparatively analyze the spatial differences in Zhejiang's e-retaileconomic linkages at this level. From the perspective of the east-west difference of the potential, Table 2 shows that the total potential of the economic development of e-retail in Northeast Zhejiang is 1269.4, which is 2.72 times that of South Zhejiang, 4.65 times that of Central Zhejiang, and 68.11 times that of Southwest Zhejiang. The variable coefficients of Northeast Zhejiang, South Zhejiang, Central Zhejiang and Southwest Zhejiang are 4.3, 1.6, 1.68, and 1.13, respectively, suggesting that Northeast Zhejiang's link with the external economy is the strongest, followed by Central Zhejiang and South Zhejiang, and that of Southwest Zhejiang is the weakest.A remarkable east-west gradient developmental difference was observed. From the viewpoint of the east-west differences in regional linkage, the link between Northeast Zhejiang and Central Zhejiang is the highest, with a linking degree of 297.09, followed by that between South Zhejiang and Northeast Zhejiang. Overall, there is a clear east-west gradient difference between the four areas of Zhejiang.

(3) The potential of the urban areas of prefecture-level cities was found to be generally higher than that of counties and county-level cities. The average potential of the urban areas of 11 prefecture-level cities in Zhejiang was 112.57, with 27.3% of these regions having a higher potential than the average. Conversely, the average potential of counties and county-level cities was only 14.89, with 24.5% of these regions having a higher potential than the average, indicating that the urban areas of prefecture-level cities are more closely linked with the external e-retail economy. In addition, the variable coefficient of the urban areas of the 11 prefecture-level cities was 1.84, while that of counties and county-level cities was 2.01, demonstrating that the difference between the urban areas of prefecture-level cities is smaller than that between the counties and county-level cities.

Table 2. E-retail economic contacts of regional difference in Zhejiang Province.

Area	Potential Value	Northeast Zhejiang	South Zhejiang	Central Zhejiang	Southwest Zhejiang	Variable Coefficient
Northeast Zhejiang	1269.64	-	68.80	297.09	16.43	4.30
South Zhejiang	466.28	19.25	-	15.71	13.45	1.60
Central Zhejiang	272.89	78.73	14.88	-	6.59	1.68
Southwest Zhejiang	18.63	0.73	2.13	1.10	-	1.13

4.2. Main Gravity Direction of E-Retail Economic Links

In accordance with Equations (1), (3) and (4), the intensity and membership degree of e-retail economic links at county-level were measured successively, and the primary linking place and secondary linking place of each city and county were selected.

Following this, a thematic figure (Figure 3) of the gravity-binding direction of the e-retail economic links in Zhejiang Province was drawn using ArcGIS 10.3, enablingan analysis of the main direction and membership relationship of the e-retail economic links at the county level in Zhejiang Province.

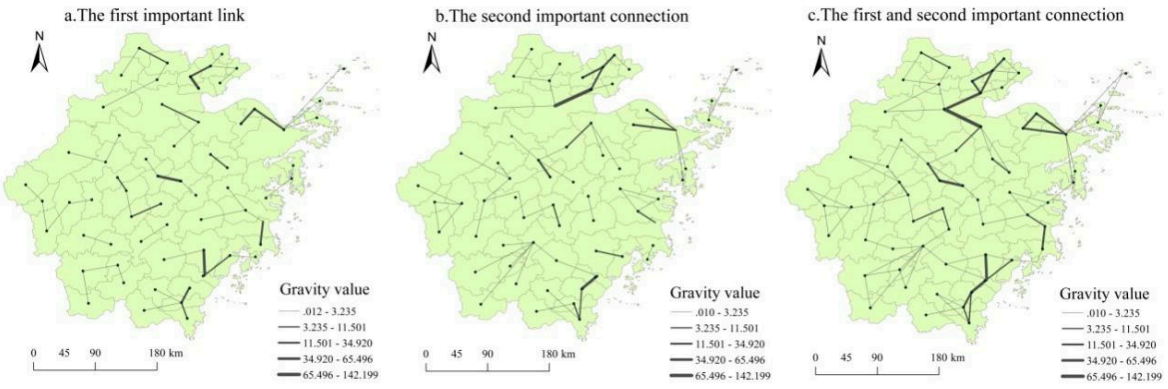


Figure 3. Main direction of the e-retail economic links at the county level in Zhejiang Province.

