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Growth Mechanism in Transformation and Upgrading of Logistics Industry

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Abstract: Despite the crucial contribution of the logistics industry to economic development, existing research has yet to comprehensively explore how the integration of basic and emerging business models fuels growth during the transformation and upgrading process. To address this research gap, this study utilizes provincial panel data from 30 regions covering the period from 2008 to 2022. By employing an intermediary effect model and a moderation effect model, we aim to uncover the underlying mechanisms driving growth. The findings reveal that the logistics industry can be categorized into traditional and emerging logistics elements, with the integration of traditional elements forming the fundamental business model. This foundational model serves as the primary driver of the logistics industry's growth, exerting both direct and indirect influences on its expansion. Moreover, the level of economic development positively moderates these direct and indirect effects. These insights underscore the importance of enhancing infrastructure development, fostering business innovation, and promoting region-specific differentiated growth strategies.

Keywords: growth mechanism; logistics operations; transformation; upgrade industries; regulation effect

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1. Introduction

The logistics industry represents a comprehensive sector integrating multiple functions, including transportation, warehousing, distribution, delivery, and information services. As a critical component of modern economic systems, it plays a pivotal role in facilitating industrial chain extension, value chain enhancement, and supply chain optimization [1]. The transformation and upgrading of the logistics industry are critical drivers of its growth as they enable the integration of traditional logistics elements with emerging technologies and models.

In recent years, China's logistics industry has demonstrated a remarkable growth trend. According to data released by the National Bureau of Statistics, the value added of transportation, warehousing, and postal services increased from CNY 1.9965 trillion in 2008 to CNY 4.9674 trillion in 2022, with a compound growth rate of 6.2 percent. The total social logistics volume increased from CNY 89.9 trillion in 2008 to CNY 347.6 trillion in 2022, with a compound growth rate of 44.8 percent. The volume of freight traffic, cargo turnover, and express delivery business all rank among the highest globally. The 20th National Congress Report of the Communist Party of China has highlighted the strategic imperative of accelerating the development of a robust transportation nation. This perspective is further strengthened by the "14th Five-Year Plan", which emphasizes cultivating new drivers for

the transformation and upgrading of modern logistics. As a critical component of national economic development, the logistics industry has demonstrated remarkable progress in recent years. China's modern logistics sector has achieved substantial milestones, evidenced by the continuous expansion of the logistics scale, the enhancement of operational efficiency, the more effective integration of logistics elements and service resources, and the progressive optimization of the policy environment [2]. However, the industry still faces substantial challenges that hinder its optimal development. Ongoing problems involve the requirement for more substantial measures to cut costs and boost efficiency. There are also structural disparities among different sectors, and despite the industry's large-scale operations, economies of scale are not fully exploited. These constraints have created notable bottlenecks that impede the sustainable growth and competitiveness of the logistics sector.

As China strides into a new era of development, the logistics sector is compelled to undergo timely transformation and upgrading. This evolution is intended to connect production and consumption via advanced logistics systems functioning on a broader and more efficient scale. The industry faces critical responsibilities, including harmonizing domestic and international dynamics, constructing a contemporary industrial framework, and unlocking the latent potential of domestic demand. Understanding the growth mechanisms during the transformation and upgrading of the logistics industry is of significant theoretical and practical importance. Theoretically, it enriches the literature on industrial evolution by providing a new perspective on how traditional and emerging business forms jointly drive growth. Practically, it offers valuable insights for policymakers and industry stakeholders to design effective strategies for sustainable development. Therefore, an in-depth study of the growth mechanisms underlying the transformation and upgrading of the logistics industry holds great significance. Through an analysis of the growth mechanisms in the context of transformation and upgrading, this study aims to provide a comprehensive understanding of how the logistics industry achieves sustainable growth via the integration of basic and emerging business forms.

Currently, the research findings of domestic and international scholars regarding logistics growth predominantly center on the micro and macro aspects. From a micro perspective, research mainly analyzes the impact on logistics growth in terms of input factors. Studies within this domain emphasize the significance of optimizing resource allocation and adopting advanced technologies to enhance efficiency. For example, Zhuckovskaya et al. [3] explore that the promising areas of application of digital technologies in logistics play a significant role in increasing labor productivity and eliminating existing gaps in the management of logistics systems. Based on the competitiveness of EU logistics, D'aleo and Sergi [4] believe that information technology and human resources investment have a significant impact on logistics performance. Wang and Feng [5] take China's four major economic zones as examples to explore the dynamic coordination relationship between energy consumption and carbon dioxide emissions on logistics growth. Through research on the relationship between regional logistics efficiency and economic development across 31 provinces in China, Li et al. [6] verified that factors such as infrastructure levels and the length of logistics chains in different regions have significant impacts on the coupling and coordination between logistics efficiency and economic development. Jhawar et al. [7] explore the enhancing effects of investment and government policy interventions on logistics performance based on a causal loop model. Conversely, from a macro perspective, the research mainly delves into the relationship between logistics development and economic growth from an overarching standpoint. Many scholars have conducted extensive research by employing diverse research methods, which have yielded abundant research findings. For instance, Khadim et al. [8] defined a Cobb–Douglas-type research framework and empirically verified that the logistics development of the China-Pakistan Economic

Corridor (CPEC) has a significant positive impact on the economic growth of both China and Pakistan, as well as the regions along the corridor. This positive impact is observable in both the short-term and long-term scenarios. Zhang [9] utilizes real GDP indices and a logistic function-based quantitative analysis model to conduct an in-depth study on the correlation between regional logistics development and economic growth, quantifying the relationship between the two. Additionally, Katrakylidis et al. [10] employ panel econometric methods and the Toda–Yamamoto causality test to examine the causal relationships between countries' logistics performance, international trade, and economic growth. Xu and Wang [11] use spatial econometric models to reveal that the logistics industry has significant direct and spatial spillover effects on the economic growth of the Yangtze River Delta urban agglomeration. Patunru and Tarsidin [12] believe that logistics is a key constraint on economic growth. It can be clearly seen from these studies that macro-level research generally depends on econometric models to analyze the relationship between logistics and economic growth across different geographical scales and time dimensions. Future research is expected to achieve breakthroughs in expanding research scope, innovating methodologies, and delving deeper into the mechanisms of influence.

