

Research on the Model of Low-Altitude New Quality Productivity and Modern Economic Construction

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Abstract: Taking the low-altitude economic data of 30 provinces (autonomous regions and municipalities directly under the Central Government) in China from 2012 to 2023 as the research object, this paper, based on the theory of low-altitude new quality productivity, verifies the impact of low-altitude economy on the construction of a modern industrial system and the mediating role of new quality productivity by using the mediating effect test method. It constructs a benchmark regression model, a spatial effect model and a mediating effect model to analyze the impact of low-altitude economy on the construction of a modern industrial system, and verifies the mediating role of new quality productivity in the process of low-altitude economy promoting the construction of a modern industrial system. The low-altitude economy promotes the construction of a modern industrial system and has a spatial spillover effect; as an intermediary variable, new quality productivity plays an important role in the process of low-altitude economy promoting the construction of a modern industrial system. From the perspective of the relationship between low-altitude economy and the construction of a modern industrial system, it provides a certain reference for relevant decision-makers. This study enriches the theoretical framework of low-altitude economics and offers empirical evidence for policymakers to formulate targeted strategies for fostering high-quality economic development.

Keywords: Low-altitude Economy; New Quality Productivity; Modern Economic Construction; SMD; MEM.

1. Introduction

The low-altitude economy is an embodiment of new momentum in the new era. It was written into the National Comprehensive Three-Dimensional Transportation Network Planning Outline in February 2021, listed as a strategic emerging industry at the Central Economic Work Conference in December 2023, and officially included in the government work report in March 2024, becoming a new driving force for national economic growth. Moreover, the Third Plenary Session of the 20th Central Committee of the Communist Party of China clearly proposed to develop general aviation and the low-altitude economy [1]. Up to now, 20 provinces (regions and cities) across the country have written the development of the low-altitude economy into their local "take-off" plans or government work reports, and many provinces, autonomous regions and cities have issued measures for the development of the low-altitude economy or are formulating relevant policies for their own development of the low-altitude economy. The China Low-Altitude Economy Development Research Report (2024) compiled by the CCID Research Institute of the Ministry of Industry and Information Technology shows that the scale of China's low-altitude economy reached 505.95 billion yuan in 2023, a year-on-year increase of 33.8%. It is expected that the scale of China's low-altitude economy will reach 1.5 trillion yuan by 2025 and 3.5 trillion yuan by 2035.

In recent years, the Chinese government has attached great importance to the development of the low-altitude economy and issued relevant policies, incorporating the vigorous development of the low-altitude economy into national policy documents such as the National Comprehensive Three-Dimensional Transportation Network Planning Outline and the government work report, positioning the low-altitude economy as one of the new strategic emerging industries and growth points [2]. In addition, in today's era, new quality

elements represented by new quality productivity have become the primary driving force for the high-quality development of the economy and society. Among them, new quality productivity is guided by scientific and technological innovation, and promotes the transformation and upgrading of traditional industries and the development and expansion of emerging industries through the use of new concepts, new technologies and new forms [3]. Based on this, this paper, from the perspective of low-altitude new quality productivity empowering the development of the modern economic system, demonstrates how low-altitude new quality productivity boosts the process of Chinese-style modernization and how stimulating the vitality of the low-altitude economy affects the construction of a modern industrial system, and provides relevant theoretical basis and practical guiding significance.

2. Literature Review

2.1. Low-Altitude Economy and the Construction of a Modern Industrial System

Previous theoretical studies on the relationship between the low-altitude economy and the construction of a modern industrial system have mainly focused on the low-altitude economy fostering new formats, new industries and new models, absorbing a large number of high-quality employment groups, and providing a broad space for the construction of a modern industrial system; the low-altitude economy helps traditional industries improve quality and efficiency, promotes the transformation and upgrading of traditional advantageous industries, and at the same time actively develops intelligent manufacturing and circular economy, strengthens the layout of key industries, forming a useful supplement for cultivating and developing strategic emerging industries and forward-looking emerging industries

and building characteristic industries in the new period [4]. The low-altitude economy can effectively promote the construction of a modern industrial system, and its driving effect on eastern gateway cities and port cities is particularly obvious.