From the spatial distribution feature of the primary linking place (Figure 3a), it is evident that important linking pairs are concentrated in the Northeast, Central and Southeast coastal regions of Zhejiang, such as the linking pairs of Haining-Tongxiang, Haining-Jiaxing, Yiwu-Dongyang, Ningbo-Yuyao, Taizhou-Linhai, and Wenzhou-Yongjia. Based on the spatial structure feature of the primary linking place, the gravity direction between each pair of cities or counties presents a remarkable directionality of adjacent areas, showing that the outside directionality of Zhejiang's county-level, e-retail economic linkage is still weak. At the area level, most of the counties and cities of Central and West Zhejiang were found to have a mainly linear linking structure, while counties and cities in the Northeast and East coastal region of Zhejiang Province had a radial spatial linking structure, with a focus on the key regional city. This indicates that the key regional city in the Northeast and East coastal region of Zhejiang Province has a strong influence and attraction upon surrounding areas, and plays a significant role in radiation and economic integration. Based on the spatial distribution feature of the secondary linking place (Figure 3b), it can be seen that important linking pairs are mainly located in the Northeast and Southeast parts of Zhejiang. From the spatial structure feature of the secondary linking place, the gravity direction between each two cities or counties still presents a remarkable directionality in terms of adjacent areas. At area level, the whole area is characterized by a complex network and radial spatial linking structure, with the network development of the northeast, central and north areas being more advanced than that of other areas.

To sum up, the main gravity direction of Zhejiang's e-retail economic linkage at the county level presents the following spatial features: (1) Significant spatial variation. Important linking pairs are mainly distributed in the Northeast, Central and Southeast coastal areas of Zhejiang, such as the linking pairs of Hangzhou-Shaoxing, Hangzhou-Haining, Yiwu-Dongyang, Taizhou-Wenling, Wenzhou-Yongjia and Wenzhou-Ruian.(2) The gravity binding direction between each pair of cities or counties presents an obvious directionality in terms of adjacent areas, showing that most counties and cities in Zhejiang are mainly affected by the economic gravity of neighboring cities, relying both on self-development and on coordinated development with adjacent areas, and lacking strong, externally-oriented economic development. (3) The spatial linking structure of the primary linking place, and that of the secondary linking place, is different. The form of cooperation between the pairs with the closest economic linkage is of a predominantly linear type, while that between the pairs of the secondary economic linkage is largely of a network type. This difference indicates that the major linking partners of most of the regions were relatively single, and that there is a problem of vulnerability in e-retail economic development. (4) The regional networked spatial linkage pattern gradually took shape.

Zhejiang initially formed a networked economic linkage pattern with Hangzhou, Ningbo, Yiwu, Jinhua, Taizhou and Wenzhou as the core, with the maritime characteristics of the e-retail economy in the Northeast and Southeast coastal areas of Zhejiang Province also becoming prominent.A pattern of

coordinated development of the eastern coastal development belt and the emerging growth poles of the central region in Zhejiang Province will take shape.

4.3. Range of E-Retail Economic Linkage

The network density and degree of centrality of Zhejiang's e-retail economic linkage at county level were calculated according to Equations (5) and (6). It was found that in 2016, the maximum number of linking relationships in the studied 64 counties and cities was 4032, while the real effective number was 383, and the network density was only 0.095, showing that the degree of economic linkage between network nodes was low, and that the organizational relationships in the economic linkage network were rather loose.

As far as the degree of centrality is concerned, Hangzhou, Yiwu and Ningbo were ranked as the top three among the county-level nodes in Zhejiang, and may be seen as the core of Zhejiang's economic linking network. The areas following closely behind were Wenzhou, Yongkang, Shaoxing, Haining, Tongxiang and Taizhou, which may be seen as the secondary centers of the economic development of e-retail. These types of cities represent the regional core that coordinates the development of provincial core cities, and leads the development of under-developed counties and cities in the surrounding area. The tertiary centers, which include Jinhua, Dongyang, Cixi, Yueqing, Rui'an, Yongjia, Huzhou, Linhai and Zhuji, can be seen as the emerging forces in the economic development of e-retail. At the same time, the degree of centrality was further decomposed into the out-degree and in-degree, and the net radiation quantity was taken as the difference between the out-degree and the in-degree, whose value can reflect the regional function performed by each county or city. The calculation results show thatonly Hangzhou, Wenzhou, Ningbo, Yiwu, Yongkang, Taizhou and Rui'an had positive net radiation values, thus belonging to the pure radiation type, and being the main sources of the radiation of Zhejiang's e-retail development. Among these seven areas, Hangzhou was found to have the largest net radiation quantity, and to be the core radiation source of the province. The following areas were Wenzhou, Yiwu, Ningbo, Yongkang and Taizhou, which can be seen as the regional core radiation sources at the next level; finally, Rui'an emerged as a regional radiation source with a small radiating capacity. It is noteworthy that the out-degree and in-degree of Rui'an, which ranks at the bottom, ranked in fourth place and first place, respectively. The reason for this is that Rui'an has a strong radiating capacity. however, due to the influence of the strong cohesive force of radiation centers such as Wenzhou, its external radiation quantity was at a rather low level. The out-degree and in-degree of Ningbo's urban area and Taizhou were relatively high, indicating that these two areas have a strong diffusing effect on the surrounding counties and cities, and are also affected by the radiation of other central nodes.