The research on the transformation and upgrading of the logistics industry mainly focuses on the fields of value chain and supply chain, modern scientific application and industrial synergy. Studies on value chain and supply chain optimization emphasize the importance of integrating logistics operations to enhance efficiency and reduce costs. For example, Jiang and Wang [13] study the impact of enterprise digital transformation on supply chain stability. They find that the enterprise digital transformation promotes industrial structure adjustment, thereby improving supply chain stability. Saqib et al. [14] developed a new theoretical framework based on technology adoption, technology integration, and sustainable operations. Their work has provided evidence indicating that digital technology innovation can enable companies to improve the sustainability of their logistics operations. Consequently, this helps to promote the development and upgrading of logistics enterprises. Liu et al. [15] conclude that the integration of digital and physical elements, combined with the moderating effects of a green economy, significantly promotes the transformation and upgrading of the logistics industry once certain threshold conditions are met. Zhang et al. [16] explored and found that the development of digital technology has a significant impact on the logistics industry. He et al. [17] conclude that the "Made in China 2025" strategy significantly enhances the high-quality development of the logistics industry by increasing production and service efficiency through independent innovation. From a micro perspective of logistics enterprises, Fan [18] constructed an indicator system for the influencing factors of smart transformation and development across four dimensions: logistics technology innovation, logistics big data sharing, logistics management upgrading, and logistics decision-making transformation. This system explores the micro-factors that influence the transformation and upgrading of the logistics industry. Through a systematic literature review, Bugarčić et al. [19] study the impact of innovation capability and the availability of the latest technologies on the overall logistics performance of countries as well as on various components of international logistics. They demonstrate that multidimensional technological variables have a positive and direct influence on logistics factors. Masadeh et al. [20] explore the impact of blockchain technology on the digitization of express delivery supply chains, exploring the benefits and challenges of applying blockchain technology in express delivery organizations within Industry 4.0 in the context of a circular economy. Taguchi et al. [21] believe that Asian economies should improve logistics performance, increase participation in the global value chain, and avoid premature industrialization.

However, few studies have explored how the transformation and upgrading of the logistics industry, particularly through the integration of traditional and emerging business

forms, contribute to its growth. This study aims to fill this gap by examining the growth mechanisms within the context of transformation and upgrading, focusing on how basic business forms and emerging business forms jointly drive growth.

In conclusion, this study distinguishes itself from previous research by adopting a business forms perspective and utilizing panel data from 30 Chinese provinces spanning 2008 to 2022. The research makes two significant contributions: Firstly, through the utilization of a mediation effect model, this research probes into the channels by which business forms have an impact on the logistics growth. In doing so, it validates the mechanism of business form innovation. Specifically, it uncovers how fundamental business forms stimulate emerging business forms, ultimately driving the growth of the logistics industry. Secondly, this study utilizes both a moderated mediation model and a panel threshold model to explore the dynamic changes in the contributions of different business forms to logistics growth as economic development progresses. The empirical results not only enrich the theory of business form evolution but also provide a solid basis for decision-making in formulating logistics development strategies.

2. Theoretical Analysis of the Growth Mechanism of the Logistics Industry

This study proposes a framework to investigate the growth mechanism of the logistics industry, as shown in Figure 1. The framework integrates traditional logistics elements (basic business forms) and emerging logistics elements (emerging business forms) to explore their respective roles in driving growth during the transformation and upgrading process.

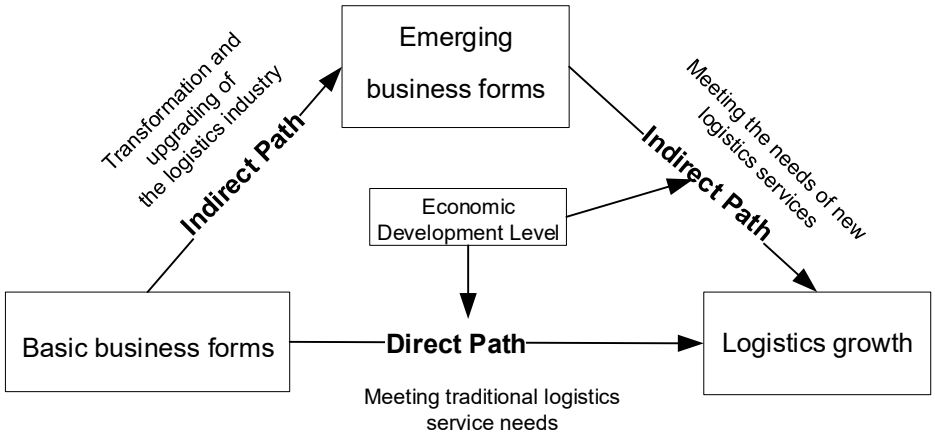


Figure 1. Logistics growth mechanism.

2.1. Factors Driving the Rapid Growth of the Logistics Industry

(1) Transformation and upgrading of the logistics industry

The transformation and upgrading of the logistics industry refer to the process of integrating traditional logistics elements with emerging technologies and models to enhance efficiency, reduce costs, and meet evolving market demands. This process is a critical driver of the industry's growth as it enables the logistics sector to adapt to new economic conditions and technological advancements. The evolving landscape of social and economic development has escalated the demands for logistics delivery, emphasizing timeliness and quality, thereby compelling the logistics industry to embark on a transformative and upgrading journey. Consequently, the industry has transitioned into a new phase of lean development, characterized by a pursuit of high quality, efficiency, and effectiveness. As a service-oriented sector, the logistics industry encompasses various logistics forms, which are essentially different service configurations formed by the amalgamation of diverse logistics elements designed to cater to the multifaceted needs of customers. The logistics ecosystem encompasses two key sets of components. On one hand, it includes traditional

elements such as human resources, infrastructure, and equipment. On the other hand, it features innovative elements that are distinguished by their high value-added capabilities, such as emerging technologies, novel business models, and advanced organizational structures. Based on the composition and integration of these logistics elements, the logistics forms can be divided into basic and emerging business forms.

① The stable development of basic business forms

The basic business form comprises traditional logistics elements, such as labor, transportation infrastructure, and logistics networks. It is characterized by fewer operational links, a single function, and a low degree of integration. These forms primarily provide foundational services, such as transportation and warehousing, which are essential for the stable operation of the logistics industry. The basic business form is the cornerstone of the rapid growth of logistics. Specific indicators are shown in Table 1.

Table 1. System of basic business indicators.

Constituent Elements	Level 1 Indicators	Level 2 Indicators
people	labor	number of logistics employees
equipment	lorry investment	vehicle ownership for road operations investment in transportation fixed assets
facility	logistics network	combined mileage of public, railroad and waterway operations

② Emerging business forms

In contrast to basic business forms, emerging business forms integrate new technologies, models, and market demands, such as smart logistics, e-commerce logistics, and international logistics. It is characterized by high-tech content, high added value, and a high degree of integration. These forms enable the logistics industry to meet evolving market demands and drive innovation through advanced technologies and specialized services.

The key difference between basic and emerging business forms lies in their operational focus and value creation. Basic business forms provide foundational services that ensure the stable operation of the logistics industry. In contrast, emerging business forms drive innovation and growth by leveraging advanced technologies and meeting specialized market demands. Collectively, these forms represent the dual dynamics of tradition and innovation in the logistics industry.

