

Article

Characterization of Rural Spatial Commodification Patterns around Metropolitan Areas and Analysis of Influential Factors: Case Study in Shanghai

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Abstract: Rural areas around developed metropolitan areas continue to attract capital inflows, promoting rural spatial commodification. Taking Shanghai as a case study, this paper analyzes the characteristics of the spatial distribution pattern and the influencing factors of rural spatial commodification (RSC) through kernel density analysis, multiple regression models, and spatial autocorrelation analysis. This study explores four types of RSC at the township scale outside the center of Shanghai: agricultural product-oriented commodification, farm housing commodification, tourism-oriented commodification, and construction land commodification. The results show the following: (1) The four types of RSC show positive spatial correlation, a clear pattern of agglomeration, and an obvious core–edge pattern, with high-density areas distributed in rural areas with specific advantages around metropolitan areas. The distribution of RSC also demonstrates an obvious polarization, forming an uneven distribution pattern. (2) Socio-economic factors, agriculture, transportation location, urbanization, and industrialization are key factors driving RSC. (3) Different types of RSC should be effectively guided at the policy and planning levels according to regional conditions and development stages to enhance the spatial organization of rural regions and achieve the effective revitalization of the countryside surrounding the metropolis.

Keywords: rural spatial commodification; spatial distribution pattern; rural transformation; rural area around metropolitan area; China



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1. Introduction

Since the 1990s, with the acceleration of globalization, modernization, and urbanization, phenomena such as reverse urbanization and industrial de-agriculture have appeared in developed countries [1]. Different changes have occurred in the spatial environment, production mode, social structure, and rural culture. The countryside has been transformed into a post-productivism paradigm. Driven by the market and technology, the mode of rural economic development has changed from agricultural production to the integration of primary, secondary, and tertiary production, from rough development to refined operation. Rural space has transformed from a single space for agricultural production to a multifaceted space integrating functions such as residence, tourism, consumption, and production [2]. The material production function of the modern countryside is gradually weakening, and the consumption function is gradually enhancing. The development and functional transformation of the countryside have led to rural spatial commodification (RSC). This study considers RSC as the dynamic process of trading material elements (land, agricultural products, lodging, natural landscapes), non-material elements (farming experience, rural culture), rural-related services, and rural space itself as “commodities” through market behavior in rural areas. This process aims to obtain a certain amount of profit to promote the socio-economic development of the countryside. RSC is one of the significant method for the transformation and reconstruction of rural space [3]. It is

also an essential means of realizing the multiple values of the countryside and integrating industrial development [4].

In 2017, China proposed a rural revitalization strategy. Since 2015, Central Document No. 1 in successive years has encouraged the flow of capital into the rural area. Driven by a series of policies, China's urbanization process has advanced profoundly. In the periphery of the developed metropolises, urban–rural integration has transitioned into a new phase of advancement, with the accelerated flow of population, information, and capital between urban and rural areas. Due to its convenient location, natural idyllic landscape, and life experience [5,6], the rural area around the metropolis attracts investment capital [7]. Rural spaces are becoming urbanized and consumerized. New heterogeneity has emerged in the economy, society, and space of rural areas. To sum up, under the impetus of policy and capital intervention, the rural areas around China's metropolises are undergoing the commercialization of rural space. Therefore, a scientific understanding of the phenomenon of RSC and considering the development mode of RSC will provide references for optimizing the rural spatial structure and promoting the sustainable development of the countryside.

To understand the historical practice of RSC from a time perspective [2,3], we can start by examining the development of rural theory. The West has researched RSC earlier while exploring rural development theory. The experience of the Second World War led to a heightened focus on food security, leading to the theory of “productivism”, in which the function of agricultural production dominates rural space [8,9]. In the later period, the change in social consumption structure and the prevalence of environmentalism formed the “post-productivism” theory, emphasizing consumption-oriented agricultural production [9]. The de-agriculture of rural development was observed in traditional agricultural powers in Europe, such as the Netherlands, Belgium, and France. The “multifunctional rural” theory was formed, taking into account the balance between “productivism” and “post-productivism”.

From a spatial perspective, the social background, core concepts, resource combination mode, operation mechanism, and the impact of RSC in several areas have already been researched. RSC focuses on commodified resources, including natural resources, land, labor, and other traditional resource elements. It also includes capital, technology, social relations, and other new resource elements, forming a more comprehensive “collection of commodities” [10,11]. The process of RSC is mainly determined by the resource endowment of the countryside itself and exogenous inputs. At present, more studies are focusing on the operational mechanisms. Western scholars have emphasized that RSC results from extensive investment and capital operation in rural areas [12]. It is the spatial characterization of the law of capital's operation at the local scale [13]. Scholars' case studies on RSC explore the creation of new tourism resources and the realization of regional development through RSC [14]. Since China is still in the early stages of the RSC phenomenon, research focuses on how capital and consumer culture have shaped rural space evolution. This includes notions and theories connected to RSC [11], rural land commodification [12,15], rural space production [12], material landscape change [16], rural social reconstruction [17], rural governance system change [18], and the operation and maintenance of rural space [19]. From the perspective of spatial production, the reproduction process of rural space driven by consumer culture is essentially a phenomenon of spatial capitalization [20,21]. Rural construction is a capital initiative to create a “Consumptive Built Environment” through the symbolization of rural space to obtain “monopoly rent”, which is the internal logic of rapid capital appreciation [22]. In addition, the study of RSC is also connected with the studies of rural gentrification [23] and the rebuilding of ecological space, lifestyle, and production in rural areas [24].

The research area mainly focuses on national rural demonstration areas such as southern Jiangsu and Zhejiang. Relatively little research has been conducted on the rural areas around metropolitan areas, especially Shanghai. Research methods mainly include the spatial analysis method [19,25] and the case study method [26]. In terms of rural development paths and spatial effects, the current research mainly focuses on the interaction

of various types of capital entities and lacks attention to spatial effects. Regarding the driving mechanism, it is generally from the perspective of social forces and government intervention. They ignore the potential impacts of the macro-socio-economic context and external conditions.

The research on the spatial pattern of RSC has mainly been carried out at the macro scale at the provincial level [27] or the micro scale, focusing on individual villages as examples to study RSC [28]. The countryside around the metropolis is a unique rural area with an active economy and abundant human activities. There is an urgent need to explore the development model of RSC at the meso level and township level. The traditional theoretical perspectives of rural spatial transformation include spatial production theory [29], actor–network theory [30], land use transformation theory [31], and multifunctional village theory [32]. These theories are based on social factors and rural space. However, they lack adequate explanations of RSC, which is driven by the combination of capital and rural background resources. This paper attempts to construct a theoretical framework for RSC under the dual dynamics of internal and external factors in the countryside, to expand the theoretical research on RSC, and to enhance the explanatory mechanism of RSC.

This paper selects nine districts outside the central city of Shanghai as typical representative regions of the rural areas around the metropolis. An empirical study was conducted on the pattern characteristics and driving factors of RSC in Shanghai. This study is supported by typological data of rural spatial commoditization (POI) and socio-economic data. It is based on townships as the unit of analysis. Kernel density analysis and spatial autocorrelation analysis are used to elucidate the pattern characteristics of RSC, and a multiple regression analysis model is used to analyze the driving factors.

The questions of this study are threefold: (1) What is the spatial distribution of RSC? (2) What are the drivers of the formation and development of RSC? (3) How do socio-economic factors and other factors affect RSC?