In line with the value of the radiation gravity of seven radiation sources to each county and city, and the total radiation quantity (in-degree) of each county and city from other counties and cities, the radiation quantity of each county and city from seven main radiation sources to its received total radiation quantity ratio was calculated and then numerically listed. The counties and cities with a ratio greater than 40% were defined as core areas affected by radiation, and those with a ratio between 10 and 40% were marked as areas significantly affected by radiation. Meanwhile, taking spatial distance into consideration, the range of core areas affected by radiation, and the range of areas significantly affected by the radiation of the seven radiation sources, were demarcated. This was done to define the main linking scope of Zhejiang's county-level e-retail economy (Figure 4).

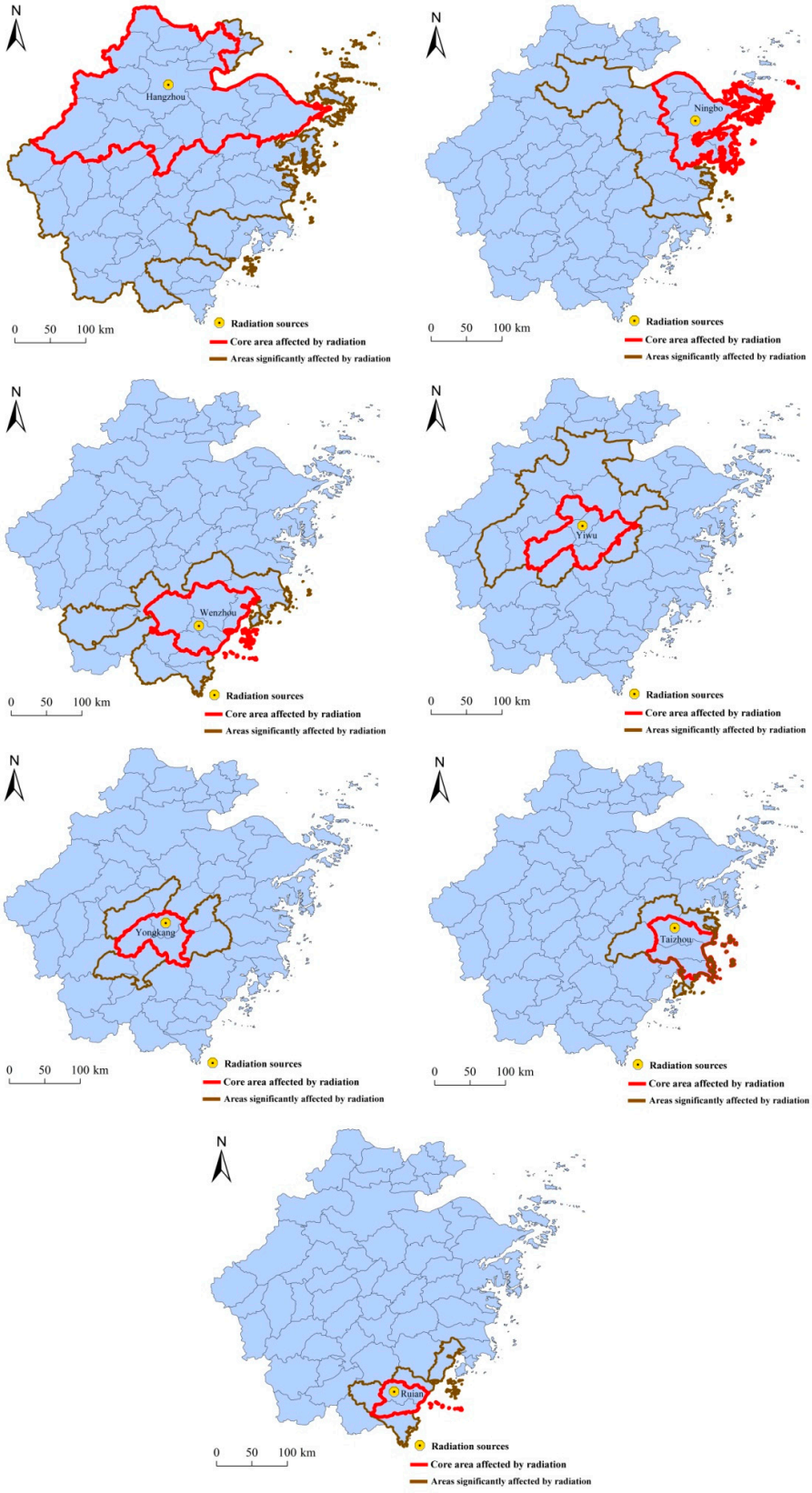


Figure 4. The spatial range of e-retail economic links at county level in Zhejiang Province.

