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The Impact of Logistics Industry Development on Resident Consumption: An Empirical Analysis Based on Chinese Macro Data

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Abstract: Logistics has become an integral part of the market economy, influencing the development of various industries and serving as an essential component of people's lives. Against the backdrop of global economic downturn following the COVID-19 pandemic, understanding the effects of China's logistics industry development on resident consumption becomes crucial. This paper employs a simple linear regression model and utilizes provincial panel data from 2005 to 2022 to explore the impact of logistics industry development on resident consumption in China. Furthermore, it employs heterogeneity analysis methods to study this relationship from different regional, temporal, and consumption perspectives. The findings of this study reveal that (1) there is a positive relationship between logistics industry development and resident consumption, (2) the effect of logistics industry development on increasing resident consumption levels is most significant in the eastern region of China, (3) the positive impact of China's logistics industry development on resident consumption increased after the introduction of free shipping by Taobao in 2008, and (4) the positive impact of China's logistics industry development on rural consumption is greater than that on urban consumption.

Keywords: logistics industry, resident consumption, heterogeneity analysis, linear regression, China

1. Introduction

The inception of logistics as a concept traces back nearly a century in foreign contexts, originating in the 1950s. The landscape of logistics has witnessed substantial expansion, thanks to the swift strides in economic development. What once encompassed mere "goods distribution" has now transformed into a holistic management paradigm that seamlessly amalgamates logistics, information flow, and fund flow. It stands as a paramount and economically prudent service model in the realm of international transportation. In 1985, the United States' Council of Logistics Management provided a definition, characterizing logistics as the process that encompasses the strategic planning, adept execution, and meticulous control of the efficient and efficacious flow and warehousing of commodities, services, and associated information from their point of origin to their final destination, all orchestrated with the sole objective of fulfilling customer demands.

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In October 1979, Japanese experts such as Masaru Toki, Vice Chairman of the Japan Council of Logistics, and Professor Zhouji Lin from the University of Tokyo, conducted academic lectures in various cities in China, including Beijing, Shanghai, and Chengdu. They introduced the current status of logistics development and logistics management experience in foreign countries, which had a strong impact in China. As a result, the term "logistics" quickly spread in China.

In 1988, China established the Ministry of Material Supply, initiating special actions for material transportation. With the acceleration of the reform and opening-up process, modern logistics entered a "new era." In the past 15 years, China's logistics industry has grown rapidly, with a significantly expanded coverage, including express delivery represented by companies like SF Express and Yunda, instant delivery represented by Meituan and Dada, and warehousing represented by Best Inc. and CMA CGM. As an economic powerhouse, China's logistics market is immense, with the scale of third-party logistics reaching 240 billion USD by 2018, ranking among the world's leaders. Logistics has become an essential part of China's market economy, connecting various industries, linking thousands of households, and playing a vital role in accelerating economic development and ensuring people's livelihood.

Since entering a new era, China's growth driven by investment and exports has slowed down, highlighting the increasingly dominant role of consumption in economic development. The strategy to expand domestic demand emphasizes the foundational role of consumption in high-quality development. Meeting the strategic significance of consumer upgrading has been reiterated in the context of accelerating the construction of a new development pattern. Promoting the quality and upgrading of consumption is an important measure to adapt to China's high-quality economic development and advance towards becoming a high-income country. Is the logistics industry, a crucial part of today's Chinese market, capable of effectively driving domestic consumption growth?

In consideration of these factors, this study undertakes an empirical examination utilizing Chinese macroeconomic data to investigate the influence of logistics industry growth on household consumption patterns. The primary objective of this research is to assess the existing correlation between the logistics sector and the composition of household expenditure, with the ultimate goal of offering actionable insights that can foster the advancement of both the logistics industry and the broader Chinese society.