This study is structured into four sections. The Section 1 reviews the pertinent literature on commodification and rural space, and the Section 2 briefly introduces the study area and describes the research methodology. The Section 3 focuses on the pattern characteristics of RSC and its driving factors in township-scale Shanghai. The Section 4 discusses the mechanisms of socio-economic and policy factors that drive RSC.

2. Basis for Research

2.1. Conceptual Frameworks for the Commodification of Rural Spaces

According to Marxist political economy theory, commodities are the material manifestation of use value, exchange value, and value [33,34]. An object becomes a commodity with an exchange value that exceeds its use value and is tradable [2,35]. Commodification has three distinct elements: goods and services are produced for exchange, exchange is monetized and subject to market conditions, and profit is the motivation for exchanging goods and services based on monetization [36].

The definition of the concept of “space” in geography is complex and multidimensional. Hart states that “the task of the geographer is to describe and analyze the interactions of phenomena in terms of space and to synthesize them”, which originated in Kant’s spatial philosophy of the “container” of space [37,38]. Rural space includes material space and immaterial space. Material space mainly includes topography, climate, soil, and other geographic elements and demographic elements. It also consists of the spatial structure of the countryside, morphology, function, and the resulting space of social relations, which is the projection of various activities, such as socio-economics and other activities [39]. Halfacree believes that rural space comprises three elements: representations of the rural, rural locality, and rural lives [40].

In the urban consumption of rural resources, the countryside creates new markets, virtual cultural landscapes, and land commodities. Rural areas follow the outline pictured by Best (1989) in an orderly movement from a commodity society into a virtual society [6]. In 1992, Cloke believed that RSC is the process by which humanity exploits the rural

environment to satisfy contemporary consumer demands. He described this phenomenon as “an increase in rural space’s role as a place for the consumption of immaterial goods and a relative decline in its role as a place of material production” [41]. In 2005, Michael John Woods conceptualized the RSC as the “sale” of rural resources through tourism activities, real estate investments by non-farmers, rural products, and rural impressions to promote agricultural products and other commodities [2]. RSC consists of five prominent components: the conversion of rural production areas into tourism destinations, including idyllic tourism and forest tourism; the repackaging of rural heritage to emphasize nostalgia and past experiences; the promotion of fictional rural scenery in movies and TV shows; the use of the countryside for extreme experiences such as adventure travel; and the sale of rural goods to urban consumers [42]. Perkins followed Cloke and Woods’s explication of the commodification of rural space and further summarized four types of rural space commodification [6]: (i) Established agricultural and horticultural products, such as rice, vegetables, fruits, and various livestock products, with a focus on expanding production due to technological and organizational innovations. (ii) New agricultural and horticultural products, emphasizing the diversity of commodity production in the countryside, with products supported by scientific and technological innovations and related to changes in consumers’ lifestyles, health, and fashion factors. (iii) The consumption of rural space by counter-urbanization, with urban residents renting or buying farmhouses for reasons of location, environment, culture, and land prices, which is often also described as rural gentrification. (iv) Rural leisure and tourism consumption utilizes existing or created landscapes, environments, and daily activities in the countryside to attract tourists. Based on this, Akira proposes the fifth type: activities that enhance living standards by managing the environment and the landscape and learning about traditional rural culture and society [43,44].

This paper argues that the essence of RSC refers to the dynamic process of trading material elements (land, agricultural products, lodging, natural landscapes), non-material elements (farming experience, rural culture), rural-related services, and rural space itself as “commodities” through market behavior in rural areas. This process generates profit to promote the socio-economic development of the countryside. Taking into account the overall development characteristics of rural China, in the time dimension, the commodification of rural construction land first appeared in the late 1970s and early 1980s, with the emergence of many township and village enterprises in the eastern coast of China and some of the more economically developed provinces. With the development of technology, rural agriculture developed rapidly, and the agricultural industry chain was extended from simple agricultural cultivation to the processing of agricultural products. After entering the 21st century, with the rapid development of China’s economy and the improvement of people’s living standards, the culture of urban consumerism has gradually emerged. Capital began to invest in the construction boom in the countryside, and the countryside landscape and rural culture have become “commodities” to be sold. With the increase in the length of stay of urban residents in the suburbs, rural accommodation services have come into being, and homestays have risen. Building on the analyses by Perkins and Akira, this paper classifies the commercialization of RSC in China into four categories (Figure 1): agricultural product-oriented commodification (APOC), farm housing commodification (FHC), tourism-oriented commodification (TOC), and construction land commodification (CLC).

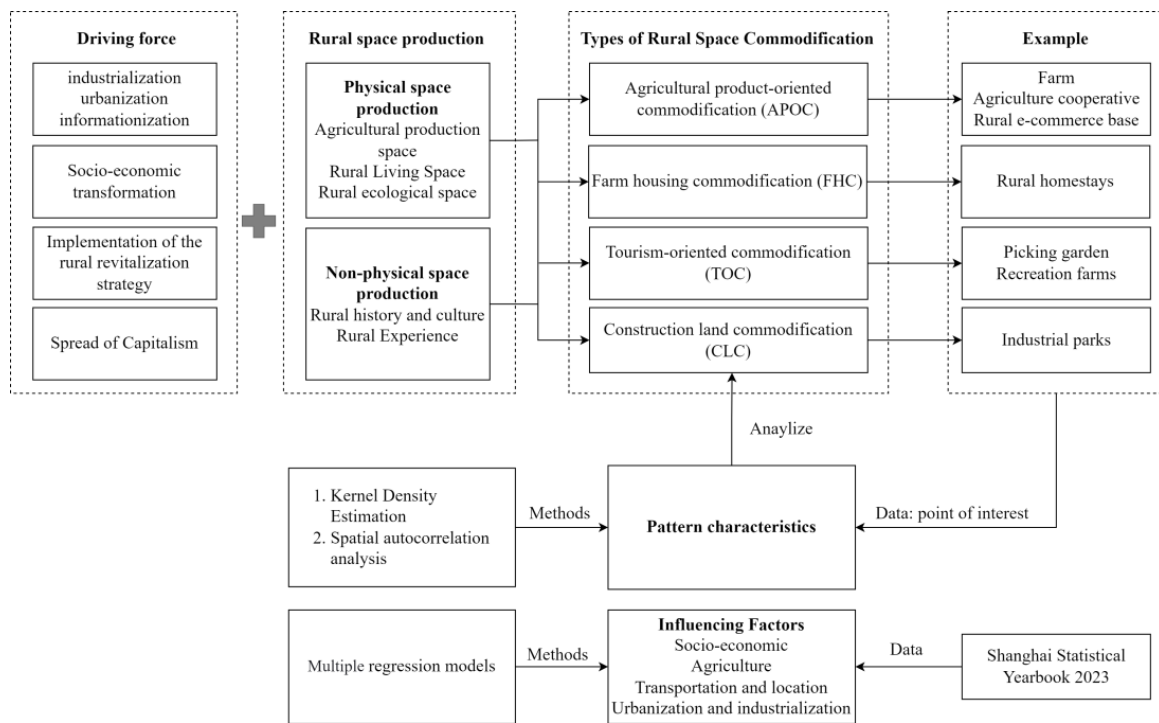


Figure 1. The conceptual framework of RSC.