As can be seen in Figure 4, the space radiation ranges of the seven main radiation sources show significant differences. Specifically, Hangzhou has the widest space radiation range, with the core area affected by its radiation covering most of the counties and cities in North and Central Zhejiang.

Moreover, the range of areas significantly affected by radiation of Hangzhou includes almost all of the counties and cities in Zhejiang Province, matching its status as Zhejiang's regional political, economic and cultural center. Ningbo, Yiwu, and Wenzhou emerged as radiation sources with a wide radiation range second only to Hangzhou, leaving an extremely important radiation influence on East, Central and South Zhejiang. In addition, Yongkang, Taizhou and Rui'an also emitted a small-scale regional influence. At the same time, the radiation ranges of the seven main radiation sources can be seen to overlap, indicating that, during the process of the radiation sources affecting their surrounding cities, the level of communication and interaction between these radiation sources also improved, thus enabling the core cities to drive the development of their neighboring counties and cities. Moreover, it is worth noting that, as a development "lowland", Southwest Zhejiang can be seen to lack radiation sources and radiation effects, and is a key obstacle to the integration of Zhejiang's regional e-retail economic development. This area should, therefore, be granted financial and policy support in the future cultivation and development planning of its industry.

4.4. Analysis of the Cohesive Subgroup Pattern of E-Retail Economic Linkages

In order to reveal the internal microstructure and spatial pattern of Zhejiang's e-retail economic linkages, Ucinet 6.0 software was used to binarize (taking the average as the judging threshold) the data of the economic linking intensity of each county and city. A cohesive subgroup analysis was then conducted by applying a concor model (an analysis method of the convergence of iterated correlation). Finally, the analysis results were imported into ArcGIS 10.3 for spatial visualization, and the results are shown in Figure 5.

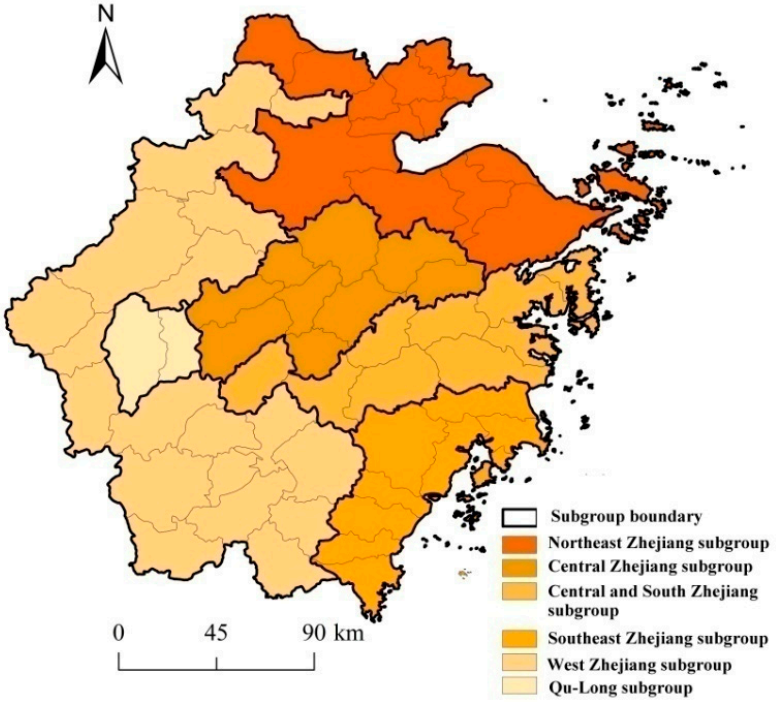


Figure 5. Cohesive network subgroups at the county level in Zhejiang Province.

Zhejiang's county-level, e-retail economic linkage network can be seen to fall into six tertiary cohesive subgroups (Figure 5). The first is the Northeast Zhejiang subgroup, comprising Hangzhou and Ningbo as its core, as well as sixteen counties and cities, including the regional centers of Jiaxing, Haining, Tongxiang, and Shaoxing. The second is the Central Zhejiang subgroup, with Yiwu as the core, andwith nine counties and cities, including the regional centers of Jinhua and Yongkang.