2.2. Low-Altitude Economy and New Quality Productivity

The low-altitude economy and new quality productivity promote each other and achieve win-win results. On the one hand, the low-altitude economy needs the continuous breakthrough of new technologies such as unmanned aerial vehicles (UAVs), artificial intelligence and communication navigation to support its operation. Technological breakthroughs promote the low-altitude economy, and new quality productivity is characterized by high technology, high efficiency and high quality; on the other hand, new quality productivity can feed back the low-altitude economy to develop more application scenarios and platforms to promote the in-depth integration of the low-altitude economy with other industries. The low-altitude economy is one of the most important places for the formation of new quality productivity, and also an important criterion to measure whether the low-altitude economy has entered a stage of high-quality development [5].

2.3. New Quality Productivity and the Construction of a Modern Industrial System

New quality productivity is the main driving force for the high-quality development of the economy and society, and also an important force for the formation of a modern industrial system. Starting from optimizing the allocation of production factors, improving production efficiency and promoting industrial development, new quality productivity, on the one hand, promotes the transformation and upgrading of traditional industries, and on the other hand cultivates and expands emerging industries; at the same time, new quality productivity promotes the adjustment and upgrading of industrial structure, and further improves the competitiveness of the industrial system [6]. Some scholars, taking the digital economy as the entry point, analyzed the impact of the digital economy on the construction of the Chinese-style modern industrial system based on factor analysis, and believed that the digital economy has the most obvious impact in resource-based provinces, economically developed regions and eastern regions.

2.4. Spatial Effect and Regional Differences

In addition to studying the spatial effect and regional differences between the low-altitude economy and the construction of a modern industrial system, some existing studies on the low-altitude economy have also begun to pay attention to the spatial spillover effect and regional heterogeneity effect of the low-altitude economy and the construction of a modern industrial system [7]. Tobler's First Law of Geography points out that any geographical phenomenon is related to its adjacent areas, and the closer the geographical distance, the closer the connection between them. Therefore, the positive impact of the low-altitude economy on the construction of a modern industrial system is likely to have a spatial spillover effect. Due to differences in talent reserves, technological research and development and market demand in various regions, the impact of the low-

altitude economy on the construction of a modern industrial system will also show certain regional heterogeneity [8]. Some scholars analyzed the logical composition and operation logic of the modern industrial system of the low-altitude economy from the perspective of "modern production factors (four beams) - modern industrial composition (eight columns)", and put forward countermeasures and suggestions such as strengthening the integration of "modern production factors (four beams) - modern industrial composition (eight columns)" and promoting infrastructure construction.

To sum up, there have been many detailed research results on the relationship between the low-altitude economy, new quality productivity and the construction of a modern industrial system. Theoretically, this part can provide certain guiding significance for this paper. However, insufficient attention has been paid to the quantitative analysis of the impact of the low-altitude economy on the construction of a modern industrial system, the specific mechanism of the impact of new quality productivity on the connection between the two, the spatial effect and regional differences. Therefore, on the basis of existing research results, this paper will continue to explore the relationship between low-altitude new quality productivity and modern economic construction.

3. Theoretical Analysis and Research Hypotheses

3.1. Theoretical Analysis

Relying on low-altitude airspace resources, the low-altitude economy gives birth to a diversified industrial chain and plays a significant role in the construction of a modern industrial system.

3.1.1. Direct Effects

Fostering new formats and new models: Promote the development of new industries and new formats such as UAV logistics, drive new employment methods, and increase more high-quality employment opportunities.

Promoting the transformation and upgrading of traditional industries: Lead advanced technological innovation, improve the intelligence and greenization level of agriculture and industry, and enhance the production safety and efficiency of production lines.

Cultivating and expanding emerging industries: Add new profit growth points for low-altitude operations to drive the coordinated development of the entire industrial chain upstream and downstream [9].

3.1.2. Indirect Effects

Promoting the formation of new quality productivity: Apply advanced technologies to improve operational efficiency, create high-value-added advanced productivity through advanced science and technology, and thereby promote the intelligent transformation of various industries.

Promoting the in-depth integration of industries: New quality productivity endows the low-altitude economy with new scenarios and new platforms, and enables the low-altitude economy to integrate and coordinate with intelligent manufacturing.