Among them, APOC reveals the tendency to scale up and industrialize agricultural production based on production space. In this instance, the traditional production mode exhibits characteristics such as scaling up, intensification, and specialization. Traditional agricultural goods become commodities with consumption value [6]. Family farms and agricultural cooperatives aggregate large amounts of land and invest heavily in infrastructure. Innovative farming methods are also examples of this type of farm. FHC refers to the transformation of rural houses into homestays, mainly with accommodation functions, some of which include catering functions. This commodification relies on city dwellers’ longing for rural life and nostalgic feelings for idyllic landscapes, especially when rural symbols and traditional ways of life are associated with it [43,45,46]. Urban dwellers usually stay in this type of village for 1.5 days or more. Examples of this type include rural B&Bs. TOC is also associated with transferring the value of rural space. However, by creating and decorating the rural environment, it offers aesthetic and experiential consumption, serving as a rural leisure and tourism destination. The primary characteristics of this type in China are leisure farms that emphasize fruit picking or agricultural experiences. City dwellers usually stay in this type of countryside for 0.5 to 1 day. CLC is linked to the transfer of urban investments to rural communities. Due to the uneven development of urban and rural land usage, rural areas can attract external investment due to their low land rent and potential for significant returns. As a result, rural construction land is being progressively utilized to establish secondary industries, such as industrial parks.

2.2. Factors Motivating the Commodification of Rural Space: A Theoretical Analysis

RSC refers to rural transformation due to government regulation (policy guidance and planning) and socio-economic factors. To seek the driving factors for RSC in an observable way, concerning the results of related studies and taking into account the accessibility, continuity, and authority of the indicators, this study categorizes the driving elements into four primary classifications: socio-economic factors, agriculture, transportation and location conditions, and urbanization and industrialization factors.

Socio-economic and demographic factors are closely related and critical determinants of the location of new development in rural areas. The drivers of demographic factors

are typically measured by total population and demographic characteristics. Densely populated areas are the most desirable for developers due to their current and future parcel advantages [47]. The demographic age composition is crucial when making capital investments [48]. The presence of a labor force suitable for a specific age group impacts the investment plans of developers and companies, indirectly influencing the development of rural areas. The disposable income per capita of rural residents is an essential indicator of the population's standard of living. It not only affects farmers' choices regarding the use of rural space and livelihoods but is also an important indicator in policymakers' assessment and adjustment of subsidy distribution policies, which impacts the entire trajectory of rural development [49,50].

Agriculture conditions are regarded as a factor influencing the transformation of agricultural production space. A study demonstrated a direct correlation between the availability of arable land and the development strategies of rural areas. Villages with ample arable land resources are more likely to pursue an efficient and high-quality production approach [51]. Furthermore, the allocation of agricultural resources is influenced by factors such as agricultural capability and planting structure, which subsequently impact rural space utilization. Agricultural overcapacity can lead to the re-release of agricultural resources and their diversion to multifunctional uses [52,53]. The number of employees in the primary sector and agricultural GDP are used to measure agriculture capacity. They are used to explain agriculture's size and productive capacity in terms of labor input and economic output, respectively.

Transportation and location factors, such as the distance to the city center and the total mileage of roads within the township unit, influence the efficiency of people and material interchange across areas. Spatial differences in location lead to different rural transformation characteristics. Multiple studies have discovered that favorable location conditions can improve transitioning and upgrading rural industries. For instance, rural tourism typically focuses on locations close to urban areas with access to public transit [54]. The closer a village is to a city or regional center, the more it can save transportation costs and facilitate the introduction of capital, talent, technology, and other factors to the town [55].

Urbanization and industrialization factors, such as revenue and gross industrial output value above a certain scale, influence rural spatial evolution. In the early stages of urban development, jobs were usually concentrated in the CBD area. Due to the progress of urbanization and industrialization, urban areas are expanding swiftly, and their functions are extending into the surrounding rural areas of metropolitan regions. The primary factor determining rural spatial function is the value of rural space. Agricultural production areas with high value are unlikely to be converted for urban use. Therefore, the value of rural space typically determines the extent of urban spatial expansion [56–58]. On the other hand, when all else is equal, lower spatial values attract more dispersed development [57]. People typically use inexpensive and sparsely populated land for development [59]. Rural built-up areas with low value are more prone to development if they possess a significant potential value when transformed for alternative purposes, such as establishing industrial parks by corporations in rural areas.

3. Materials and Methods

3.1. Study Area

Shanghai is a megacity in China (Figure 2), with a municipal land area of 6340.5 square kilometers. By the end of 2022, the study area included nine districts (Chongming, Jinshan, Pudong, Jiading, Songjiang, Baoshan, Minhang, Fengxian, and Qingpu), with a total of 101 townships and 55 street offices, and a resident population of 24,758,900 people, with 2,034,800 people in rural areas. The total agricultural output value is CNY 27.353 billion, and the per capita disposable income of the city's residents is CNY 79,610.

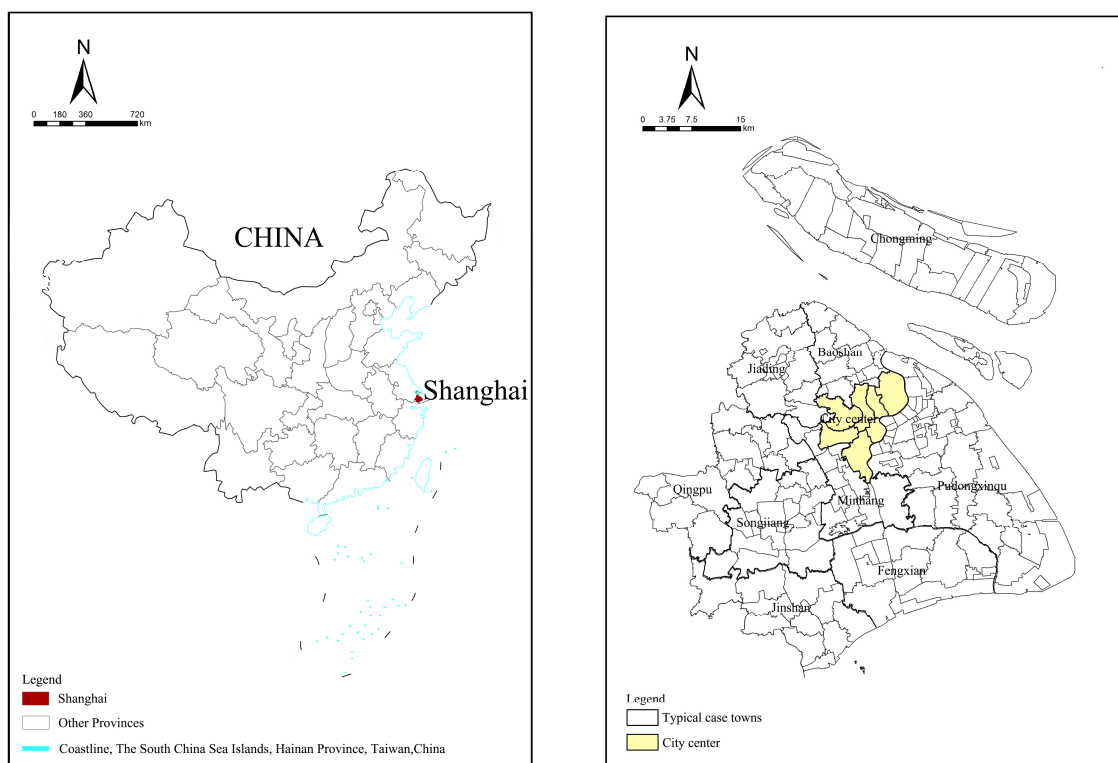


Figure 2. The study area of Shanghai City. Note: the map of China is from the official website of the Ministry of Natural Resources of China; the approval number is 4070671157; the base map is not modified.