2. Literature Review

Among the research relevant to this paper, one category of literature focuses on the development of the logistics industry itself. Cui Yiheng [1] proposed targeted optimization paths for green logistics in rural e-commerce platforms, emphasizing the importance of promoting environmental sustainability. Zou Wenfeng et al. [2] discussed the significance of innovation in modern logistics management in the context of modern enterprise logistics management. They analyzed new characteristics of logistics management in the e-commerce environment and provided specific strategies for innovation and development by systematically analyzing the issues faced by modern enterprise logistics management. Shi Guanqing et al. [3] proposed a methodology for the top-level design of urban smart logistics platforms by analyzing its content, role, objectives, and principles. Luo Rongkun et al. [4] analyzed the current status of agricultural product e-commerce logistics in Guizhou Province and conducted research on the problems and countermeasures in e-commerce logistics development. Huang Feixuan et al. [5] used a survey questionnaire to analyze issues related to rural logistics distribution, transportation networks, logistics infrastructure, and urban-rural transportation systems.

Another category of research relevant to this paper explores the impact effects or influencing factors of the logistics industry. Lu Ersai et al. [6] established a multiple regression model based on factors such as industrial structure, transport structure, and infrastructure construction to analyze the

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influencing factors of logistics cost levels in China. Some studies have proposed the main pathways for achieving sustainable development in China's logistics industry through green and low-carbon technologies [7]. Yang Fengtao [8] empirically studied the impact of cold chain logistics development on China's international trade in agricultural products and provided policy insights for promoting high-quality development of China's agricultural product international trade through the development of cold chain logistics. Deng Meng [9], using JD Logistics as an example, explored the specific impact of digital transformation on enterprise value after in-depth analysis of JD Logistics' journey towards digital transformation, aiming to enrich the thinking of digital transformation for logistics enterprises in China. Wang Jun and Song Jiwei [10] pointed out that the scale and structure of logistics industry development are important influencing factors that lead to a nonlinear relationship between the development of the logistics industry, economic growth, and environmental protection.

Building upon the existing literature, this research is poised to make notable contributions across four distinct dimensions. Firstly, regarding research methodologies, our study will encompass three diverse forms of heterogeneity analysis, specifically delving into regional, temporal, and consumption variations. Secondly, in terms of thematic focus, it's noteworthy that there is a relative scarcity of scholarly articles that center on the comprehensive assessment and analysis of the logistics industry's influence on Chinese household consumption. This paper takes a unique approach, utilizing China's total freight volume as a representative metric of logistics industry development to scrutinize its impact on domestic consumption trends, along with the associated policy implications. Thirdly, we leverage data sourced from the National Bureau of Statistics of China, spanning the years 2005 to 2022. This dataset not only offers comprehensive coverage but also boasts recent relevance, closely aligning with the contemporary socio-economic landscape. It serves as a robust foundation for shedding light on China's overarching economic trajectory over the past two decades, enabling us to draw precise and timely conclusions. Lastly, the backdrop of the global economic downturn post the COVID-19 pandemic accentuates the urgency of our research. In this context, our findings and policy recommendations assume heightened significance, holding both theoretical and practical relevance. They stand to offer valuable insights and solutions, grounded in Chinese experiences, for other developing nations grappling with similar challenges on a global scale.