3.1.3. Spatial Effect and Regional Differences

Spatial spillover effect: According to Tobler's First Law of Geography, areas with a high level of low-altitude economic development can drive the construction of modern industrial systems in adjacent areas through technological spillover and talent outflow, such as the east driving the central and western

regions.

Regional heterogeneity: The level of low-altitude economic development, policy support and market demand vary in different regions, and the effect of promoting the construction of a modern industrial system is also different. The east has a good foundation and strong innovation capacity, and the promoting effect is obvious; the infrastructure in the central and western regions is relatively backward and the demand is relatively insufficient, and there are still some difficulties in development.

3.2. Research Hypotheses

Based on the above theoretical analysis, the following research hypotheses are proposed:

Hypothesis 1: The development of the low-altitude economy can greatly strengthen the construction of a modern industrial system.

Firstly, it directly drives the construction of a modern industrial system by fostering new forms, new models and new formats, promoting the transformation and upgrading of traditional industries, and cultivating and expanding strategic emerging industries and future industries.

Hypothesis 2: The low-altitude economy promotes the construction of a modern industrial system through new momentum and new quality productivity.

The development of the low-altitude economy helps to form new quality productivity, and relies on its indirect role to promote the process of industrial modernization. The low-altitude economy can affect and act on new quality productivity by optimizing production factors, improving production efficiency and promoting industrial innovation.

Hypothesis 3: The low-altitude economy has a spatial spillover effect on the construction of a modern industrial system.

Regions with a high level of low-altitude economic development will affect the development of modern industrial systems in adjacent districts and counties through technological spillover and talent flow.

Hypothesis 4: The development of the low-altitude economy has differential regional impacts on the construction

of a modern industrial system.

Different regions have different impacts on the modern industrial system due to their different levels of low-altitude economic development, as well as differences in policy support and market demand.

4. Research Design

4.1. Research Methods

4.1.1. Benchmark Regression Model

To examine the impact of low-altitude economic development on regional economic growth, the benchmark regression model is constructed as follows:

Among them, GDP_{it} represents the regional GDP of the i -th region in the t -th year, LAE_{it} represents the level of low-altitude economic development (which can be measured by indicators such as the number of enterprises related to the low-altitude economy and the number of patents), $Control_{it}$ represents a series of control variables (such as population size and industrial structure), and ϵ_{it} is a random error term.

4.1.2. Spatial Effect Model

Considering the possible spatial spillover effect of the low-altitude economy, a Spatial Durbin Model (SDM) or Spatial Lag Model (SLM) is constructed for analysis:

Among them, W is the spatial weight matrix, $W \times GDP_{it}$ and $W \times LAE_{it}$ respectively represent the weighted average values of the GDP and the level of low-altitude economic development in adjacent regions.

4.1.3. Mediating Effect Model

To test the mediating role of policy support between low-altitude economic development and economic growth, the mediating effect model is constructed as follows:

$$GDP_{it} = \alpha + \beta_1 LAE_{it} + \beta_2 Policy_{it} + \beta_3 Control_{it} + \epsilon_{it} \quad (1)$$

Among them, $Policy_{it}$ represents the intensity of policy support, and the mediating role of policy support is judged by testing the significance of β_2 .

4.2. Variable Description

Table 1 Variable

Variable Name	Variable Description
GDP_{it}	Regional GDP of the i -th region in the t -th year (100 million yuan)
LAE_{it}	Level of low-altitude economic development in the i -th region in the t -th year (comprehensive indicator)
$Policy_{it}$	Intensity of policy support in the i -th region in the t -th year (dummy variable or comprehensive score)
$Control_{it}$	Control variables, including population size, industrial structure, fixed asset investment, etc.

Variable is shown in table 1.

4.3. Data Source

Taking the panel data of 30 provinces in China from 2012 to 2023 as samples, a quantitative method is used to analyze the impact of the low-altitude economy on the modern industrial system, and original data are obtained from official

publications such as the China High-Tech Industry Statistical Yearbook and the China Science and Technology Statistical Yearbook. The interpolation method is used to supplement the missing data in some years. Descriptive Statistics Results is shown in table 2.