The typical significance of Shanghai as a case for this study is threefold:

First, Shanghai has differentiated natural environmental conditions. Shanghai is located in the Yangtze River Delta, an inseparable part of the Taihu Lake basin. It is the northeastern extension of the ancient land of Jiangnan in the estuarine region of the Yangtze River. The basic pattern of the topography and geomorphology of the Shanghai area can be divided into the western lakes and marsh plain area, the eastern coastal plain area, and the estuarine sandbar silt area. The western lake and marsh plain area is distributed in Jinshan, Qingpu, and the western part of Songjiang, with low-lying terrain, wide and deep rivers, and intertwined ditches. The eastern coastal plain has a higher terrain, with rivers and canals. The estuary sandbar silt zone is in northeastern Shanghai, including the Yangtze River Estuary and Chongming. The regional terrain is flat.

Secondly, Shanghai is a modern international city that has emerged recently. As Shanghai enters a mature and stable development stage in the late stages of urbanization, there has been a gradual “commodification” of rural spaces. In 2017, the 19th CPC National Congress proposed revitalizing rural area, and Shanghai responded positively to the country’s call for a megacity rural revitalization strategy in 2021. The city’s revitalization should highlight economic, ecological, and aesthetic value requirements and the “three parks” project, including beautiful homes, green fields, and happy paradises. Rural construction and development actions have attracted capital to the countryside. The internal structure of the countryside has undergone significant changes, with the metropolis’s suburban space transforming from providing agricultural products to having diversified and compound functions such as tourism, study, and consumption and from a subsidiary function to a core function. Shanghai’s countryside is no longer a mere agricultural production base but is becoming the cradle of innovation and development of secondary and tertiary industries in the new era.

Thirdly, as a leading economic powerhouse and megacity in China, Shanghai is well positioned to take the lead in promoting rural revitalization and serves as a key benchmark for the revitalization of countryside areas in metropolitan regions across the country. The future development of Shanghai's countryside is expected to be comparable to that of developed Western countries. Through this study, we explore the development model of RSC in developed regions of China and provide references for promoting the effective and efficient utilization of rural land in metropolitan areas of China, enhancing the efficiency of the rural spatial organization and hence facilitating the sustainable rejuvenation of rural areas.

3.2. Data Source

This study focuses on 101 administrative townships outside the central city of Shanghai. These townships are considered the study unit. The essential data for this work include RSC representation data, agricultural and socio-economic data, and fundamental geography data.

(1) The Representation data of RSC for this study include points of interest from online maps. Geographic points with distinct property fields (name, category, type, and location) are collected through keyword searches via the API (Application Programming Interface) provided by AutoNavi Map, one of the major online mapping service providers in China. Central urban areas (Huangpu, Xuhui, Changning, Jingan, Putuo, Hongkou, and Yangpu) were excluded to focus on rural POIs (points of interest) around Shanghai. The main search terms for APOC are "cooperatives" and "e-commerce", "B&B" for FHC, "recreation farm" and "picking garden" for TOC, and "industrial park" for CLC. In total, there are 6462 data points consisting of APOC (855 POIs), FHC (1817 POIs), TOC (3064 POIs), and CLC (726 POIs) (Table 1).

Table 1. Representation data of RSC.

Category	Symbol	Variables	Definition	Total Number of POIs
APOC	Y1	cooperatives	An economic organization formed by farmers or producers of agricultural products	855
		e-commerce	Trading mainly in agricultural products through the Internet	
FHC	Y2	B&B	A small accommodation facility operated by rural residents or private owners that provides accommodation services	1817
TOC	Y3	recreation farm	Visitors to the farm for leisure, entertainment, education, and rural experience, including restaurants	3064
		picking garden	Fruit and vegetable picking experience garden	
CLC	Y4	industrial park	An industrial park dominated by industrial industries	726

(2) Agricultural and socio-economic data were obtained from the following sources: Shanghai Statistical Yearbook 2023, Songjiang Statistical Yearbook 2023, Chongming Statistical Yearbook 2023, Baoshan Statistical Yearbook 2023, Fengxian Statistical Yearbook 2023, Jinshan Statistical Yearbook 2023, Minhang Statistical Yearbook 2023, Qingpu Statistical Yearbook 2023, Pudong Statistical Yearbook 2023, Jiading Statistical Yearbook 2023, Minhang Statistical Yearbook 2023, Pudong Statistical Yearbook 2023, and Jiading Statistical Yearbook 2023.

(3) The primary geographic data of this study were obtained from the Resource and Environmental Science Data Center of the Chinese Academy of Sciences. This paper mainly used the boundary data of cities, districts, and townships; road data were obtained from OpenStreetMap (OSM).

3.3. Methods

The spatial pattern and driving elements of RSC were analyzed using the following methods:

3.3.1. Kernel Density Analysis

Kernel density analysis primarily calculates the distance between the estimated element and the sample element to determine the probability density value. This method uses the spatial attributes of the data samples to study the characteristics of spatial distribution. It provides a more accurate depiction of clustering levels in the distribution of RSC and the effects of distance attenuation [60].

The formula is as follows:

$$f(x) = \frac{1}{nh} \sum_{i=1}^n K \frac{x - x_i}{h} \quad (1)$$

where $f(x)$ represents the kernel density function at a specific spatial position x ; h is the analysis range threshold, which is the search radius. K is the default spatial weight kernel function. $x - x_i$ indicates the distance from the valuation point to the output grid. This paper utilizes the kernel density analysis module in ArcGIS 10.8 to examine the kernel density of several forms of rural spatial commodification features in Shanghai.

3.3.2. Spatial Autocorrelation Analysis

Moran's I , also referred to as the spatial autocorrelation index, is calculated based on the spatial distribution of elements and the qualities associated with them. Spatial autocorrelation encompasses both global and local spatial autocorrelation [61]. Global Moran's I quantifies the level of spatial clustering of an element across the entire region. At the same time, Local Moran's I examines the spatial clustering patterns within the region and its neighboring regions, revealing the spatial distribution of high and low values of the attribute being analyzed. Anselin Local Moran's I , also known as LISA map, is a visualization tool used to depict clusters and outliers.

3.3.3. Multiple Regression Model (OLS)

Data standardization and dimensionless normalization are required. In order to eliminate the influence of magnitude and dimensions, the raw data (independent variables and dependent variables) need to be standardized. Then, dimensionless methods were adopted to ensure that all normalized data were positive and could be calculated. The calculation formulas are as follows:

$$X' = \frac{X_{ij} - \text{Min}X_{ij}}{\text{Max}(X_{ij}) - \text{Min}(X_{ij})} \quad (2)$$

where X_{ij} is the value of the "j" indicator of the "i" sample, $i = 1, 2, 3 \dots n$; $j = 1, 2, 3 \dots m$. $\text{Min} X_{ij}$ is the minimum index of column j ; $\text{Max}(X_{ij})$ is the maximum index of column j .

The multiple regression model (OLS) is employed to evaluate the variables that impact RSC. This study employed the density of RSC points in Shanghai townships as the dependent variable (Table 1). Furthermore, ten independent variables were chosen, considering data from four distinct categories: socio-economic, agricultural, transportation and location, and urbanization–industrialization circumstances (Table 2).

Table 2. Indicators for analyzing the driving factors of RSC.