The integration of traditional business models with new approaches aligns with the demands of composite services and has led to the emergence of new logistics forms, such as express logistics, e-commerce logistics, and instant distribution. Models like instant retail and online shopping have also arisen in the context of the digital economy. Overall, the combination of basic business forms and innovative models has molded the logistics landscape, enabling it to more effectively meet contemporary requirements. The new structure is embodied in the change of industrial structure. In the context of industrial structure upgrading, the share of the tertiary industry within the industrial structure is steadily increasing. The service industry is witnessing continuous improvements in its level, with the modern and emerging service sectors growing at a rapid pace. The burgeoning demand for productive and living services has spurred the emergence of emerging business forms such as supply chain logistics and third-party logistics, which are in line with the trend of demand upgrading. Export-oriented economy is the performance of China's economy to open up the market to the outside, and the integration of the new market and the basic business form has led to the emerging business forms such as international logistics, bonded logistics and so on. Therefore, starting from the four new

elements of new technology, new model, new structure and new market, combined with the availability of data, the index system of emerging business forms is constructed, as shown in Table 2. The transformation and upgrading of the logistics industry have the following three characteristics: first, from low value-added to high value-added; second, from low-tech to high-tech; and third, from a single type of service to integrated services.

Table 2. Index system of emerging business forms.

New Elements	Element Performance	Emerging Business Forms	Level 1 Indicators	Level 2 Indicators
new technologies	the Internet	smart logistics	technology market turnover	Total value of projects concluded in the national technology market contracts
	the Internet of Things	Contactless delivery	Internet penetration rate	Number of Internet users/population
new models	instant retail	Instant delivery	express delivery business volume	Total number of all types of express delivery services received and sent by express delivery enterprises
	online shopping	e-commerce logistics	E-commerce sales	Total amount of goods and services actually sold with the help of Internet orders
new structures	adjustment of industrial structure	supply chain logistics	Advanced industrial structure	Value added of tertiary industry/value added of secondary industry
		third-party logistics		
new markets	export-oriented economy	international logistics	External trade dependence	Total import and export/GDP

(2) The improvement of economic development level

The growth of the logistics industry requires not only the promotion of transformation and upgrading but also the pulling effect of the national economy. The demand for logistics services is generated in the development of the economy, and the growth of the total amount of various logistics is realized in meeting the demand for logistics services. Over the past decade, China's economy has maintained steady and rapid growth. The gross domestic product has increased from CNY 59.3 trillion to CNY 121 trillion, with an average annual growth rate of more than 6 percent. Its total economic volume now ranks second globally. The per capita GDP has grown from CNY 43,497 to CNY 85,698. Calculated at the average annual exchange rate, China's per capita GDP in 2022 has exceeded USD 12,000 for two consecutive years. Rapid economic development has created favorable demand conditions for the rapid development of the modern logistics industry. On the one hand, the demand for traditional services still exists in economic growth, and the basic business form meets the needs of traditional logistics. On the other hand, with the rapid growth of new service demand in economic development, emerging business forms meet the needs of new logistics services.

(3) Other factors of logistics industry growth

In addition to the two major factors mentioned above, logistics growth is also influenced by policy, urbanization, finance, information technology and other factors. The logistics industry has a certain dependence on policy. For example, Chen et al. [22] employ a super-SBM combined with the Global Malmquist–Luenberger index and panel regression and threshold regression models to analyze how environmental regulations significantly impact the logistics efficiency in China's Yangtze River Economic Belt. Zhang and Zhang [23] use the propensity score matching-difference in difference (PSM-DID) method to analyze the impact of new urbanization on the development of modern logistics, finding that it has a significant positive influence. Gao [24] uses a two-way fixed effects model to empirically analyze the significant positive impact of digital finance on the agglomeration development

of the logistics industry. Yusof et al. [25] adopt a quantitative approach through surveys to conclude that the integration of Information Technology (IT) in tracking, security, customer service, and overall IT systems significantly enhances the performance of Malaysia's logistics industry.

2.2. Mechanisms for the Growth of the Logistics Industry

2.2.1. Basic Business Forms, Emerging Business Forms and Logistics Growth

This paper focuses on understanding the internal dynamics of the logistics industry, particularly in light of its rapid growth. It explores the relationships between various logistics forms, economic development, and the overall growth of the logistics sector during a period of transformation and upgrading. The study reveals how these factors interconnect and identifies the mechanisms driving growth in the logistics industry. It emphasizes that the primary business model serves as the foundation for this growth and highlights the collaborative role of both established and emerging business models in supporting the logistics industry's expansion. Additionally, the paper outlines two pathways through which different logistics forms can influence the growth of the sector.

First, through the expansion of the number of traditional logistics elements and the improvement of efficiency, the stable development of the basic business form meets the needs of simple services and directly supports the growth of the logistics industry. The logistics industry provides services based on service resources. People, equipment, facilities and other traditional factors of production are the first resources to promote the growth of the logistics industry. On the one hand, the supporting role of the basic business form is reflected in the growth of traditional logistics factors. The scale of labor supply in the logistics industry is increasing, from 5.6025 million people in 2008 to 7.7619 million people in 2022, a relative increase of 2.1593 million people, a total growth rate of 38.54 percent, which provides sufficient human support for the development of the logistics industry. The steady growth of investment by state-owned capital, private capital and foreign capital in roads, logistics parks, ports, yards and stations, etc., has led to the increasing service capacity of the basic business form. On the other hand, the supportive role of the basic business form is evident in the ongoing enhancement of service efficiency. By continuously improving logistics facilities and equipment, we can optimize the transportation structure, reduce logistics costs and fees associated with various transportation modes, and establish a solid foundation for the development of multimodal transport. This improvement also facilitates the transportation of bulk cargo and supports medium- to long-distance transport through methods such as 'road-to-rail' and 'road-to-water'. Key logistics metrics such as energy consumption, response time, and inventory turnover rate reflect these advancements, ultimately leading to increased service efficiency and promoting stable growth in the logistics industry.

The basic business form is evolving in conjunction with new technologies, innovative models, new structures, emerging markets, and other contemporary elements of business. This evolution leads to the development of an emerging business form that meets the demands for composite services and fosters growth in the logistics industry. Firstly, the basic business form is closely linked to this emerging business form. Based on existing research, it is evident that the emerging business form is a combination of the basic business form and new logistics components. After reviewing the literature of the logistics industry system, Koh et al. [26] found that the new capabilities under the new logistics form are divided into four key areas, namely, business, logistics, digital and personal capabilities, with a total of 17 sub-areas. This state-of-the-art framework contributes to academic research by updating the existing capability framework. Mikl et al. [27] put forward new ideas about the emerging business form of the logistics industry and determined a strategy

to deal with digital changes and the digital technology needed for the future logistics environment. Through the systematic analysis and classification of global logistics start-ups, 23 types of digital logistics business models have been organized, and the changes required from the traditional form of the logistics industry to the emerging business form have been systematically analyzed. Poszler et al. [28] propose that more and more deployment of blockchain technology provides promising opportunities for the logistics industry, especially for the new form of the logistics industry, and to some extent provides ideas for the transformation of the traditional form of the logistics industry to the new form.