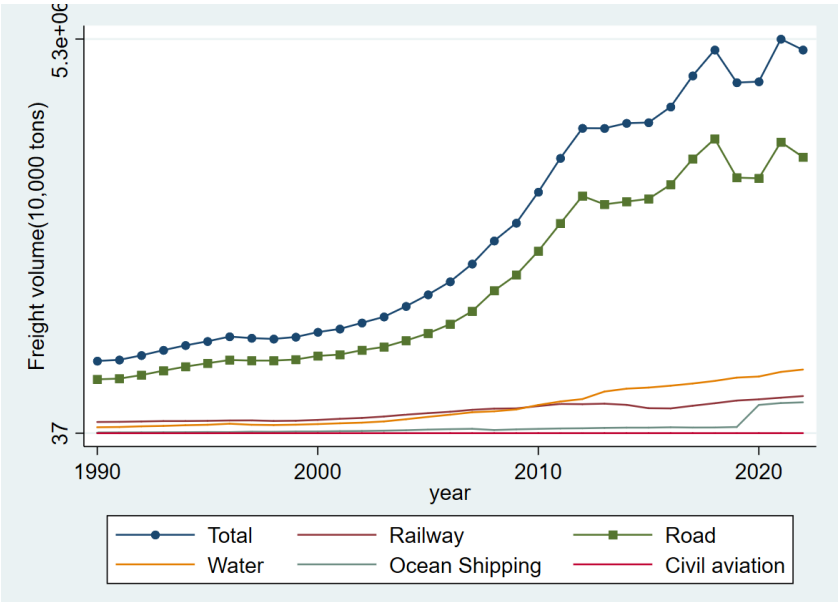

Figure 1: Development Trends of China's Logistics Industry from 1990 to 2022.

Data Source: National Bureau of Statistics

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3. Key Characteristics of China's Logistics Industry Development

Figure 1 reflects the changing trends in China's freight transportation volume and the volume of freight transportation by various modes from 1990 to 2022, which can be used to measure the development trends of China's logistics industry. From Figure 1, it can be observed that China's freight transportation volume has shown a continuous upward trend, rising from 9,706,020,000 tons in 1990 to 51,525,710,000 tons in 2022. During the period from 1990 to 2000, it increased steadily but slowly, while there was rapid growth from 2000 to 2018. After 2019, it experienced significant fluctuations due to the impact of the COVID-19 pandemic. The total freight transportation volume reached its historical highest level of 52,984,990,000 tons in 2021 and its historical lowest level of 9,706,020,000 tons in 1990. Over the past 33 years, the average freight transportation volume in China was 26,814,459,700 tons, with a standard deviation of 15,173,988,460 tons.

Overall, among various transportation modes, road transportation accounts for the largest proportion of the total transportation volume and is the most widely used transportation method.

4. Research Design

4.1. Variable Selection

In this study, the primary focus lies on the resident consumption as the dependent variable. To operationalize this, we employ the level of resident consumption as a proxy variable, aligning with existing research practices. The key explanatory variable at the heart of our analysis pertains to the freight transportation volume, serving as a quantitative measure of China's logistics industry development.

4.2. Data Sources

For the empirical segment of our investigation, we have chosen to examine 31 distinct provinces, municipalities, or autonomous regions within China. The observation period extends from 2005 to 2022, encompassing a comprehensive range of data points. To ensure data reliability, we have meticulously obtained sample data from the National Bureau of Statistics (NBS). In Table 1, we present descriptive statistics of the empirical dataset utilized in our study, highlighting that all empirical data has been subjected to logarithmic transformation to meet the necessary analytical requirements.

Table 1: Descriptive Statistics.

Variable	Unit	Obs	Mean	Std.Dev.	Min	Max
Freight Volume	Million Tons	558	122237	92509	348	434298
Per Capita Consumer Expenditure for All Residents	Yuan	558	14261	8319	2872	48879
Per Capita Consumer Expenditure for Urban Residents	Yuan	558	8732	5108	1658	27483
Per Capita Consumer Expenditure for Rural Residents	Yuan	558	18608	8598	5960	51295

4.3. Model Setting

The research model in this paper is a simple linear regression, as follows:

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$$Y = \alpha X + \beta + \varepsilon \quad (1)$$

Where Y is the dependent variable, per capita consumer expenditure for residents (in Yuan), X is the core explanatory variable, freight transportation volume (in million tons), and ε is the random error term.