Category	Symbol	Variables	Definition	Unit
Socio-economic	X1	Total population	The population of the township	One person
	X2	Aging population rate	The percentage of the aging population	%
	X3	Rural dwellers' per capita disposable income	The per capita disposable income of rural residents	Yuan (CNY unit)
	X4	Number of employees in the primary sector	The number of employees in the primary sector	One person
Agriculture	X5	Cultivated area	The cultivated land area of the township	Hectares
	X6	Agricultural GDP	Total agriculture output	CNY 10,000
Transportation and Location	X7	Total road mileage	The total mileage of roads within township units	Meter
	X8	Distance to the city center	Distance between the township and the city center	Meter
Urbanization and Industrialization	X9	Revenue	Township fiscal revenue	CNY 100 million
	X10	Gross industrial output value above scale	Total output value of industries above township size	CNY 100 million

4. Results

4.1. Rural Spatial Commodification Distribution

The density map provides a visual representation of the overall distribution pattern of RSC. In Figure 3, the densities of RSC data points in townships were computed and classified into five classes by the natural breaks method, including very high, high, medium, low, and very low. The four categories of RSC have a distinct core–periphery pattern, characterized by concentrated high-density regions in metropolitan centers and rural locations with unique benefits. At the same time, the distribution of RSC levels also shows a clear divergence trend. Certain regions have significantly higher levels of commodification than others, creating an uneven distribution pattern. It can be seen that among the four types, high-density and very high-density areas account for a relatively high proportion of RSC, APOC, TOC, and CLC. In contrast, FHC high-density and very high-density areas account for a relatively low proportion.

APOC was mainly distributed in the middle and far suburbs (Chongming, Baoshan, Jiading, Pudong, Minhang, Fengxian, Qingpu, and Jinshan). Since the early 1990s, with the accelerated expansion of land used for the construction of urban built-up areas, industrial parks, and infrastructure, agricultural land has been continuously transformed into non-agricultural land. Consequently, the shrinkage of agricultural land has accelerated, and the center of agricultural production has gradually shifted to the middle and far suburbs.

FHC was mainly distributed in Pudong, Chongming, and Qingpu. Shanghai is a typical Jiangnan water town, rich in ancient towns, water towns, old streets, ancient cultural sites, and natural scenery of fields. There is a good foundation for revitalizing the idle houses of farmers. In 2018, the Shanghai Municipal Government issued the “Guidelines on Promoting the Development of Rural B&B in the City”. Social capital showed strong interest in utilizing farm buildings for investment and construction. Relying on the geographical advantage of Chuansha Town in Pudong, which is close to Disneyland, relevant enterprises have created modern B&Bs with different styles and themes. B&Bs in Chongming are mainly concentrated in Jianshe town. Hongqiao Village in Jianshe town is adjacent to the national 4A level tourist attraction Dongping National Forest Park. The villagers organized the group management of lodging, catering, picking, and agricultural product sales functions within a single village-style B&B group. Several B&B clusters have also been formed in the three towns of Qingpu. This phenomenon is similar to that observed in villages in other parts of China. For instance, most of the B&Bs are located around major tourist attractions in Chongqing, China [25].

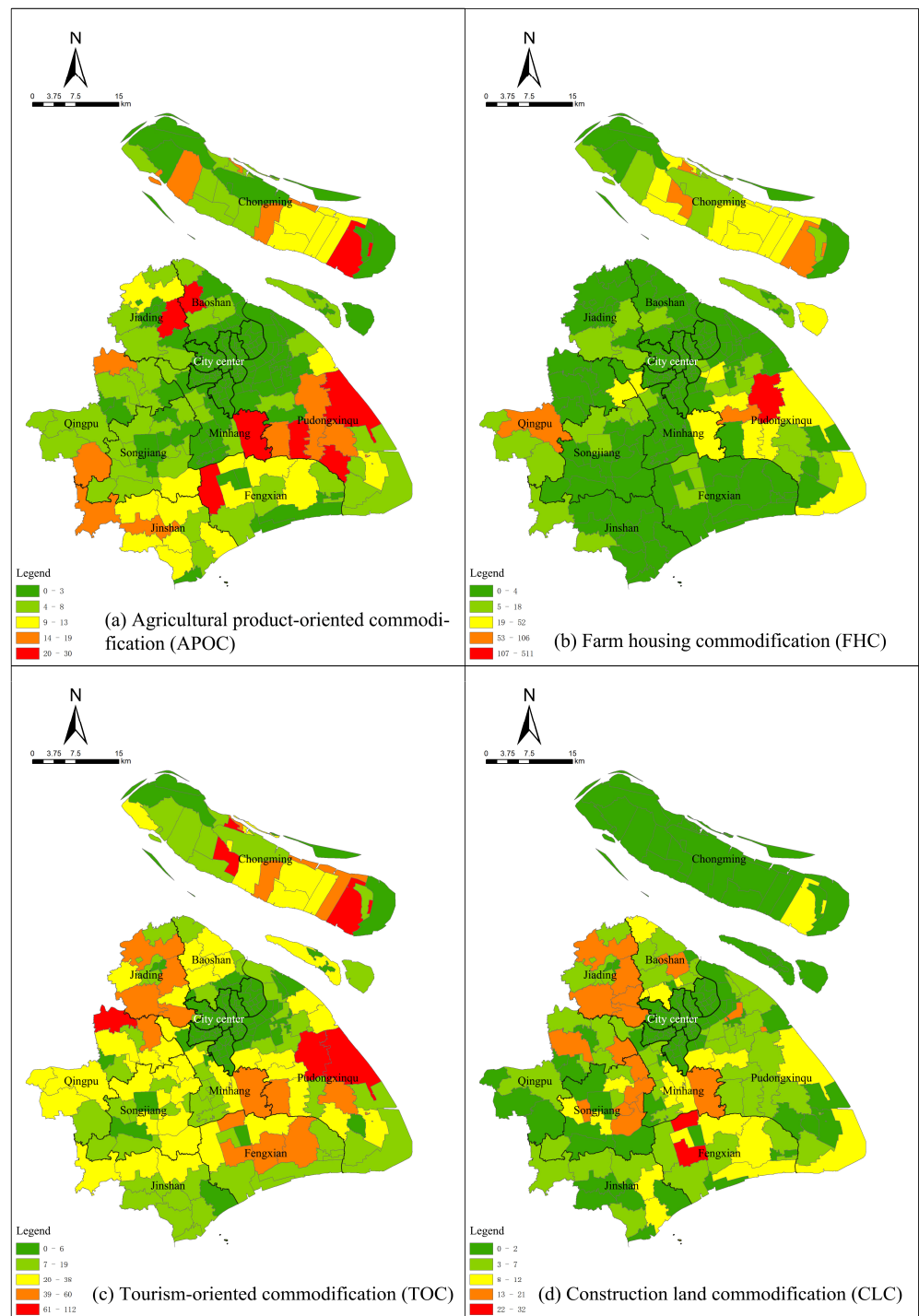


Figure 3. A map showing RSC density on a township level.

TOC occurred in the middle and outer suburbs, mainly including Jiading, Chongming, Pudong, Fengxian, Minhang, and Qingpu. The middle and outer suburbs of Shanghai are rich in natural resources, have high environmental quality, and retain more traditional rural culture and folk customs. TOC develops quickly near tourist attractions. In Indonesia and Shijiazhuang, China, the commercialization of rural landscapes was driven by the establishment of parks [53,62].

CLC mainly occurred in suburban townships, including Baoshan, Jiading, Qingpu, Songjiang, and Fengxian. The land cost in the peripheral urban areas is relatively low compared to the central urban areas, allowing enterprises to obtain larger production space at a lower cost. Transportation is more developed, providing convenient conditions for logistics and transportation in industrial parks. Constructing industrial parks can attract enterprises in related industrial chains to gather, form industrial clusters, and improve industrial competitiveness and innovation.