Therefore, the basic business form is closely related to the new form, which is an extension of the service scope based on the basic service and can provide more value-added services. Moreover, the emerging business forms apply new elements to enhance the comprehensive capability of logistics services in terms of intelligence, timeliness, specialization and internationalization, and drive logistics growth with high-value-added services. First, the emerging business form leverages advanced technology to coordinate and manage the entire logistics process through electronic and networked systems. This approach enhances the overall intelligence of the process, improving communication and efficiency from the initial point of the network all the way to the end customer. Secondly, the new model is designed to cater to the latest market demands. As a result, it brings about the expansion and improvement of business service offerings, while also enhancing the timeliness of logistics services. Third, the new changes in the industrial structure and the international division of labor have greatly expanded the service development space of the domestic and international markets. The emerging business form has met the logistics service needs of the new space and has improved the specialization and internationalization of service capabilities. In summary, within the indirect path mediated by the emerging business form, the emerging business form endows traditional factors with new capabilities through novel factors. It bolsters the capacity of industrial entities in the utilization, allocation, and innovation of factors. In this manner, it spurs the enhancement of service efficiency, expedites the matching and transaction of services (products), generates the ability to offer new composite services, and propels the growth of the logistics sector. The logistics industry depends on traditional elements like infrastructure and labor to provide essential services, directly supporting growth. However, with the progression of technology and the evolution of market demands, these traditional elements combine with novel technologies and models, thereby giving rise to emerging business forms. These emerging forms enhance efficiency and add value, generating new demands and indirectly fueling growth. Consequently, the growth of the logistics industry is propelled by both the direct influence of basic business forms and the indirect influence exerted through emerging forms. Based on the above analysis, this paper proposes the following research Hypothesis 1:

H1: *The driving path of industry on logistics growth is divided into two: one is the direct effect path of the basic business form, and the other is the indirect effect path through the emerging business form, using the emerging business form to produce intermediary effects affecting logistics growth.*

2.2.2. Economic Development and Logistics Industry Growth

The level of economic development affects the direct effect of the basic business form. As economic development progresses, consumer demand evolves significantly. According to Maslow's hierarchy of needs theory, basic logistics services that cater to people's lower-level needs manifest as essential logistics activities that connect the production and consumption fields. These include the fundamental logistics functions that support economic and social production and the operation of daily life. As economic development steadily progresses and improves, the living standards of residents ascend, thereby bringing about significant alterations in their consumption concepts and structures. The

demand for logistics services has shown high-end development characteristics, especially the demand for instant logistics distribution and express delivery services has increased, while the demand for lower-level traditional and simple logistics services has decreased. The reduction in the demand for traditional and simple logistics services has weakened the direct effect of basic business forms on logistics growth. In less developed economies, basic logistics services are essential for economic operations, making the basic business form a key driver of growth. However, as economies develop, the demand for high-value logistics services increases, reducing the relative importance of basic business forms. Based on the above analysis, this paper proposes the following research Hypothesis 2:

H2: *The level of economic development reversely regulates the direct effect between the basic business form and logistics growth; that is, with the improvement of the level of economic development, the basic business form has a weaker effect on logistics growth.*

The level of economic development affects the indirect effect of emerging business forms. Yang et al. [29] use a three-stage DEA model and regression analysis to explore how economic factors, including regional economic development levels and government support, impact the financial needs and growth of strategic emerging industries. They conclude that the level of regional economic development has a significant impact on the development of strategic emerging industries and can expand their demand space. With the improvement of the level of economic development, people's logistics demand is moving from simple traditional logistics service demand to composite logistics service demand, and the demand for personalized products and new composite services is increasing. The process of escalating its demand has put forward new requirements for the supply of logistics services in China. The logistics form has evolved from traditional products, organizations, and business forms to products, organizations, and business forms that integrate new elements. With its professional, refined, and personalized services, the emerging business form meets the need for personalized products and new composite services, and the indirect effect is enhanced. Second, the improvement of the level of economic development will have a positive impact on the integration, combination and allocation efficiency of new elements and facilitate the functioning of the indirect effect. With the improvement of the level of economic development, new changes have taken place in factor conditions, mainly referring to rising costs and changes in factor combinations. Under the background of rapid economic growth, the cost of a series of traditional basic elements such as labor, land and mineral resources is rising, and the profit space of traditional industries and their growth modes is gradually shrinking. The factor input mode that has long supported the growth of the logistics industry in the past is unsustainable, which forces the logistics industry to integrate new elements and adjust the combination of new and old elements. It is conducive to the use of new elements to improve the logistics service ability of emerging business forms to reduce costs, increase efficiency, and drive logistics growth.

New technologies and economic development form a virtuous cycle that boosts logistics growth. Economic development fuels technological innovation, allowing logistics firms to enhance operations with advanced tools. Conversely, technological advancements increase logistics efficiency and competitiveness, further driving economic growth. For example, IoT and big data analytics improve logistics operations and provide data for economic and business strategies. Similarly, e-commerce logistics growth, spurred by tech advancements and consumer demand, creates jobs and stimulates related sectors like manufacturing and retail. As economies develop, the demand for advanced logistics services grows, creating opportunities for emerging business forms that leverage new technologies and specialized services. Developed economies also have better infrastructure and resource

allocation mechanisms, facilitating the growth of emerging business forms. Based on the above analysis, this paper proposes the following research Hypothesis 3:

H3: *The level of economic development positively regulates the back end of the indirect path with emerging business forms as the intermediary variable; that is, the higher the level of economic development, the stronger the role of emerging business forms in promoting logistics growth.*

3. Research Design

3.1. Data Source and Processing

According to the above research hypothesis, the empirical research part uses the panel data of 30 provincial units (except Tibet due to significant data limitations and inconsistencies in the availability of key indicators required for our study) in China from 2008 to 2022. All data are from the China Statistical Yearbook, China Science and Technology Statistical Yearbook, as well as the official website of the National Bureau of Statistics and the official website of the provincial statistical bureaus. To address missing data, we adopted interpolation methods to fill in the gaps. Linear interpolation is commonly used, which allows us to maintain the integrity of the panel dataset without excluding entire observations due to sporadic missing values. In addition to handling missing data, we detected outliers using IQR and z-score analysis, removing those identified as errors or anomalies to avoid skewing results while retaining valid extreme observations to preserve dataset representativeness.

3.2. Model Setting

(1) Mediation Effect Model

This model looks into whether the influence of basic business forms on logistics growth acts directly or is channeled indirectly via emerging business forms. Essentially, it clarifies whether traditional logistics elements drive growth on their own or through intermediaries like smart logistics. According to the influence mechanism of the basic business form on logistics growth, this paper sets the following benchmark model:

$$lnlog_{it} = \varphi + \varphi_1 bbf_{it} + \varphi_2 control_{it} + \mu_i \varepsilon_{it} \quad (1)$$

where i represents the region, t represents the year, $lnlog$ is the logistics growth, bbf is the basic business form, and control is the control variable, i is the fixed effect term of the model, and ε_{it} is the random disturbance term.