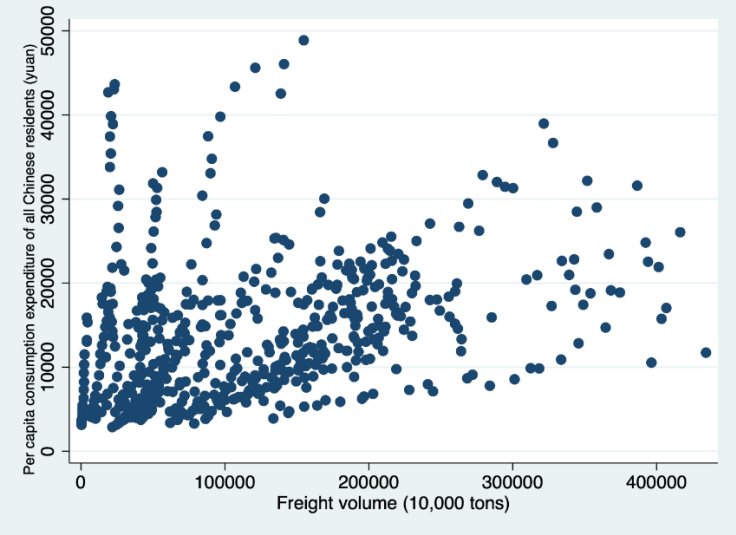

Figure 2: Correlation between Freight Volume and Resident Consumption.

5. Empirical Analysis

5.1. Correlation Analysis

Figure 2 illustrates the relationship between per capita consumer expenditure for all residents in China and freight volume. Preliminarily, the trend observed in the figure suggests that per capita consumer expenditure for all residents in China increases with the growth of freight volume. However, the relationship between per capita consumer expenditure for all residents in China and freight volume needs to be confirmed through regression analysis in this study.

5.2. Baseline Regression

The key findings pertaining to the impact of logistics industry development on resident consumption, as derived from Model (1), are detailed in Table 2. Notably, the estimated coefficient associated with the principal explanatory variable stands at 0.8385, demonstrating statistical significance at the 1% confidence level. Our analysis, underpinned by a robust dataset comprising 558 observations, provides compelling evidence that, within the context of China, the ongoing progress of the logistics industry exerts an unequivocally positive and substantial influence on resident consumption.

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Table 2: Baseline Regression and Regional Heterogeneity Analysis.

	(1)	(2)	(3)	(4)	(5)
	y	y	y	y	y
x	0.8385***	0.9321***	0.8979***	0.5254***	0.2700***
	(26.6809)	(12.5718)	(14.5718)	(13.3205)	(2.7160)
_cons	-0.0767	-0.9885	-1.4986**	3.5105***	6.3575***
	(-0.2119)	(-1.1431)	(-2.0261)	(8.1292)	(5.6915)
N	558	180	108	216	54
R2	0.7056	0.6424	0.7748	0.8092	0.9761

Note: ***, **, * indicate statistical significance at the 1%, 5%, and 10% levels, respectively, with t-values in parentheses. The same applies below.

5.3. Heterogeneity Analysis

5.3.1. Regional Heterogeneity Analysis

Drawing upon the National Bureau of Statistics' regional classification from 2011, we have partitioned all Chinese provinces into four principal geographical regions: East, Central, West, and Northeast. This categorization enables us to discern the nuanced regional dynamics at play in the relationship between logistics industry development and resident consumption.1 Table 2 features Models (2), (3), (4), and (5), respectively, providing detailed regression results that illuminate the impact of logistics industry growth on resident consumption levels within these distinct regions of China.

The estimated coefficients for the explanatory variables are as follows: 0.9321 for the East, 0.8979 for the Central, 0.5254 for the West, and 0.2700 for the Northeast. Significantly, all these regression outcomes attain statistical significance at the 1% confidence level. These results collectively underscore that the influence of logistics industry advancement is most prominently positive in the East region, followed by the Central region. In contrast, the West and Northeast regions exhibit relatively smaller effects of logistics industry development on resident consumption levels.

5.3.2. Temporal Heterogeneity Analysis

Based on data feasibility, this study used the implementation of free shipping by Taobao in China in 2008 as a time point and divided the sample period into two segments for temporal heterogeneity analysis. Table 3, Models (1) and (2), respectively, report the regression results for the impact of China's wage levels on economic growth in 2005-2008 and 2008-2022, with estimated coefficients of 0.3466 and 0.8015, both of which are statistically significant at the 1% level. The regression results indicate that the positive impact of China's logistics industry development on resident consumption levels increased rapidly after the implementation of free shipping by Taobao.