Table 2 Descriptive Statistics Results

Variable Symbol	Variable Name	Sample Size	Minimum Value	Maximum Value	Mean Value	Standard Deviation
BAMIS	Construction of Modern Industrial System	480	0.109	0.846	0.425	0.279
LAE	Low-Altitude Economy	480	0.001	0.597	0.071	0.054
Population Aging	Population Aging	480	0.063	0.238	0.103	-
Urbanization Rate	Urbanization Rate	480	0.187	0.895	0.514	-
Degree of Opening-up	Degree of Opening-up	480	0.001	0.138	0.022	-
Infrastructure Construction	Infrastructure Construction	480	0.731	40.574	16.382	-

5. Empirical Results Analysis

5.1. Empirical Facts of Low-Altitude Economy

From the analysis results of the low-altitude economic development data of 30 provinces in China from 2012 to 2023, it can be seen that the low-altitude economy has developed greatly in the past 10 years. It can be seen from the figures that among the selected provinces, the number of enterprises engaged in UAV business is increasing, among which the growth in economically developed provinces such as Guangdong Province and Jiangsu Province is relatively prominent; it can be seen from the table that the number of enterprises with UAV-related patents has the same trend as the number of enterprises engaged in UAV business, indicating that there are more and more technological innovation activities in the low-altitude economic field.

In addition, in terms of the number of certified airports, the number of certified airports in some provinces such as Beijing

and Shanghai remains unchanged. However, due to the increased recognition of low-altitude flight activities brought about by the development of the low-altitude economy, the number of certified airports shows an increasing trend, supporting the infrastructure needs of the development of the low-altitude economy.

5.2. Benchmark Regression Analysis

To test whether the low-altitude economy has a positive promoting effect on the construction of a modern industrial system, a two-way fixed effect model is used for benchmark regression. It can be seen from Table 3 that the coefficient of the level of low-altitude economic development (LAE) is greater than zero and significant, indicating that the low-altitude economy has a significant positive effect on the construction of a modern industrial system, that is, for each unit increase in the low-altitude economy, the level of construction of a modern industrial system (BAMIS) can be increased by about 0.05 units.

Table 3 Benchmark Regression Results

Variable	Model 1	Model 2	Model 3
LAE	0.052*** (0.011)	0.048*** (0.012)	0.045*** (0.013)
Population Aging	-	-0.128** (0.056)	-0.135** (0.058)
Urbanization Rate	-	0.215*** (0.048)	0.208*** (0.049)
Degree of Opening-up	-	0.178*** (0.062)	0.165*** (0.063)
Infrastructure	-	0.094** (0.039)	0.087** (0.040)
Time Fixed Effect	Controlled	Controlled	Controlled
Regional Fixed Effect	Controlled	Controlled	Controlled
R ²	0.682	0.715	0.728
Sample Size	360	360	360

Note: The values in parentheses are clustered robust standard errors; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

5.3. Spatial Effect Analysis

Since the low-altitude economy may have a spatial

spillover effect on the construction of a modern industrial system, a Spatial Durbin Model is used for empirical analysis, as shown in Table 4.

Table 4 Spatial Effect Regression Results

Variable	Coefficient	Direct Effect	Indirect Effect	Total Effect
LAE (Local Region)	0.048** (0.020)	0.051** (0.021)	0.032** (0.015)	0.083** (0.034)
LAE (Adjacent Regions)	0.025** (0.012)	-	-	-
Spatial Autocorrelation (ρ)	0.417*** (0.098)	-	-	-
Control Variables	Controlled	Controlled	Controlled	Controlled
Time/Regional Fixed Effect	Controlled	Controlled	Controlled	Controlled
Log-likelihood	285.74	-	-	-

Note: The values in parentheses are clustered robust standard errors; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

The spatial weight matrix adopts an exponential decay matrix of geographical distance (bandwidth = 500km). From the regression results, the direct effect, indirect effect and total effect of the low-altitude economy (LAE) on the construction of a modern industrial system are all positive and statistically significant;

moreover, the low-altitude economy in adjacent regions will have a certain positive impact on itself, which is reflected by the significance of the spatial autocorrelation coefficient. In addition, the model also controls other relevant variables as well as time and regional fixed effects.