The next is the Central and South Zhejiang subgroup of nine counties and cities, including Tiantai and Linhai. The fourth is the Southeast Zhejiang subgroup, whose core is Wenzhou and which

consists of nine counties and cities, including Rui'an and Taizhou. Subgroup 5 is that of West Zhejiang, composed of nineteencounties and cities in the west. The last is the Qu-Long subgroup, which includes Quzhou and Longyou.

From the density matrix derived from the convergent correlation analysis (Table 3), it can be seen that the internal network densities of the above six subgroups are 0.641, 0.452, 0.267, 0.711, 1.000, and 0.000, respectively. Apart from Qu-Long (0.000), the internal network densities of the other five subgroups are much greater than that of the whole Zhejiang Province, indicating that there is a close relationship between the members of these five subgroups. In terms of the link between the cohesive subgroups, the radiation effects of the Northeast Zhejiang subgroup on the Central Zhejiang subgroup, the Central and South Zhejiang subgroup and the Southeast Zhejiang subgroup, are all relatively large, among which the Northeast and Central Zhejiang subgroups have the closest link. The Central Zhejiang subgroup has the greatest radiation effect on the West Zhejiang subgroup, and its link with other subgroups is looser than the average of the whole province. The internal link of the subgroup in West Zhejiang is close, but the link with the other subgroups is less. The link between the Qu-Long subgroup and the other five subgroups is below the provincial average level, indicating that this subgroup was less affected by the external economy.

Table 3. Density matrix of cohesive subgroups at the county level in Zhejiang Province.

Subgroup	1	2	3	4	5	6
1	0.641	0.275	0.128	0.162	0.077	0.092
2	0.044	0.452	0.024	0.071	0.143	0.011
3	0.000	0.048	0.267	0.100	0.000	0.013
4	0.131	0.243	0.283	0.711	0.100	0.085
5	0.000	0.000	0.000	0.000	1.000	0.038
6	0.000	0.000	0.000	0.000	0.000	0.000

In summary, the micro-decomposition results of Zhejiang's county-level, e-retail economic linkage network show that the internal and external links of the Northeast Zhejiang subgroup, the Central Zhejiang subgroup and the Southeast Zhejiang subgroup, are all rather close, while those of the Central and South Zhejiang subgroup and the Qu-Long subgroup, are loose. The West Zhejiang subgroup is less linked with other subgroups, while the Central Zhejiang subgroup has close links with the East Zhejiang subgroup, the Southeast Zhejiang subgroup and the West Zhejiang subgroup. Therefore, as an intermediary area connecting west and east, the Central Zhejiang subgroup may be said to play an important role in balanced regional development. These findings imply that, in the future integration of Zhejiang's e-retail economy, close attention should be paid to improving the radiation effect of the more advantaged areas of Northeast Zhejiang and Southeast Zhejiang on Central Zhejiang and Central and South Zhejiang. Efforts should also be made to advance the link and cooperation between the West Zhejiang and Qu-Long areas with the more advantaged areas in the east by virtue of the intermediation of Central Zhejiang (which links east and west), thus accelerating the balanced and integrated development of Zhejiang's regional e-retail economy.

In an overview of the macro-pattern of the economic development of China's e-retail sector, Zhejiang Province can be seen as a miniature representation of the country as a whole. With regard to its geographical location and economic characteristics, China's eastern coastal areas and Zhejiang's eastern coastal areas are both coastal economic belts with a strong economic foundation. In terms of their development pattern, China and Zhejiang share an area of successful e-retail economic development, which centers on the northeast, southeast coastal parts and some central areas, such as the Beijing-Tianjin-Hebei region, Shandong, Jiangsu, Zhejiang, Fujian, and Guangdong in the eastern coastal area, and Wuhan and Changsha in the central area.

With regard to regional development differences, both China's and Zhejiang's e-retail economic development is characterized by spatial polarization and an east-west gradient difference, with the

western part of China and Zhejiang being relatively underdeveloped. Major aspects can, arguably, be perceived from small ones; as such, the micro-analysis results of Zhejiang's county-level e-retail economic linkage network can offer some insights as to the overall development of China's e-retail economy, to some extent; namely, the emphatic need to improve the radiation effect of the Beijing-Tianjin-Hebei region and advantaged provinces of the eastern coastal part on the central and western provinces. A further implication is the need to advance the link and cooperation between the western provinces with the advantaged central and eastern provinces, by virtue of the intermediation of the central provinces that link east and west, so as to accelerate the balanced and integrated development of China's regional e-retail economy.

