Analysis on Spatial Distribution of Commodity Delivery Warehouses in Yangtze River Delta

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Abstract. We take 239 commodity delivery warehouses in 25 cities of the Yangtze River Delta region as our research object to study their spatial distribution and driving mechanism. Our research shows that: First, the spatial distribution type of commodity delivery warehouses in the Yangtze River Delta is condensation type; the commodity delivery warehouses are concentrated in Shanghai, Ningbo, Suzhou, Wuxi, and these four cities have becoming the cluster center areas; Among these cities, Shanghai City, has the highest level of significance, and has become the core area of the construction and development of the commodity exchange and the delivery warehouse in the Yangtze River Delta; Secondly, the commodity delivery warehouses in the Delta are mainly concentrated in the economic zones along the Yangtze River and the Gulf coast of Hangzhou Bay, while others are scattered along the main highways in this region; Thirdly, the Yangtze River Delta region is located in the intersection point of two major national strategy layout, "The Belt and Road", "the Yangtze River Economic Belt", so the commodity delivery warehouse space pattern in this region is influenced by geographical location, social policy and service environment, region economic development level, infrastructure construction and other driving factors.

Introduction

As a bridge between the spot market and the futures market, delivery system is an important guarantee for the function of futures market, while the delivery warehouses and their layout are in the core part of the entire delivery system. The Yangtze River Delta is located at the intersection of two major national strategic layouts "One Belt, One Road" and "the Yangtze River Economic Belt" [1], whose common characteristics are spanning administrative divisions and promoting regional coordinated development, which will form new regional economic layout and new development spatial pattern. So it will be a realistic subject to study the effective management of commodity spot delivery on the basis of spatial pattern analysis of commodity delivery warehouses in Yangtze River Delta [2], which will maximize the controlling of the release of production capacity and promoting the transformation and upgrading of traditional industries.

Research Foundation

Domestic research on commodity delivery warehouses is still few, while with the continuing concern of government departments and industry associations, research results are gradually revealed. Wang Zongfang studies the delivery warehouse layout of cotton futures on the Zhengzhou Mercantile Exchange, and tests the rationality of cotton futures delivery warehouse layout from the delivery data and other aspects of cotton futures [3]; on this basis, Wang Zongfang also studies the layout of the entire domestic commodity futures delivery warehouses, and points out that delivery warehouse should be set in centralized sales area or goods distributing center areas as the basic delivery area, and premium of different delivery warehouse should be set according to the transportation cost [4]; Jiang Chaofeng studies the development of warehousing industry in our country, points out that the demand for futures delivery warehouse and electronic commerce
delivery warehouse is increasing in China at present [5]. Faye Wong, Han Zhaoliang studies the significance of the delivery warehouse and systematically analyzes the possibility of setting up futures delivery warehouse in Heilongjiang [6]; Bofen, Du Yu, Wang Hui take a designated delivery warehouse (Tianjin TEDA Public Warehouse) of the Dalian Commodity Exchange as the research object, discuss the business model by the combination of futures delivery and logistics services [7], Liu Qian studies the distribution of futures delivery warehouses in Shandong and their influence on the regional economy [8]; Xie Lingbin explores the historical evolution of China's commodity futures delivery system [9]; Li Yanxi, Chen Wei, Xu Xinzhong, taking the soybean meal futures as an example and from the delivery cost expectations and spot price based on the delivery option pricing model, proposes the general method of premium setting for commodity futures delivery [10], Sun Axue analyzes the profit of futures delivery warehouse operation of logistics enterprises [11]; Hu Jianghua discusses the factors that should be considered in the design of delivery warehouse in theory and then gives his suggestions [12]; Huo Ruirong studies of the evolution of domestic and foreign futures delivery theory and the direction of the reform of China's futures market delivery system [13].