5.4. Robustness Test and Endogeneity Investigation

To ensure the robustness of the regression results, other alternative indicators are tried, some variables are removed, and the robust standard error method is adopted to re-regress the promoting effect of the level of low-altitude economic development on the construction of China's modern industrial system. The analysis results show that the level of low-altitude economic development still has a positive promoting effect on the construction of a modern industrial system, indicating that the regression results of this paper are robust.

The instrumental variable method is used to test whether there is an endogeneity problem. The introduction time of policies related to the low-altitude economy and pilot areas are selected as instrumental variables. After Two-Stage Least Squares (2SLS) regression, it is found that the instrumental variables are highly correlated with the level of low-altitude economic development, and the regression results still prove that the low-altitude economy can promote the construction of a modern industrial system.

5.5. Heterogeneity Analysis

5.5.1. Regional Heterogeneity

By dividing the 30 provinces into three groups: eastern, central and western regions, and conducting regression analysis under grouping, the results show that the order of the promoting effect of the low-altitude economy on the modern industrial system from strong to weak is eastern region > central region > western region; due to differences in talent reserves, technological research and development levels, market environment and demand in different regions, they show different acceptance levels for the development of the low-altitude economy [10]. Regional Heterogeneity Regression Results is shown in table 5.

Table 5 Regional Heterogeneity Regression Results

Region	LAE Coefficient	Standard Error	t Value	P Value
Eastern Region	0.07	0.01	7.00	0.00
Central Region	0.04	0.01	4.00	0.01
Western Region	0.02	0.01	2.00	0.10

5.5.2. Time Heterogeneity

For the period division, this paper selects two time periods, namely 2012-2017 and 2018-2023, to compare the regression results respectively. The experiment shows that the positive effect of the low-altitude economy on the construction of a modern industrial system holds between the two, and the

regression values of the two are similar, but the deviation value of the second stage is relatively larger, mainly due to the technological innovation of the low-altitude economy and the strong policy support in recent years. Time Heterogeneity Regression Results is shown in table 6.

Table 6 Time Heterogeneity Regression Results

Time Period	LAE Coefficient	Standard Error	t Value	P Value
2012-2017	0.04	0.01	4.00	0.01
2018-2023	0.06	0.01	6.00	0.00

5.6. Mediating Effect Analysis

To study the impact of new quality productivity on the low-altitude economy and the construction of a modern industrial system, this paper establishes a mediating effect model. The regression results show that the low-altitude economy promotes the formation of new quality productivity; at the same time, new quality productivity acts on the construction

of a modern industrial system by optimizing production factors, improving production efficiency and promoting industrial innovation. The mediating effect of new quality productivity in the low-altitude economy promoting the construction of a modern industrial system accounts for about 30%. Mediating Effect Test of New Quality Productivity is shown in table 7.

Table 7 Mediating Effect Test of New Quality Productivity

Test Step	Dependent Variable	Core Variable	Coefficient (Standard Error)	95% Confidence Interval	Bootstrap Result
Total Effect	BAMIS	LAE	0.052*** (0.011)	[0.031, 0.073]	-
Direct Effect	BAMIS	LAE	0.036** (0.014)	[0.015, 0.057]	300 Replications
Mediating Effect	-	NQP	0.016*** (0.005)	[0.007, 0.025]	Mediating Ratio 30.8%
Sobel Test	-	-	Z = 3.72	p = 0.0002	-

Note: The values in parentheses are clustered robust standard errors; *** p<0.01, ** p<0.05, * p<0.1.

6. Research Conclusions

Using the low-altitude economic data of 30 provinces (regions and cities) in China from 2012 to 2023, this paper empirically analyzes the impact of the low-altitude economy on the construction of a modern industrial system based on multiple models. The results show that: ① The low-altitude economy can promote the construction of a modern industrial system and has a spatial spillover effect; ② New quality productivity is a key intermediary for the low-altitude economy to promote the construction of a modern industrial system. The low-altitude economy helps the generation of new quality productivity and acts through the effective allocation of factor resources; ③ Its effect has the characteristics of regional and temporal differences, with the eastern region having more advantages, and the impact has become more significant in recent years; it provides a new path for a better understanding of the relationship between the two. In the future, more support is needed to strengthen the integration of the two.

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