Examining the role of emerging business forms in promoting logistics growth is divided into three steps.

The first step is the stepwise regression method. Through the stepwise regression method, on the basis of the benchmark model setting, the mediating effect model is used to test its mechanism of action. In Combination (1), the model is set as follows:

$$ebf_{it} = \alpha + \alpha_1 bbf_{it} + \alpha_2 control_{it} + \mu_i + \varepsilon_{it} \quad (2)$$

$$lnlog_{it} = \varnothing + \varnothing_1 bbf_{it} + \varnothing_2 ebf_{it} + \varnothing_3 control + \mu_i + \varepsilon_{it} \quad (3)$$

where ebf is an emerging business form; φ_1 represents the total effect of bbf on log, $\alpha_1 \times \varphi_2$ is the mediating effect through ebf transmission, and $\varnothing_1$ represents the direct effect of bbf on log. If the mediating variable is unique, the relationship between the coefficients is: $\varphi_1 = \varnothing_1 + \alpha_1 \times \varnothing_2$, that is, the size of the mediating effect can be expressed by the difference between the total effect and the direct effect.

In the second step, the Bootstrap test is carried out. If it is significant, it shows that the mediating effect is significant.

The third step is causal mediation analysis. Because both the traditional mediation effect analysis method and the Bootstrap test determine whether the mediation effect exists through the coefficient significance, they fail to solve the endogenous problem caused by confounding factors in the model. The causal mediation analysis recognizes the existence of confounding factors and tests the degree to which confounding factors will change the mediation effect. It has a natural advantage in overcoming the endogeneity of mediating variables. Therefore, based on the traditional intermediary effect model, this paper makes a preliminary test on the relationship between basic business forms, emerging business forms and logistics growth, and further uses the causal intermediary effect model constructed by Imai, Kosuke, Luke Keele, and Teppei Yamamoto [30] to verify this impact mechanism. The two verify each other and complement each other.

(2) Moderated mediating effect model

This model investigates the extent to which economic development modifies the relationship between basic business forms and logistics growth. It reveals whether higher levels of economic development amplify or diminish the role of both traditional and emerging business forms in driving logistics growth.

To verify the hypothesis of H2 and H3 in this paper and to explore the regulatory role of economic development in logistics growth, based on model (1), this paper introduces economic development variables and the interaction between economic development and basic business forms and emerging business forms. The extended model is set as follows:

$$lnlog_{it} = v + v_1 bbf_{it} + v_2 pgdp_{it} + v_3 bbf_{it} * pgdp_{it} + v_4 control_{it} + \mu_i + \varepsilon_{it} \quad (4)$$

$$lnlog_{it} = k + k_1 bbf_{it} + k_2 ebf_{it} + k_3 pgdp_{it} + k_4 ebf_{it} * pgdp_{it} + k_5 control + \mu_i + \varepsilon_{it} \quad (5)$$

where v and k are all constant terms; v_1 and k_1 are regression coefficients; $pgdp$ represents the economic development of the adjustment variable, and the interpretation of the remaining variables is the same as Equation (1).

(3) Panel threshold model

This model assesses whether the impact of business forms on logistics growth shifts at varying levels of economic development. It seeks to uncover if there is a critical threshold where the influence of traditional and emerging business forms on growth undergoes a significant change.

In order to further verify the hypotheses H2 and H3, the threshold regression model proposed by Hansen [31] is used to explore whether the promotion effect of business forms on logistics growth will change or differ in intensity due to different levels of economic development. On the basis of Equations (5) and (6), the level of economic development is taken as the threshold variable, and the basic business form and emerging business form are taken as the core explanatory variables to construct the following single threshold model.

$$lnlog_{it} = \beta_1 bbf_{it} \times I\{thr \leq \gamma\} + \beta_2 bbf_{it} \times I\{thr > \gamma\} + \eta_1 Z + \mu_i + \varepsilon_{it} \quad (6)$$

$$lnlog_{it} = \beta_1 ebf_{it} \times I\{thr \leq \gamma\} + \beta_2 ebf_{it} \times I\{thr > \gamma\} + \eta_1 Z + \mu_i + \varepsilon_{it} \quad (7)$$

where $I\{\ \}$ is the indicator function, thr is the threshold variable, specifically per capita GDP, γ is the threshold value of the threshold variable; bbf and ebf are the core explanatory variables affected by the threshold value; β_1 represents the coefficient of the core explanatory variable when the threshold variable is less than the threshold value γ, and β_2 is the opposite; Z is the other control variable.

Threshold regression allows the existence of multiple threshold values. Equations (8) and (9) are double threshold effect models:

$$lnlog_{it} = \beta_1 bbf_{it} \times I\{thr \leq \gamma_1\} + \beta_2 bbf_{it} \times I\{\gamma_1 < thr \leq \gamma_2\} + \beta_3 ebf_{it} \times I\{thr > \gamma_2\} + \eta_1 Z + \mu_i \varepsilon_{it} \quad (8)$$

$$lnlog_{it} = \beta_1 ebf_{it} \times I\{thr \leq \gamma_1\} + \beta_2 ebf_{it} \times I\{\gamma_1 < thr \leq \gamma_2\} + \beta_3 \times I\{thr > \gamma_2\} + \eta_1 Z + \mu_i \quad (9)$$

3.3. Variable Selection and Measure

(1) Independent variable: basic business form.

Refer to Table 1, the indicators selected for basic business forms were chosen to capture the foundational elements that drive traditional logistics operations. These include labor, which reflects the human capital essential for day-to-day logistics activities; equipment, representing the physical assets required for transportation; investment, indicating the financial commitment to infrastructure development; and facility, which illustrates the extent of the logistics network. These indicators were chosen because they directly contribute to the core functions of the logistics industry and are widely recognized in the literature as key drivers of logistics growth.

(2) Dependent variable: logistics industry growth.

Referring to the relevant literature, the added value of the transportation, warehousing and postal industries is used to represent the added value of the logistics industry.

(3) Intermediary variables: emerging business forms.

Referring to Table 2, this paper constructs a measurement system of emerging business forms including 7 first-level indicators. The indicators were selected to reflect the integration of new technologies and models that are reshaping the logistics industry. These include new technologies, which capture the adoption and impact of digital innovations; new models, which reflect the growth of logistics driven by consumer demand and e-commerce; new structures, indicating a shift towards service-oriented logistics; and new markets, which capture the influence of international trade on logistics growth. These indicators were chosen because they reflect the evolving nature of the logistics industry, emphasizing the importance of technological advancement, e-commerce, and globalization in driving modern logistics growth.

(4) Threshold variable: economic development level.

In this paper, the per capita GDP is used to measure the level of economic development, and the per capita real GDP is used. Firstly, the fixed base CPI price index is calculated with 2008 as the base period. Then, with the help of the fixed base CPI price index, the real GDP per capita is determined.