To sum up, the existing researches mainly focus on the distribution of the delivery warehouse from the perspective of an area or certain commodity using the methodology of qualitative analysis [3, 6, 7, 8, 9, 10], and researchers begin to study the significance of the delivery warehouse [4, 5, 6], the combination of delivery warehouse and logistics service [7, 11], cost and risk control [11, 13], and other aspects. There is few quantitative analysis of bulk commodity delivery warehouses, and it is more rarely seen to study the spatial distribution characteristics of commodity delivery warehouse using spatial analysis method. There is also less research work on the distribution of the development and delivery warehouses of commodity exchanges in Yangtze River Delta. This study, taking the Yangtze River Delta as the research area, and taking 25 cities in this region as the research unit, using GIS spatial analysis method, try to analyze the spatial distribution characteristics of the designated delivery warehouse (located in the Yangtze River Delta region) in the Yangtze River Delta region, and discusses the factors affecting the spatial distribution of the delivery warehouses with the expectation to give suggestions of optimizing the spatial layout of commodity delivery warehouses in the Yangtze River Delta region and other regions in China.

Data Sources

The commodity delivery warehouses in the Yangtze River Delta region involved in this study is gotten from the notice by Zhejiang Xinhua Commodities Trading Center, Zhejiang Zhoushan Commodities Exchange, Ningbo Commodity Exchanges, the Yangtze River Delta Commodity Exchange, Shanghai Futures Exchange and etc. As of the end of December 2015, there are 185 commodity delivery warehouses in all of the commodity exchanges in the Yangtze River Delta region. Excluding 54 delivery warehouses outside the Yangtze River Delta, there are 131 commodity delivery warehouses. Subsequently, in order to ensure the overall data, we get 108 delivery warehouses of other commodity exchanges established in the Yangtze River Delta. So there are 239 delivery warehouses in this region.

The data collected in the Yangtze River Delta region, include the name of the 239 commodity delivery warehouses, city membership (all the geographical position be refined to county level), Delivery warehouse area, geographical position (the latitude and longitude coordinates of the 239 delivery warehouses in the Yangtze River Delta region obtained through the Earth Google tool), variety of delivery goods and etc. Other data of this study, such as total investment in fixed assets and etc. come from Shanghai City Statistical Yearbook 2015, Jiangsu Province Statistical Yearbook 2015 and Zhejiang Province Statistical Yearbook 2015.

Analysis of Space Pattern of Commodity Delivery Warehouses in the Yangtze River Delta Region

The space distribution characteristics. As of the end of 2015, the Yangtze River Delta region
has 239 commodity delivery warehouses in all kinds, among them, there are 169 industrial product delivery warehouses, 58 agricultural goods warehouses, and 12 miscellaneous warehouses. The total area of the warehouses goes up to 25290.8 m², and among them, 162 warehouses’ storage area goes beyond 100,000 m².

After the space measure processing of commodity warehouses’ latitude and longitude in the Yangtze River Delta region, our study matches them in the Yangtze River Delta region municipal administrative map, and using Arcgis10.1 to do space visualization, and gets Figure 1.

**Spatial distribution of cold & hot spots.** In order to explore the spatial distribution characteristics of commodity delivery warehouses in the Yangtze River Delta region, we take 25 cities in the Yangtze River Delta as the research object, using the spatial autocorrelation method, according to the spatial autocorrelation formula, then we get the index Getis-OrdGi* to reflect the concentration degree and distribution characteristics of commodity delivery warehouses in the Yangtze River Delta, and the calculating result is as showed in Figure 2.

It can be seen from Figure 2 that commodity delivery warehouses in the Yangtze River Delta region present obvious spatial agglomeration, and agglomeration area can be further divided into high-value agglomeration area and low-value agglomeration area. Among these areas, Shanghai, Suzhou and Jiaxing have the highest level of significance, which presents classic high-value agglomeration, and are the core area for the development of commodity exchange and delivery warehouses in the Yangtze River Delta. These four cities have leading roles in the commodity delivery warehouses construction; the five cities, Xuzhou, Lianyungang, Suqian, Huaian and Yancheng, which are located in the north part of Jiangsu province, present low-value agglomeration area, which indicates the number of commodity delivery warehouses in these cities is less and is the cold spot area of commodity delivery warehouses in the Yangtze River Delta.

**Spatial LISA clustering.** In order to further explore the local spatial distribution characteristics of commodity delivery warehouses in the Yangtze River Delta region, according to the local spatial
autocorrelation formula, combining with the calculation of the ArcGIS10.1, we obtained the Local 'Moran s’ I index and LISA distribution map, so as to reflects spatial concentration degree and distribution characteristics of commodity delivery warehouses in the Yangtze River Delta. The result is showed as follows in Figure 3.