5. Conclusions and Discussion

Based on the space interaction theory and growth pole theory, this paper uses a revised gravity model and social network analysis to quantitatively study the spatial characteristics of the e-retail economic linkages at county level in Zhejiang Province according to the "point-line-surface" idea. The conclusions are as follows: (1) At the "point" level, the spatial pattern of e-retail economic linkages at the county level in Zhejiang Province has obvious spatial differentiation features, and the regional east-west gradient difference and the coastal-inland difference are obvious. (2) At the "line" level, the main direction of the gravity linkage has the significant characteristic of adjacent city pointing, indicating that most counties were mainly influenced by the economic gravity of neighboring counties. The extroversion of economic development is weak. In addition, the analysis results also show that the major linking partners of most counties were single, which indicates the vulnerability of the e-retail economy in Zhejiang Province. (3) At the "surface" level, the overall development degree and openness of the e-retail economic network at county level in Zhejiang Province are relatively low. The centrality analysis showed that there were seven major radiation sources in Zhejiang Province, among which Hangzhou is the core radiation source whose spatial radiation scope covers the whole province, and Ningbo, Yiwu and Wenzhou are the regional radiation sources whose radiation scope is only second to Hangzhou. It is worth noting that Southwest Zhejiang is a development "depression", lacking major radiation sources and effects, which is an important obstacle in the integration process of regional e-retail economic development. (4) In terms of the cohesive subgroup pattern, Zhejiang Province is divided into six sub-groups. As an intermediary plate connecting east and west, the Central Zhejiang sub-group plays an important role in the development of a regional equilibrium. (5) The macro-patterns of the development of China's e-retail economy are somewhat similar to those of Zhejiang Province. The microscopic analysis results of the e-retail economic connection network at county level in Zhejiang Province can provide some enlightenment for the overall development of China's regional e-retail economy. This includes the recommendation to focus on improving the radiation effect of the Beijing-Tianjin-Hebei region and of the advantaged eastern coastal provinces on the central and western provinces. The link and cooperation between the western provinces with the advantaged central and eastern provinces should also be promoted, by virtue of the intermediation of the central provinces that link east and west, thus accelerating the balanced and integrated development of China's regional e-retail economy.

We conducted a quantitative study on the spatial characteristics of e-retail economic linkages in Zhejiang Province from a macro perspective. We revealed the spatial organization of the regional e-retail economy and provide a scientific reference for the regional e-retail economy integration development strategy. However, we note that this study still has some limitations: (1) This study takes into account potential linkages derived from the gravity model under the assumption of the distance decay of linkage intensity. However, it should be emphasized that these potential linkages are not the actual economic linkages that were measured, but potential linkages modeled by the gravity model. This is a limitation on our interpretation of the results. (2) This research treated Zhejiang Province as isolated, but for sure the e-retail business is not (completely) constrained by provincial borders. If counties outside of Zhejiang Province were also included, the results could be some potential change.

(3) Due to the difficulty of obtaining data, we only analyzed a single year. However, it is certain that we would obtain more valuable findings from time series analysis. (4)This study lacks an in-depth discussion regarding the driving forces beneath the spatial patterns and linkages of the regional e-retailing economy. As a consequence, several questions are not fully answered: For instance, it is not known which factors lead to the three poles in e-retail in Zhejiang, the east-west or coastal-inland gradient, and the six subgroups, nor is it known why the first important link is "single" and the second is more complex.

Author Contributions: Wei Shen and Yaochen Qin conceived and designed the research, Wei Shen, Zhixiang Xie analyzed the data; Yaochen Qin and Zhixiang Xie revised the manuscript of this study; and Wei Shen wrote the paper. All authors read and approved the final manuscript.