RSC shows a contiguous and centralized development, which reflects the significant influence of regional conditions in the commodification transformation. Under the combined influence of natural geography, policy environment, transportation location, and economic development level, the development of RSC shows an unbalanced and polarized pattern.

4.2. Spatial Autocorrelation of Rural Spatial Commodification

4.2.1. Global Moran's I Analysis

The Global Moran's I of the four types of RSC in Shanghai are all higher than 0, indicating positive spatial autocorrelation. Positive Moran's index values > 0.10 and p -value < 0.01 for three types of APOC, TOC, and CLC indicate an aggregation pattern of these types of commodification at the township scale (Table 3). It implies that the commodification of these types creates beneficial connections and interactions between adjacent townships and that townships with significant levels of development impact the growth of neighboring townships. In contrast, the spatial autocorrelation of FHC was not apparent, as shown by the Moran's I value of 0.0397. The result unveiled a random distribution pattern of FHC.

Table 3. Results of global spatial autocorrelation analysis.

	APOC	FHC	TOC	CLC
Moran's I	0.317453	0.039790	0.364269	0.270525
Z score	20.640797	3.901126	23.732025	17.670547
p -value	0.000000	0.000096	0.000000	0.000000

4.2.2. Local Moran's I Analysis

LISA clustering diagrams can be used to further visualize the clustering effects of different types of RSC in different townships of Shanghai, and LISA clustering includes four types: High-High and Low-Low belong to positive spatial autocorrelation with homogeneity and Low-High and High-Low, which belong to negative spatial autocorrelation with heterogeneity. Through analysis, the agglomeration characteristics of RSC in Shanghai are shown in Figure 4.

In the case of TOC, the spatial autocorrelation is the strongest. There is apparent spatial heterogeneity. The H-H clusters were dispersed across Pudong, Chongming, Jiading, and Qingpu. Due to the proximity to the central urban area and the more developed infrastructure, the population is distributed centrally, and rural tourism development is rapid. The spatial autocorrelation of APOC is second, and H-H clusters were primarily concentrated in Pudong, Fengxian, Jinshan, and Chongming. The spatial autocorrelation of CLC is in third place, with H-H clusters distributed in a semicircle from northwest to southeast around the downtown area of Shanghai, including Baoshan, Jiading, Qingpu, Songjiang, Minhang, Fengxian, and Pudong. CLC is evident due to the influence of location factors and the industrial development plan. The spatial autocorrelation of FHC is the weakest. Pudong and Chongming were the primary areas where H-H clusters were predominantly found.

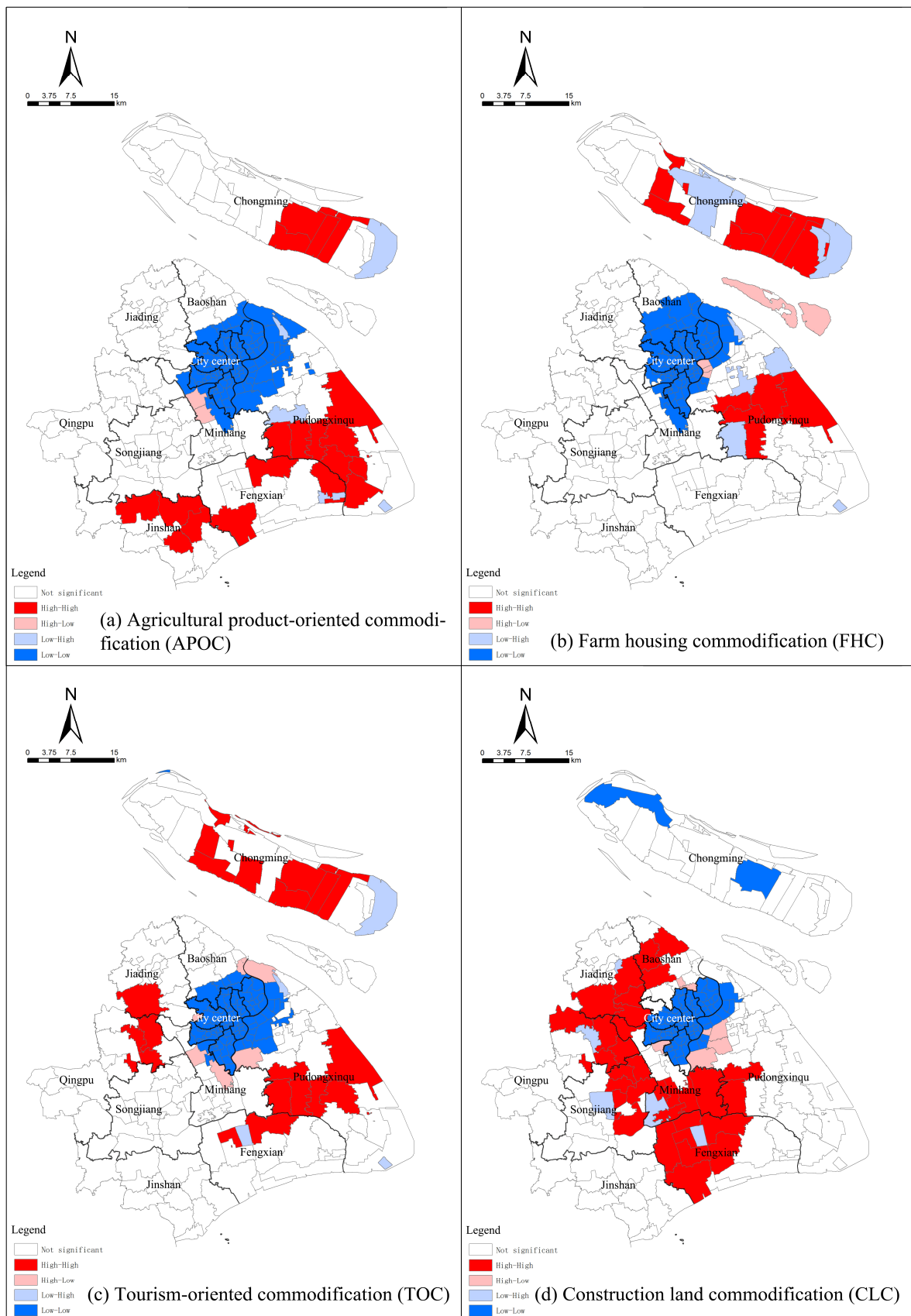


Figure 4. LISA cluster map for RSC.

4.3. Factors Affecting the Rural Spatial Commodification

Based on the above spatial analysis, this study further analyzed the main factors affecting the spatial distribution pattern of various types of RSC using the OLS model. Before building the model, data were first standardized. The variance inflation factors (VIFs) of all independent variables were initially assessed, revealing that all VIFs were below 3, indicating the absence of multicollinearity among the independent variables; this establishes the reliability of the model's conclusions. Table 4 shows the results of OLS. Overall, the adjusted R^2 values reached 0.32, indicating that the model fits RSC satisfactorily. Among the four types of RSC, the CLC model demonstrates superior explanatory capability, as evidenced by its highest adjusted R^2 value of 0.503.

Table 4. Multiple regression analysis of RSC.