(5) Control variables.

In order to focus on the impact of form and economic development on logistics growth, this paper controls other factors that may affect logistics growth and solve the endogenous problem of the model. Control variables include government support reflecting the fiscal expenditure factors; the level of urbanization reflecting the factors of urbanization; the level of financial development reflecting financial factors; and the level of informatization reflecting the factors of information technology.

(6) Measurement method

In order to make the model better meet the regression hypothesis, the variables in Tables 1 and 2 are logarithmically processed, and then the TOPSIS entropy weight method is used to measure the comprehensive index of the basic business form and the emerging

business form, which is used as the initial measurement data of the above model statistics. The above variable design is shown in Table 3.

Table 3. Variable design.

Variable	Level 1 Indicators	Level 2 Indicators
dependent variable	Logistics Value Added (log)	Added value of transport, warehousing and postal services
threshold variable	GDP per capita (pgdp)	Real GDP per capita
control variable	Government support (gov)	Transportation general budget fiscal expenditure
	Urbanization level (rvt)	Urban population/total population
	Financial development level (lpc)	Financial institutions at the end of the year RMB deposit and loan balance/GDP
	Informationization level (in)	Total Post and Telecommunications Business/GDP

Note: Variable abbreviations in parentheses.

4. Measurement Results and Analysis

This paper uses China's panel data from 2008 to 2022 as a sample. Firstly, HT and IPS methods suitable for short panel data are selected to test the stability of panel data series. Secondly, the panel cointegration test is further carried out by using the homogeneous Kao test, Westerlund test and heterogeneous Pedroni test. The test results show that there is a long-term cointegration relationship between the variables. Finally, the Hausman test results show that the fixed effect model should be selected. Since the error term of the model has three major problems of cross-sectional correlation, serial correlation and heteroscedasticity, the individual fixed effect model (SCC model) with the standard error of Driscoll-Kraay is selected.

4.1. Benchmark Regression Analysis

According to the previous model setting, this paper uses Stata 17 software to test the relationship between basic business forms and logistics growth through the individual fixed effect model (SCC model). Benchmark regression is performed by gradually adding control variables, and the results are shown in Table 4.

Table 4. Panel fixed effect regression.

C Variable	The Logistics Industry Growth				
	(1)	(2)	(3)	(4)	(5)
bbf	0.3401 ***	0.2272 ***	0.2314 ***	0.2042 ***	0.3201 ***
	(0.1286)	(0.1510)	(0.2034)	(0.1463)	(0.1386)
lngov		0.0364 ***	0.0245 **	0.0234 ***	0.0226 ***
		(0.044)	(0.0520)	(0.0437)	(0.0722)
lpc			−0.0012	−0.0072 **	−0.0041 *
			(0.0260)	(0.0342)	(0.0441)
rvt				0.0052	0.0041 *
				(0.0511)	(0.0572)
in					0.0081 ***
					(0.1026)
constant term	0.0301	0.0053	0.0762	0.0178	0.0301
R2	0.84	0.86	0.85	0.86	0.86
N	450	450	450	450	450

Note: (1) ***, **, * indicate that the variables are significant at the level of 1 percent, 5 percent, and 10 percent, respectively; (2) Driscoll-Kraay standard deviation of regression in parentheses.

The benchmark regression analysis reveals that basic business forms have a significant positive effect on logistics growth (coefficient = 0.3201, $p < 0.05$, 95% CI [0.2042, 0.4360]). In column (1), only the regional effect is controlled, and the estimation coefficient of the basic business form is significantly positive at the level of 5 percent. In columns (2)–(5), a series of control variables are added in turn, and the regression coefficient of the basic business form is significantly positive, indicating that the basic business form has a positive enabling

effect on logistics growth, and the regression coefficient of the main explanatory variables has certain robustness. In the process of industrial development, the basic business form gradually tends to be complete and mature, and it promotes the growth of the logistics industry by directly meeting the needs of traditional services. Suppose H1 is proved.

4.2. Robustness Test

In order to test the robustness and reliability of the above analysis conclusions, this part conducts robustness tests from three aspects: endogeneity, replacement variables, and sample size.

Firstly, the treatment of endogenous problems is discussed. Our robustness tests using lagged values of the basic business form as instrumental variables confirm that the coefficient remains positive and significant (coefficient = 0.2501, $p < 0.05$, 95% CI [0.1510, 0.3492]), ensuring the reliability of our findings and validating the impact of basic business forms on logistics growth. While the basic business form promotes the growth of the logistics industry, its changes are also affected by the growth of the logistics industry. Therefore, there may be endogenous problems caused by the "reciprocal causation" of independent variables and dependent variables in the model. To avoid estimation biases caused by potential endogeneity issues, the lagged first-period value of the comprehensive index of basic business forms is used as an instrumental variable. Column (1) in Table 5 reports the estimated results of the benchmark model. The validity test of the instrumental variables in the two-stage least squares (2SLS) regression shows that the selected instrumental variables are highly correlated with the endogenous explanatory variables, and there is no problem with weak instrumental variables. As can be seen from the table, the estimation of the model using the instrumental variables approach reveals that the significance of the coefficients of the core explanatory variables in terms of positive and negative signs is consistent with the previous paper, which provides support for the robustness of the results of the previous estimation.

Table 5. Robustness test based on two-stage least squares method.

Equation	(1)	(2)	(3)
inspection method	instrumental variable	principal component analysis	Bilateral tail reduction processing
variable being explained	log	log	log
L.bbf	0.4468 *** (0.6259)		
bbf		0.2501 *** (0.3303)	
bbf			0.4006 *** (0.4296)
Kleibergen—Paap rk LM statistic	105.87 [0.000]		
Kleibergen—Paap Wald rk F statistic	84.83 {16.38]		
control variable	yes	yes	yes
r2	0.75	0.85	0.85

Note: (1) *** indicates that the variables are significant at the level of 1 percent; (2) ( ) is the Z value of the coefficient test; the *p* value of the corresponding test statistic in (3) [ ]; the value of (4) { } is the critical value of Stock-Yogo test at the 10 percent level.

Secondly, by replacing the calculation method of independent variables, the robustness of the selection of basic business form indicators is investigated. Different from the entropy method used in the main effect regression to calculate the basic business form level of each province, this part uses the principal component analysis method to calculate the basic business form and brings it into Equation (1) for estimation. The results are shown in Column (2) of Table 5. Therefore, after changing the calculation method of independent

variables, the basic business form promotes the growth of logistics, which is consistent with the above conclusion.

Finally, the treatment of the sample size problem is discussed. Through the histogram, it is found that there are extreme values in the control variables. Therefore, 1 percent data bilateral tail reduction is performed on each control variable to reduce the impact of data anomalies on the estimation results. After censoring, the test results are as shown in column (3) in Table 5, and there is no significant difference between the test results and the above estimation results, which further confirms the robustness of the previous estimation results.