Funding: This research was funded by the National Natural Science Foundation of China, grant number41671536,41501588.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Shi, K.B.; Vos, J.D.; Yang, Y.C.; Witlox, F. Does e-shopping replace shopping trips? Empirical evidence fromChengdu, China. *Trans. Res. Part A* **2019**, *122*, 21–33.
2. Visser, E.J.; Lanzendorf, M. Mobility and Accessibility Effects of B2C E-commerce:A Literature Review. *Tijdschr. Econ. Soc. Geogr.* **2004**, *95*, 189–205. [CrossRef]
3. Stranahan, H.; kosiel, D. E-tail spending patterns and the importance of online store familiarity. *Internet Res.* **2007**, *17*, 421–434. [CrossRef]
4. Ha, S.; Stoel, L. Online apparel retailing: Roles of e shopping quality and experiential e shopping motives. *J. Serv. Manag.* **2012**, *23*, 197–215. [CrossRef]
5. Colton, D.A.; Roth, M.S.; Bearden, W.O. Drivers of international e-tail performance: The complexities of orientations and resources. *J. Int. Mark.* **2010**, *18*, 1–22. [CrossRef]
6. Siddiqui, U.A.; Khan, M.S. An exploratory study on effect of demographic factors on consumer satisfaction and its determinants in e-retailing. *Manag. Stud. Econ. Syst.* **2017**, *3*, 159–171. [CrossRef]
7. Park, S.O. The impact of business-to-business electronic commerce on the dynamics of metropolitan spaces. *Urban Geogr.* **2004**, *25*, 289–314. [CrossRef]
8. Gorman, S.P. Where are the Web Factories: The Urban Bias of E-business Location. *Tijdschr. Econ. Soc. Geogr.* **2002**, *93*, 522–536. [CrossRef]
9. Farag, S.; Krizek, K.J.; Dijst, M. E-shopping and Its Relationship with In-store Shopping: Empirical Evidence from the Netherlands and the U.S. *Transp. Rev.* **2006**, *26*, 43–61. [CrossRef]
10. Farag, S.; Schwanen, T.; Dijst, M. Empirical Investigation of Online Searching and Buying and Their Relationship to Shopping Trips. *Transp. Res. Rec.* **2005**, *1926*, 242–251. [CrossRef]
11. Anderson, W.P.; Chatterjee, L.; Lakshmanan, T.R. E-commerce, Transportation, and Economic Geography. *Growth Chang.* **2003**, *34*, 415–432. [CrossRef]
12. Weltevreden, J.W.J.; Rotem-Mindali, O. Mobility effects of b2c and c2c E-commerce in the Netherlands: A Quantitative Assessment. *J. Transp. Geogr.* **2009**, *17*, 83–92. [CrossRef]
13. Huang, Y.; Zhen, F.; Wang, X. Spatial Organization and Expansion of Economical Chainstore Hotel under the in Fluence of E-Commerce in the Main City of Nanjing as an Example. *Econ. Geogr.* **2012**, *32*, 56–62.
14. Shi, K.B.; Yang, Y.C.; Yang, X.A.; Bai, S.; Shao, R.; Li, B. Does time dictate the location of e-commerce business?A study of O2O businesses in Chengdu, China. *Acta Geogr. Sin.* **2016**, *71*, 500–514.
15. Shi, K.B.; Yang, Y.C.; Bai, S.; Li, E.L.; Chen, D. Innovation diffusion hypothesis or efficiency hypothesis: Spatial penetration of online-to-offline e-commerce in China based on Meituan.com. *Geogr. Res.* **2018**, *37*, 83–796.
16. Haythornthwaite, C. Social network analysis: An approach and technique for the study of information exchange. *Libr. Inf. Sci. Res.* **1996**, *18*, 323–342. [CrossRef]
17. Yang, L.H.; Liu, N.; Bai, C.L. The Spatial Structure of the Tourism Economy in Beijing-Tianjin-Hebei-Xiongan Region. *Sci. Geogr. Sin.* **2018**, *38*, 394–401.