Variables	APOC	FHC	TOC	CLC
Socio-economic factors				
Total population	−0.010	3.587 *	0.595	0.112
Aging population rate	0.066	−2.691 *	−1.275 **	−0.068
Rural dwellers' per capita disposable income	−0.131	0.949	0.388	0.075
Number of employees in the primary sector	0.270 **	−3.423 ***	−0.728 *	−0.193 *
Agriculture factors				
Cultivated area	0.153 *	−0.691 *	−0.158 *	−0.006
Agricultural GDP	0.490 **	−2.197	−0.317	−0.125
Transportation and Location				
Total road mileage	0.342 *	0.095	1.405 **	0.476 ***
Distance to the city center	0.186	−0.266	−1.031 *	−0.167
Urbanization and Industrialization				
Fiscal Revenue	−0.112	1.197 **	0.087 **	0.040
Gross industrial output value above scale	−0.157 *	−1.051 **	−0.197 *	0.006
_cons	−0.179	3.030	2.077 ***	−0.239
adj. R^2	0.451	0.328	0.408	0.503

Note: *, **, and *** indicate significant values at the 10%, 5%, and 1% levels, respectively.

The OLS analysis identified a link between RSC and agricultural, transportation location, and socio-economic factors. Among the socio-economic factors, FHC has a significant positive correlation with the total population. As the economy develops, the infrastructure and living conditions in rural areas are improved, attracting more people to return or move to the countryside. This population growth drives the demand for farmhouses, and a larger population attracts capital to invest in housing development and renovation, which in turn promotes FHC. FHC and TOC are significantly and negatively correlated with the aging population rate. The development of B&Bs and the tourism industry usually requires a large number of laborers. In particular, it provides young people with opportunities for entrepreneurship and employment. The government's rural entrepreneurship support policies also attract and retain young people, so these villages have a relatively high proportion of young people in their population structure. The number of employees in the primary sector is positively correlated with agricultural products. In the villages, after the crops are matured, villagers engaged in the primary industry will further process the crops to turn them into commodities with exchange value. Therefore, employment in the primary industry has a significant impact on its commodification. In contrast, employment in the primary industry has a significant negative correlation with FHC, TOC, and CLC because the secondary and tertiary industries dominate all three types of commodification.

Regarding agricultural conditions, the cultivated area is positively correlated with APOC but negatively correlated with FHC, TOC, and CLC. The larger the area of cultivated land, the more crops can be grown, and more agricultural products can be produced. The concentration and specialization of agricultural activities will reduce the space for other

non-agricultural activities. Gross agricultural output is positively correlated with APOC and has no significant correlation with FHC, TOC, or CLC.

Regarding transportation and location factors, total road mileage within the township unit has a significant positive effect on APOC, TOC, and CLC. The results show that the more roads within the township unit, the more accessible it is, which facilitates the movement of people, goods, and money. Distance to the city center has a significant adverse effect on TOC. This result can be explained by the fact that TOC relies mainly on tourist attractions, idyllic landscapes, and the experience of living in the countryside in their original form to attract customers, usually far from urban centers.

In terms of urbanization and industrialization factors, fiscal revenues are positively correlated with FHC and TOC. The development of FHC can drive local employment and increase job opportunities. Increased employment means more personal income tax and social security contributions, which are also an essential part of fiscal revenues. TOC includes other services such as catering, shopping, and entertainment. All of these consumption behaviors bring additional tax revenues to local governments. The gross industrial output value above the scale is negatively correlated with APOC, TOC, and FHC. The gross industrial output value above the scale is positively correlated with IPOC. The development of industrial parks requires a large amount of resources, such as land and energy, which limits the rural spatial resources needed for the development of the other three types of commercialization.

5. Discussion

5.1. Causes for Spatial Aggregation of RSC

The spatial aggregation analysis reveals a positive autocorrelation among APOC, FHC, TOC, and CLC, which means these four types have a strong aggregation effect at the township level. At the planning level, implementing China's rural revitalization strategy and establishing the national land spatial planning system have introduced new requirements for village planning. Shanghai has gradually formed a rural spatial governance model guided by a township as the "basic unit". Contiguous development areas with adjacent natural geographical locations, similar cultural characteristics, and similar industrial development have been considered as a whole. As a result, the same type of RSC spreads among neighboring townships, forming a continuous cluster of advantages. In addition, since the implementation of the rural revitalization strategy, Shanghai has created 4 batches of 88 model villages for rural revitalization. The process of RSC in the model villages is also a critical path in promoting rural economic development. The successful paths and experiences of the model villages in RSC have been widely disseminated through the government and the market, inspiring neighboring villages and towns to learn from and imitate them.

5.2. Influencing Factors of RSC

Against the backdrop of rapid urbanization in China, the phenomenon of counter-urbanization first appeared in developed regions [63]. Consumerism plays a vital role in fueling the process of counter-urbanization. In order to pursue a better quality of life and a natural lifestyle [64], urban residents have increased their demand for consumer activities such as tourism, leisure, and entertainment. Rural areas have become more attractive spaces for people to consume. The natural environment, lifestyle, rural culture, and idyllic scenery of the countryside are all essential elements [65]. Currently, RSC is in its start-up phase, with the Chinese government showing great enthusiasm and effective measures. The spread of capitalism is intricately intertwined with state action. RSC strengthens the flow of economic capital [66]. The countryside is transformed and upgraded from a traditional production space to a modern consumption space. RSC can establish a more complex market transaction relationship with the outside and accelerate the exchange of urban and rural elements. In the suburbs of Shanghai, local governments and villagers attracted foreign capital by transferring the use rights of houses and land rentals,

converting farmhouses into B&Bs for rent. Capital is invested in the construction of farms and picking gardens. These rural areas attracted increasingly more people. In Xixinnan Village, Huangshan City, the township government has promoted the intermingling of primary, secondary, and tertiary industries through the commodification of real estate, creative tourism experiences, and nature. RSC preserves the sense of place of ancient architecture and local culture [14].

Moreover, there are examples in China of the commodification of rural land through the transfer of development rights. In Chengdu, multiple levels of local governments have worked together to construct land development rights as a commodity, establishing market institutions to facilitate transactions, which have reconfigured rural land use patterns and changed rural spatial representations. Chongqing's 'land ticket' trading allows individual households or villages to relinquish their housing land, which is then reclaimed into farmland by an authorized company, to gain a TDR quota (the 'land ticket') and trade it in the municipal Rural Land Exchange [12].

The development of counter-urbanization and industrialization has promoted the demand for rural space. Rural enterprises and industries have gradually developed [67]. Urban capital has transformed the unique resources of the countryside into assets, promoting rural industries from agriculture to non-agricultural industries, rural production modes from dispersed rural natural economy to social large-scale production, resource factors from agriculture to non-agricultural and service industries, and from labor-intensive to capital and technology-intensive transformation [68]. CLC has emerged in the suburban villages of Shanghai. On the one hand, urban capital can obtain land with cheaper rent; on the other hand, industrialization generates a significant demand for labor, providing villagers with a large number of non-agricultural jobs, changing the relatively homogeneous situation of the villagers' employment structure, and offering much higher income than agricultural income. This, in turn, provides villagers with an economic basis for pursuing a more comfortable residential lifestyle [69].

5.3. Policy Implication

The movement of capital to the countryside has led to the rise of RSC under the effect of the market economy. The flow and expansion of capital are important driving factors. With the rise of capitalism in China [12], the rural area has shifted from an economy centered on agriculture and manufacturing to one centered on services [70]. Furthermore, the shift has ushered in the transformation of rural space [71].

The essence of capital is the pursuit of capital appreciation, aiming at the reproduction of rural space and the maximization of the value of rural space [72]. In this process, the spatial pattern of rural development gradually changes. However, we must also be aware of the potential risks associated with RSC and be wary of the uncontrolled expansion of capital in the countryside [73]. In order to comprehensively promote the rural revitalization strategy, the government must switch roles in due course to ensure the positive interaction of capital, resources, and rural society. The lack of government regulation in many countries is a cause for deep reflection. In China, the main body of development and construction in rural areas is gradually replaced by the government and corporate capital. Villagers have become subordinate to capital in rural production, construction, and governance. They have lost their primary position and voice in rural development and have become increasingly marginalized.