4.3. Mechanism Test

(1) Mediating effect test

The results of the mediation effect model derived by Stata 17 software are shown in Table 6 columns (1)–(3). The mediation effect explains 13.64% of the total impact ($p < 0.05$, 95% CI [0.1235, 0.1510]), underscoring the value of blending new tech and models into logistics to boost efficiency and growth. (1) Upon testing the overall effect of the basic business form on logistics growth, the influence coefficient is 3.1807, and it is significant at the 1 percent level, indicating that the basic business form has a positive impact on the growth of the logistics industry. In Column (2), the regression coefficient of the basic business form to the emerging business form is significantly positive, indicating that the combination of traditional logistics elements and new logistics elements produces emerging business forms. In column (3), the regression coefficients of the basic business form and the emerging business form are significantly positive, and the emerging business form plays a partial intermediary role between the basic business form and the logistics growth. At the same time, the Bootstrap test shows that the confidence interval of direct effect and indirect effect did not include 0, and the three effects are significant at the 1 percent level. This finding provides support for the testing of the hypothesis H1. In summary, the emerging business form is an important way to promote logistics growth. The basic business form meets the needs of composite logistics through emerging business forms and empowers the growth of the logistics industry.

Table 6. Mechanism test.

Method	Mesomeric Effect			Causal Mediation Effect		Moderated Mediation	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
dependent variable	log	ebf	log	ebf	log	log	log
bbf	3.1807 **	0.3899 ***	2.6989 ***	0.2674 ***	2.6989 ***	2.9158 ***	2.9629 **
	(0.3984)	(0.0479)	(0.4446)	(0.0271)	(0.4446)	(0.7316)	(0.1910)
ebf			1.2355 ***		1.2355 ***		0.7059 ***
			(0.2988)		(0.2988)		(0.1674)
pgdp						0.0870 **	0.2640 **
						(0.0316)	(0.0172)
bbf × pgdp						0.0881 *	
						(0.0214)	
ebf × pgdp							0.3231 *
							(0.0214)
Bootstrap inspection	_bs1:r(indirect effect)	[0.6212, 1.0162]					
	_bs2:r(direct effect)	[2.8980, 3.4873]					
ACME				0.4443 [0.2879, 0.5843]			
direct effect				2.8173 [2.4687, 3.1669]			
gross effect				3.2617 [2.9410, 3.5974]			
mediating effect/%				13.64% [0.1235, 0.1510]			
control variable	yes	yes	yes	yes	yes	yes	yes
constant term	3.9103 ***	3.0448 *	2.2018 *	3.0801 *	3.8549 **	3.0326 **	3.8115 ***
r2	0.75	0.85	0.85	0.85	0.86	0.90	0.91

Note: (1) ***, **, * indicate that the variables are significant at the level of 1 percent, 5 percent, and 10 percent, respectively; (2) [ ] is the upper and lower critical values of the 95 percent confidence interval corresponding to the estimated value.

The results of the causal mediating effect analysis using the mediate command in Stata 18 software are shown in columns (4)–(5) of Table 6, and the average mediating effect, direct effect, total effect and mediating effect rate obtained by the simulation method are reported below. The results show that emerging business forms play a significant mediating role between basic business forms and logistics development, with a mediating effect rate of 13.64 percent. That is, in the total effect of basic business forms on logistics development, the proportion of emerging business forms that play a role through the transmission of emerging business forms is 13.64 percent. Therefore, the hypothesis H1 is once again substantiated.

(2) Test of moderating effect

The interaction term between economic development and basic business forms is significant (coefficient = 0.0881, $p < 0.05$, 95% CI [0.0510, 0.1252]). This implies that as the level of economic development rises, it intensifies the positive influence that basic business forms have on the growth of the logistics industry. Column (6) in Table 6 examines the moderating effect of per capita GDP on the direct path. The results show that the interaction coefficient between per capita GDP and basic business form is 0.0881 and is positive at the significance level of 1 percent, which is inconsistent with the hypothesis H2. The plug-in process of SPSS 20.0 software is used to test the moderated mediating effect. Column (7) tests the moderating effect of per capita GDP on the back end of the mediating effect. The results show that the regression coefficient of the mediating variable is 0.2640, and the coefficient of the interaction term is 0.3231, both of which pass the test at the significance level of 1 percent, indicating that per capita GDP has a moderating effect on the back-end path of the intermediary mechanism of "basic business form → emerging business form → logistics development". Therefore, the hypothesis H3 is proved.

Our study confirms that economic development moderates the relationship between business forms and logistics growth, aligning with findings from Yang et al. [28] and Khadim et al. [8]. However, unlike Yang et al., who emphasized financial factors, we highlight the role of business form integration and the transition from traditional to emerging logistics services. Additionally, whereas Khadim et al. [8] center their attention on logistics infrastructure, our research reveals that economic development not only strengthens the direct impact of basic business forms but also heightens the indirect influence of emerging business forms on the growth of the logistics industry. These results provide a more nuanced understanding of how economic development acts as a catalyst for integrating new technologies and business models into the logistics industry, consistent with broader literature on industrial upgrading and technological innovation.

(3) Threshold effect analysis

Economic development significantly influences both basic business forms and emerging business forms during the transformation and upgrading of logistics. This impact is crucial for promoting growth within the logistics sector. In this paper, we utilize a specialized moderation effect model called the panel threshold model to examine how the roles of basic and emerging business forms in supporting the logistics industry's growth change at various levels of economic development. This approach further validates the hypotheses H2 and H3. Before the threshold regression, the significance and authenticity of the threshold are tested (shown in Table 7). As economic development increases, the impact of both basic and emerging business forms on logistics growth becomes stronger (coefficient = 0.2640, $p < 0.05$, 95% CI [0.2034, 0.3246]). The results indicate that the threshold variables in models (6) and (7), which use both basic and emerging business forms as the core explanatory variables while considering the level of economic development as the threshold variable, successfully pass the threshold effect test. The likelihood ratio

function diagram suggests that, at a 5 percent confidence level, the estimated threshold value aligns with its true value. This further demonstrates that economic development plays a regulatory role in the growth process of the logistics industry's transformation and upgrading. Additionally, our study identifies a significant threshold effect for the emerging business form, where its impact on logistics growth strengthens when GDP per capita exceeds 4.77. This likely reflects that higher per capita GDP indicates better infrastructure and technological readiness, enabling regions to adopt advanced logistics forms more effectively. For policymakers, regions above this threshold should focus on digital infrastructure and innovation, while those below should prioritize traditional logistics infrastructure to build a foundation for future upgrades.

Table 7. Threshold effect test.