18. Sun, Q.; Tang, F.H.; Tang, Y. An economic tie networkstructure analysis of urban agglomeration in the middle reaches of Changjiang River based on SNA. *J. Geogr. Sci.* **2015**, *25*, 739–755. [CrossRef]
19. Glückler, J. Economic geography and the evolution of networks. *J. Econ. Geogr.* **2007**, *7*, 619–634. [CrossRef]
20. Zhong, Y.X.; Feng, X.H.; Wen, Y.Z. The evolvement and driving mechanism of economic network structure in the Changjiang River economic zone. *Sci. Geogr. Sin.* **2016**, *36*, 10–19.
21. Li, X.D. Spatial structure of the Yangtze River Delta urban network based on the pattern of listed companies network. *Prog. Geogr.* **2014**, *33*, 1587–1600.
22. Wang, D.G.; Chen, T.; Lu, L. Mechanism and HSR effect of spatial structure of regional tourist flow:Case study of Beijing-Shanghai HSR in China. *Acta Geogr. Sin.* **2015**, *70*, 214–233.
23. Liu, H.J.; Liu, C.M.; Sun, Y.N. Spatial Correlation network structure of energy consumption and its effect in china.China. *Ind. Econ.* **2015**, *29*, 83–95.
24. Zhou, C.; Zeng, G.; Cao, X.Z. Chinese inter-city innovation networks structure and city innovation capability. *Geogr. Res.* **2017**, *36*, 1297–1308.
25. Eroglu, S.A.; Machleit, K.A.; Davis, L.M. Atmospheric qualities of online retailing: A conceptual model and implications. *J. Bus. Res.* **2001**, *54*, 177–184. [CrossRef]
26. Chung, K.H.; Shin, J.I.; Tang, H.T.; Dong, Q. The relationship between Internet retail attributes, Internet satisfaction and Internet loyalty. *J. Trans. Foreign Lit. Econ.* **2010**, *15*, 67–77.
27. Acimovic, J.; Groaves, S.C. Mitigating Spillover in Online Retailing via Replenishment. *Manuf. Serv. Oper. Manag.* **2017**, *19*, 419–436. [CrossRef]
28. Chenavaz, R.; Drouard, J.; Escobar, O.R.; Karoubi, B. Convenience pricing in online retailing: Evidence from Amazon.com. *Econ. Model.* **2018**, *70*, 127–139. [CrossRef]
29. Cullinane, S. From bricks to clicks: The impact of online retailing on transport and the environment. *Transp. Rev.* **2009**, *29*, 759–774. [CrossRef]
30. Yeung, G.; Ang, K.L. Online fashion retailing and retail geography: The blogshop phenomenon in Singapore. *Tijdschr. Econ. Soc. Geogr.* **2016**, *107*, 81–99. [CrossRef]
31. Tolstoy, D.; Jonsson, A.; Sharma, D.D. The influence of a retail firm's geographic scope of operations on its international online sales. *Int. J. Electron. Comm.* **2016**, *20*, 293–318. [CrossRef]
32. Tamimi, N.; Rajan, M.; Sebastianelli, R. The state of online retailing. *Internet Res.* **2003**, *13*, 146–155. [CrossRef]
33. Souitaris, V.; Balabanis, G. Tailoring Online retail strategies to increase customer satisfaction and loyalty. *Long Range Plan.* **2007**, *40*, 244–261. [CrossRef]
34. Edwards, J.B.; Mckinnon, A.C.; Cullinnane, S.L. Comparative analysis of the carbon footprints of conventional and online retailing: A last mile perspective. *Int. J. Phys. Distrib. Logist. Manag.* **2010**, *40*, 103–123. [CrossRef]
35. Shi, Y.; Yang, Z.F.; Yan, H.; Tian, X. Delivery efficiency and supplier performance evaluation in China's E-retailing industry. *J. Syst. Sci.Complex.* **2017**, *30*, 392–410. [CrossRef]
36. Ahn, T.; Ryu, S.; Han, I. The impact of Web quality and playfulness on user acceptance of online retailing. *Inf. Manag.* **2007**, *44*, 263–275. [CrossRef]
37. Wang, M.F.; Lu, S. Exploring the spatial organization of online retailing:A case study of Dangdang.com. *Geogr. Res.* **2011**, *30*, 965–976.
38. Griffis, S.E.; Rao, S.; Goldsby, T.J.; Niranjan, T.T. The customer consequences of returns in online retailing: An empirical analysis. *J. Oper. Manag.* **2012**, *30*, 282–294. [CrossRef]
39. Subramanian, N.; Gunasekaran, J.; Yu, J.; Cheng, J.; Ning, K. Customer satisfaction and competitiveness in the Chinese E-retailing: Structural equation modeling (SEM) approach to identify the role of quality factors. *Expert Syst. Appl.* **2014**, *40*, 69–80. [CrossRef]
40. Wang, M.M.; Cao, X.S. The measurement of inter-county economic linkage and spatio-temporal dynamics analysis in Guanzhong-Tianshui economic region based on the traffic accessibility. *Geogr. Res.* **2016**, *35*, 1107–1126.
41. Li, S.C.; Gong, J.; Deng, Q.J.; Zhou, T.Y. Impacts of the Qinghai–Tibet railway on accessibility and economic linkage of the third pole. *Sustainability* **2018**, *10*, 3982. [CrossRef]
42. Yang, W.L.; Du, D.B.; Liu, C.L.; Ma, Y.H. Study on the spatial-temporal evolution and internal mechanism of geo-economic connections of China. *Acta Geogr. Sin.* **2016**, *71*, 956–969.
43. Miao, H.L.; Zhou, H.A. Comparative Analysis on Economic Linkage and Hierarchical Structure of the Top Three Urban Agglomerations in China—Using a Synthesized Gravity Model. *Econ. Geogr.* **2017**, *37*, 52–59.
44. Ou, X.J.; Xue, L.P.; Gu, W.J. Characteristic in Space Economic Contacts of Cities and Counties in Jiangsu Province. *Econ. Geogr.* **2015**, *35*, 24–31.

45. Liu, J. Research and analysis of social network model. *Sociol. Res.* **2004**, *19*, 1–12.
46. Zou, J.L.; Liu, W.D. Trade Network of China and Countries along "Belt and Road Initiative"Areas from 2001 to 2013. *Sci. Geogr. Sin.* **2016**, *36*, 1629–1636.
47. Yu, X.X.; Wu, Y.X. The system of administrative division and the development of the cities in central area of Zhejiang—A case study on the Jinhua-Yiwu relationship. *Econ. Geogr.* **2011**, *31*, 72–78.



© 2019 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (http://creativecommons.org/licenses/by/4.0/).