The hidden plunder of rural land resources by capital has gradually transformed the rural space from a productive space serving villagers to a consumer space serving the urban residents. In the "productionism period", some developed countries, such as Britain, Japan, France, and Australia, faced problems such as agricultural overproduction and environmental decline. In the period after productionism, the leisure tourism area was troubled by such problems as environmental degradation, traffic congestion, and high consumption. Therefore, it is necessary to formulate relevant policies to regulate the entry of capital into the countryside. The government should establish a strict access mechanism,

set access conditions, and make rural investment motivation and capability prerequisites for capital entering the countryside.

Furthermore, it should establish a review system to scrutinize the motivation, operational capability, and development planning of industrial and commercial capital. It should also improve the mechanism for linking the interests of capital and villagers and establish market-based cooperative relationships. For example, if farmers produce agricultural products, capital will mainly establish sales channels to sell them.

5.4. Insights into the Different Types of RSC

RSC is a dynamic process of rural resource reconstruction. RSC is a necessary path and an important guarantee for rural revitalization. Under the market economy, through the combined effects of power, capital, science and technology, enterprises, and other external forces, as well as local endogenous factors such as capable people and land, RSC is cultivated and gradually promoted. In order to sustainably promote and guarantee the high-quality realization of rural transformation and rural revitalization, this study has thoroughly explored rural resources and put forward proposals to promote RSC.

The spatial distribution of RSC exhibits both spatial concentration and polarization. This layout style promotes the development of industrial clusters and strengthens the competitive advantages of rural industries by effectively integrating resources. The government should establish a development and management system tailored to specific geographical conditions. For regions with abundant agricultural resources, where land is often contiguous and farming conditions are superior, efforts should be made to expedite land consolidation and improve cooperation between villages and enterprises. Local enterprises should be encouraged to enhance their technological capabilities to improve the quality of agricultural products. Additionally, innovation in agricultural product development should be fostered to expand scale and brand recognition.

For regions near scenic areas and urban centers, integrated infrastructure and advanced communication networks create convenient conditions for the bidirectional flow of urban and rural resources. By vigorously developing diverse forms of agriculture, such as leisure and experiential agriculture, these regions can promote the deep integration of agriculture with tourism, culture, and health industries. Efforts should be focused on enhancing the quality of rural spaces, enriching rural experiential activities, and improving service quality. Establishing cooperative linkages with scenic areas can facilitate resource sharing and market coordination, leading to the joint creation of tourism routes and products. Continuous marketing and promotion can enhance the visibility and attractiveness of rural areas.

The spatial optimization of rural industrial land can be promoted through agglomeration into industrial parks, the transformation of reserved land, and the reduction in reclamation. Firstly, industrial land with competitive advantages is encouraged to concentrate within industrial parks, facilitating agglomeration and enhancing the scale and competitiveness of specialized industries. This approach aims to promote land use intensification and industrial structure optimization. Secondly, industrial land with locational advantages in rural areas is encouraged to undergo functional transformation. For inefficient industrial land, functional transformation is suggested, with the potential to integrate with rural tourism development. Methods such as villagers' equity participation can be employed to develop rural collective industries, transforming these areas into tourism support facilities, thereby fostering rural leisure industries. Idle industrial land can be repurposed into rural e-commerce hubs or exhibition centers, with benefits shared among villagers. Thirdly, the relocation of and reduction in small-scale, low-efficiency, and spatially dispersed industrial land are promoted to reclaim land, thereby improving the rural ecological environment and enhancing the level of intensive land use. This comprehensive strategy aims to improve the ecological environment of the countryside and enhance the level of intensive land use.

In addition, unique activities in rural areas can be realized by utilizing local resources. For example, the Terakia area in Aoba Ward, Yokohama City, Japan, supports RSC through the symbiosis of rurality and art on the basis of preserving the ecology of the countryside. The nature preservation activities and artistic and cultural activities promote exchanges between city dwellers and farmers and improve the cohesion of rural and urban communities [74].

6. Conclusions

In the context of reverse urbanization and rural revitalization strategies, this paper employs a quantitative analysis method to study the pattern characteristics and driving factors of rural spatial commodification (RSC) around a metropolis, using Shanghai as a case study. It proposes development models and policy recommendations to optimize RSC, offering a new perspective for exploring this phenomenon. The conclusions are as follows:

There are various types of RSC around Shanghai, primarily including four types: agricultural product-oriented commodification (APOC), farm housing commodification (FHC), tourism-oriented commodification (TOC), and construction land commodification (CLC). The overall distribution pattern shows that APOC, TOC, and IPOC account for a higher proportion of high-density and very high-density areas. In contrast, FHC accounts for a lower proportion of these areas. APOC is mainly distributed in the middle and far suburban areas. FHC is mainly found in Pudong, Chongming, and Qingpu. TOC primarily occurs in the middle and far suburban townships. The development of RSC exhibits an unbalanced and polarized pattern.

Regarding spatial correlation, Shanghai's RSC demonstrates positive spatial autocorrelation. There is higher spatial autocorrelation for APOC, TOC, and CLC and lower spatial autocorrelation for FHC.

China's RSC is still in its developmental stage, with existing studies primarily analyzing typical villages from a micro perspective, focusing on the interactions of various types of capital subjects [14,75]. This study introduces the spatial dimension in analyzing RSC, providing insights into the tendencies of RSC around China's developed metropolises. This approach helps to understand the transformation of rural areas in the context of metropolitan development in China. As Woods observed in the West, urban residents in developed regions have sufficient capacity to pay for the commodification of rural landscapes, lifestyles, and experiences [2]. The development of RSC in Shanghai has been driven by both the endogenous needs of the countryside and the external environment, leading to the production of rural material and non-material spaces. Influenced by urban capital, consumerism, social and economic conditions, agricultural factors, location factors, urbanization, and industrialization, different forms of rural spatial commodification agglomeration have emerged.

Taking Shanghai as an example, this paper explores the characteristics of the pattern of RSC around metropolitan areas in developed regions and the driving factors for its formation and development. It proposes development patterns and policy recommendations to optimize RSC. However, this study attempts to analyze the phenomenon of RSC around metropolitan areas in developed regions of China through spatial patterns, and it lacks a comprehensive discussion. The development of RSC in China is still in its nascent stage. It requires more detailed exploration in theory and practice, considering the characteristics and actual situations of villages in different regions of China. Due to data acquisition limitations, this study only selected indicators for the four major influencing factors: socio-economics, agriculture, transportation location, urbanization, and industrialization. These factors are relatively limited, whereas rural society is a comprehensive and complex system. Commodification is structural in the sense that commercial forces and state policies constitute structural power relations to sell things for economic returns. Therefore, the analysis of the commodification of RSC needs to be linked to broader political and economic processes [76]. It should be analyzed in depth from various dimensions, such as policy, rural culture, social values, and villagers' wishes. Therefore, future research

should analyze typical cases at the micro level, combining quantitative and qualitative analyses to investigate the micro spatial features and underlying factors that influence RSC. Additionally, this study adopts a categorical approach to studying RSC. In contrast, RSC is usually not limited to one type, and the synergistic development of different types of RSC is significant for realizing rural revitalization. Therefore, future research should analyze it from a holistic and unified perspective and explore the interrelationships between different types. This study only analyzes the year 2022, and future research can also examine the evolution of RSC from the time dimension to predict future direction and trends.

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