![Figure 3. LISA conglomeration distribution of commodity delivery warehouse in Yangtze River Delta.](image)

It can be seen from Figure 3 that in the Yangtze River Delta, the spatial distribution of the commodity delivery warehouses presents obvious characteristics of agglomeration distribution. Among these cities, Shanghai, Suzhou, Wuxi and Jiaxing are the HH region, which indicates commodity spot delivery level is relatively high, meanwhile the peripheral cities, such as Hangzhou, Taizhou and Nantong also have relatively high commodity spot delivery level, and there is little regional difference; in addition, Huzhou, Shaoxing, Changzhou and Zhoushan are LH area, which indicates that the distribution of the commodity delivery warehouse is spatially discrete distribution, reflecting the lower concentration of the bulk commodity delivery warehouse in these cities, while their peripheral cities, such as Ningbo, have relatively high concentration level, which exists large regional differences among them. Cities in Northern Jiangsu and the southwest of Zhejiang Province is the LL region, showing that these cities and their peripheral cities are all low-value agglomeration area of commodity delivery warehouses.

**Driving mechanism analysis**

**The advantage of regional policy.** With the guidance of national policy, all levels of government in the Yangtze River Delta region have attached great importance to the construction of commodity trading market. Many cities regard developing commodity-trading-related industries as an important breakthrough point for regional economic transformation and upgrading and the development of new service industry. Hangzhou, Ningbo, Suzhou, Wuxi and other places all emphasized in their 13th Local Five-Year Plan to improve the financial market system, to develop futures markets, to develop commodity futures delivery warehouses of all kinds.

In order to improve the circulation efficiency of the real economy and reduce the occupation of social capital and operating costs, many local government, such as the government of Ningbo, Shanghai, Hangzhou, Zhoushan, Suzhou, Wuxi, all support the development of commodity e-commerce trading platform. After years of development, Yangtze River Delta commodity market continues to expand on the scale, delivery system and trading varieties, and the good policy environment also contributed to the cluster distribution of commodity delivery warehouses in the region.

**Infrastructure advantage.** Commodity spot delivery activities are highly concentrated joint activities of people, logistics, capital flowing, and information flowing, which has higher requirements for the city infrastructure. Since 2002, the Yangtze River Delta region has seen large number of fixed assets investment of civil aviation, railways, highways and other transportation facilities, which make the regional transportation network presents the trend of leap forward development. Table 3 shows that the cities with high total investment in fixed assets are also the
areas which have a large number of commodity delivery warehouses. The Yangtze River Delta region sees its effective delivery system with perfect supporting infrastructure, and an effective delivery system cannot be easily controlled by investment predators, so as to ensure the effective implementation of futures hedging.

**Commodity attribute factor.** Commodity is used for industrial and agricultural production, whose price, trading, stock and logistic has significant influence on national economy development. According to different commodity attribute, their delivery warehouse also has different distribution characteristic. For example, the agriculture product delivery warehouses are usually set in the place of origin, while the industrial product delivery warehouses are usually set in the harbor cities or well developed commodity distributing center. All of these can be seen in our spatial distribution figures.

**Conclusions**

Our study shows that: First: by spatial economic analysis, the spatial distribution type of commodity warehouses in the Yangtze River Delta region is agglomeration type; in the space of city scale, commodity delivery warehouse in the Yangtze River Delta is more concentrated in Shanghai, Ningbo, Suzhou, Wuxi, among which Shanghai has the most significance degree and is the core area of delivery warehouse construction and development in the Yangtze River Delta. The core area and central area of commodity delivery warehouse distribution in the Yangtze River Delta present obvious high-value conglomeration, and the following areas are the economic zone along the Yangtze River and the region along the Gulf Economy Zone.

Secondly, by further spatial analysis, the commodity warehouses in the Yangtze River Delta region are agglomerated along the economic zone along the Yangtze River and the region along the Gulf Economy Zone, while other spot points are also scattered on the main highways in this region.

Thirdly, the Yangtze River Delta is located in the intersection of the two major development strategy layout of national implementation, "The Belt and Road", "The Yangtze River Economic Belt", the spatial pattern of the commodity delivery warehouse is affected by geographical location, social policy environment, regional economic level, the improvement of infrastructure and the nature of the goods themselves.

**References**