[1] The eastern region is comprised of ten provinces, encompassing Beijing Municipality, Hebei Province, Tianjin Municipality, Shandong Province, Shanghai Municipality, Jiangsu Province, Zhejiang Province, Guangdong Province, Hainan Province, and Fujian Province.

In contrast, the central region consists of seven provinces, including Inner Mongolia Autonomous Region, Shanxi Province, Henan Province, Anhui Province, Jiangxi Province, Hubei Province, and Hunan Province.

Moving westward, the western region spans eleven provinces and regions, which encompass Xinjiang Uyghur Autonomous Region, Tibet Autonomous Region, Gansu Province, Qinghai Province, Sichuan Province, Yunnan Province, Guangxi Zhuang Autonomous Region, Ningxia Hui Autonomous Region, Guizhou Province, Chongqing Municipality, and Shaanxi Province.

Lastly, the northeastern region consists of three provinces, namely Heilongjiang Province, Jilin Province, and Liaoning Province. This comprehensive regional breakdown facilitates a detailed exploration of the logistics industry's impact on resident consumption across distinct geographic areas.

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5.3.3. Consumption Heterogeneity Analysis

Based on consumption types, this study divided resident consumption levels into rural and urban consumption categories for consumption heterogeneity analysis. Table 3, Models (3) and (4), respectively, report the regression analysis results for the impact of China's logistics industry development on urban and rural consumption, with estimated coefficients of 0.6195 and 0.7283. Both regression results are statistically significant at the 1% level. The regression results indicate that the impact of China's logistics industry development on rural consumption is higher, while its impact on urban consumption is relatively lower.

Table 3: Temporal Heterogeneity Analysis and Consumption.

	(1)	(2)	(3)	(4)
	y	y	y	y
x	0.3466***	0.8015***	0.6195***	0.7283***
	(5.8614)	(19.8040)	(22.6324)	(20.2224)
_cons	4.8945***	0.4056	2.7235***	0.6634
	(7.6638)	(0.8670)	(8.6835)	(1.6128)
N	93	465	558	558
R2	0.6182	0.6765	0.6964	0.6633

6. Conclusions

Drawing from the empirical findings outlined earlier, this study arrives at several key conclusions: 1. There exists a discernible positive correlation between the advancement of China's logistics industry and the elevation of resident consumption levels. 2. Within the diverse regions of China, the impact of logistics industry progress on enhancing resident consumption is most pronounced in the eastern region, followed by the central region. Conversely, its effect on the western and northeastern regions is comparatively more modest. 3. When segmented across distinct time periods, it becomes evident that the influence of China's logistics industry development on resident consumption levels experienced an upswing following the introduction of Taobao's free shipping policy in 2008. 4. Analyzing consumption patterns, we ascertain that the favorable influence of China's logistics industry development is more pronounced on rural consumption than on urban consumption.

These conclusions yield the following implications: 1. Recognizing the constructive influence of China's logistics industry growth on resident consumption, it is imperative for the government to expedite the establishment of a robust commercial logistics industry system. This strategic move will unlock the latent consumption potential within China. 2. Tailored logistics policies ought to be meticulously crafted and enacted to cater to the distinct needs of various regions in China. Priority should be accorded to expediting logistics industry development in the eastern region, followed by a phased approach to enhancing logistics infrastructure in the central, western, and northeastern regions. 3. A concerted effort should be made to fortify rural road infrastructure, as this will serve as a catalyst for the flourishing of rural logistics, thereby fostering rural development.

While this research chiefly delved into the interplay between the logistics industry and resident consumption in China, it is vital to acknowledge the potential influence of other determinants on resident consumption, which were not within the purview of this study. Hence, future investigations might explore the roles of fiscal policies, developments in the education sector, internet proliferation, and demographic aging in shaping resident consumption patterns in China. For instance, when investigating the impact of educational sector progress on resident consumption, one could consider

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metrics such as the proportion of the population engaged in educational pursuits as a pivotal explanatory variable.

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