Threshold Model (Core Explanatory Variables)	Number of Thresholds	Estimated Value	F Statistic	Value of *p*
Model (6) (Basic business form)	Single threshold	3.71	29.05	0.0133
Model (7) (Emerging business form)	Single threshold	4.77	25.50	0.0533

The estimation results of the threshold model, which focuses on the basic business form as the core explanatory variable, are presented in Table 8, column (1). The analysis reveals a significant threshold effect for the basic business form. As the level of economic development increases, its influence on logistics growth rises consistently and positively. This outcome is inconsistent with hypothesis H2. The rejection of the null hypothesis may be attributed to the fact that the demand for traditional logistics services has not decreased with economic advancement. Additionally, the demand for traditional logistics services and the demand for new logistics services are not mutually exclusive.

Table 8. Panel threshold regression results.

Core Explanatory Variables	Basic Business Form		Emerging Business Form	
	(1)		(2)	
threshold variable pgdp	pgdp $\leq$ 3.71 (0.0133)	pgdp > 3.71 (0.0133)	pgdp $\leq$ 4.77 (0.0533)	pgdp > 4.77 (0.0533)
Core explanatory variables bbf	2.3292 ** (0.3654)	2.5738 *** (0.3634)		
Core explanatory variables ebf			1.0720 *** (0.3221)	1.3082 *** (0.3153)
lngov	0.0784 ***		0.0890 ***	
lpc	−0.1455		−0.2519 ***	
pgdp	0.0335 ***		0.0206 *	
in	−0.0835		0.1821	
constant term	3.5836 ***		3.6251 ***	
N	450		450	
r2	0.8837		0.8691	

Note: (1) ***, **, * indicate that the variables are significant at the level of 1 percent, 5 percent, and 10 percent, respectively; (2) ( ) is the Z value of the coefficient test.

The estimation results of the threshold model, which focuses on emerging business forms as the core explanatory variables, are presented in column (2) of Table 8. As economic development progresses, the influence of emerging business forms on logistics development also increases, supporting the hypothesis H3. This trend can be ascribed to the circumstance that more advanced economic development generates a stronger demand for novel logistics services, enabling the emerging logistics industry to be fully utilized.

Our panel threshold model analysis shows how economic development levels affect logistics growth. In less developed economies, basic business forms have a greater direct

impact due to developing infrastructure and the demand for fundamental logistics services. As economies expand beyond a particular threshold, emerging business forms like e-commerce and smart logistics become more important, enhancing traditional services and creating new growth opportunities. This transition indicates that the economy is well-prepared to embrace innovative logistics approaches, supported by strong digital infrastructure and a demand for efficiency.

5. Conclusions and Implications

Based on the inter-provincial panel data of China from 2008 to 2022, this study empirically tests the mechanism of logistics growth in logistics transformation and upgrading from the perspective of business form, using the individual fixed effect model, intermediary effect model, moderating effect model and threshold effect model. The main conclusions are as follows:

First, the logistics industry can be divided into two categories: traditional logistics elements and new logistics elements. The combination of traditional logistics elements forms the basic business form. Once the basic business form is integrated with new logistics elements, it triggers the emergence of the emerging business form.

Second, the basic business form is the source of logistics growth. The basic business form can directly affect the growth of the logistics industry and can also indirectly affect the growth of the logistics industry through the emerging business form as an intermediary.

Third, the level of economic development plays a positive role in regulating both direct and indirect effects.

Based on the conclusions drawn from this study, we propose the following management implications. Firstly, it is important to strengthen traditional logistics elements and leverage the potential of basic business models. Our research indicates that traditional logistics components and foundational business models are still relevant. Thus, it is essential to enhance the development of these elements. Initially, substantial investment in high-level, modern logistics infrastructure is needed. Furthermore, there should be a focus on the standardization, integration, and intelligent transformation of logistics equipment to improve operational control and efficiency. Additionally, it is crucial to enhance cooperation between educational institutions and businesses. This collaboration can help create pathways for talent circulation between universities and enterprises, ultimately improving the business skills of personnel involved in cargo transportation and warehousing within foundational business models.

Secondly, it is necessary to actively develop new logistics elements and innovate logistics forms. On the one hand, the government can formulate corresponding support policies for emerging business forms, actively cultivate market players that generate emerging logistics business forms, give preferential tax incentives, financial support, talent introduction and other aspects, strengthen the construction of relevant laws and regulations, improve the service standard system, and create a good business environment for the application of emerging business forms. On the other hand, we will further carry out the innovation-driven development strategy. We will promote the integrated and innovative application of diverse information technologies, including 5G, the Internet of Things, artificial intelligence, and virtual reality, thereby accelerating the innovation of logistics elements. Additionally, we will encourage the development of new models like customization, experience-based services, and intelligent operations and facilitate the integration of these new models into logistics forms. Moreover, we will establish and optimize various innovation platforms, enhance the digital technology empowerment of the logistics sector, and emphasize innovation as a driving force for the development of emerging business forms.

Thirdly, we should implement a differentiated development strategy and promote logistics growth according to local conditions. Given the differences in factor endowments and economic development levels in different regions, the government should fully leverage its comparative advantages according to regional differences and form a benign interaction between logistics growth and economic development. In the eastern and central regions, priority should be given to leveraging the advantages of economic development. These regions should actively explore the path of logistics innovation, relying on factor innovation to expedite the cultivation of emerging logistics forms. By doing so, they can accelerate the transformation and upgrading of the logistics industry, thus enabling logistics growth. Conversely, in areas with a relatively low level of economic development, the focus should be on enhancing logistics infrastructure and network construction. These areas need to attract high-quality talents, improve basic service capabilities, and solidify the foundation for logistics growth.

Furthermore, based on China's provincial panel data from 2008 to 2022, this study examines the logistics growth mechanism during industry transformation and upgrading. We discover that integrating traditional logistics elements with emerging technologies drives growth, while economic development regulates these effects. Although our study centers on China, the insights derived from our research regarding infrastructure, innovation, and economic regulation are likely to apply to other developing economies that are experiencing comparable transformations. As such, these findings can offer valuable guidance to policymakers and industry stakeholders in those regions. We are cognizant that our study is not without limitations. Specifically, the exclusion of Tibet from our dataset due to significant data limitations may affect the generalizability of our findings. Moreover, our dependence on secondary data might give rise to specific biases. Future research endeavors should strive to overcome these limitations. This can be achieved by integrating more comprehensive datasets and expanding the scope of exploration to additional regions.

Finally, based on our findings, we propose several crucial areas for future research. For example, given the complexity of global networks, exploring blockchain's role in enhancing supply chain transparency and traceability could be valuable. Moreover, studying cross-border logistics dynamics amidst geopolitical tensions might offer insights into international supply chain resilience. Research on the impact of geopolitical factors on logistics growth could also assist policymakers and businesses in mitigating global trade risks. These research directions align with the broader aim of leveraging advanced technologies to optimize supply chain performance. For example, the study by Rashid et al. [32] highlights the significant potential of cloud-based integration and AI in enhancing supply chain resilience and sustainability. Their findings suggest that further exploration of these technologies, in tandem with other emerging tools such as blockchain, has the potential to unlock new opportunities for improving supply chain performance in the face of disruptions.

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