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Can the Integration of Rural Industries Help Strengthen China's Agricultural Economic Resilience?

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Abstract: Rural industrial integration is the key to promoting the development of rural industrial restructuring and modernization, and plays a vital role in improving agricultural economic resilience. Based on the evaluation index system of agricultural economic resilience and the level of rural industrial integration development, respectively, this paper uses panel data from 30 provincial administrative regions in China from 2000 to 2020 to empirically test the impact of rural industrial integration development on agricultural economic resilience by using an individual fixed-effects model and a mediating-effects model. The results show that rural industrial integration significantly contributes to enhancing agricultural economic resilience, and the conclusion still holds after a series of robustness tests. There is dimensional and regional heterogeneity in the impact of rural industrial integration on agricultural economic resilience, and the strength of the promotion effect by dimension is in the order of adaptive adjustment capacity, transformation and innovation capacity, and resilience to recovery capacity. In the eastern and central regions, the promotion effect of rural industrial integration on agricultural economic resilience is more significant. In the main food-producing areas, the promotion effect of rural industrial integration on resilience to recovery is significantly slighter than that of non-food-producing regions. Mechanism analysis indicates that regional industrial structure optimization is an essential channel for rural industrial integration to enhance the resilience of the agricultural economy. On this basis, in order to strengthen agricultural economic resilience, provinces should actively explore differentiated industrial integration policies to enhance industrial structure optimization and upgrading, stimulate agricultural economic vitality, and foster the development of China's agricultural modernization.

Keywords: agricultural economic resilience; rural industrial integration; food security; agricultural function expansion; agricultural chain extension

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1. Introduction

Agriculture is the source of the survival and development of human society and civilization. China is an ancient agricultural country and a large country of farmers. In 2022, as a large country of 1.4 billion people with more than 64% of farmers, it has not only achieved self-sufficiency in farm products, but also played a stabilizing role in the global market. Among them, grain production was as high as 68.655 billion kilograms, an increase of 3.7 billion kilograms year on year. It remained above 0.65 trillion kilograms for eight consecutive years (source: Ministry of Agriculture of the People's Republic of China for Rural Affairs). As the basis of all production activities, agriculture is an important industry that supports the national livelihood and economic construction and development, and its healthy and stable growth is directly related to the sustainable development of the economy and long-term social stability. Since the 21st century, from 2004 to 2023, the No. 1 document of the central government has put agriculture in first place for 20 consecutive years. The 2023 No. 1 document of the central government pointed out that, based on the national agricultural situation, we should build a solid agricultural country with

strong supply security, industrial resilience, and competitiveness. "Strong agricultural country" was written into the document for the first time. Besides, it reflects the value the national government attaches to the supply capacity of agricultural products and national food security, and provides an essential way to promote the development of China's agricultural modernization. In the face of a profoundly changing external environment, high-quality agriculture with strong resilience not only provides robust protection for vulnerable agriculture, but also injects a strong impetus for China's economy to withstand risks, adapt to the environment, and adjust quickly. Hence, enhancing the resilience of the agricultural economy is crucial to China's socio-economic development. Nowadays, the world is in the midst of the most remarkable change of the century, especially the increase in geopolitical risks, frequent extreme weather disasters, the rise of trade protectionism and unilateralism, the conflict between Russia and Ukraine, the COVID-19 pandemic, high inflation, and other uncertainties have intensified the instability of the global economy. The economies of all countries have slowed down. In the World Economic Situation and Prospects 2023 report by the United Nations, the world economic growth rate reached 14.84% from 2018 to 2022, and GDP per capita growth rate up to 10.26%. Among them, the economic growth rate of the United States is only slightly higher than the world level, at 24.24%, while that of Japan and the European Union show negative growth, both lower than the world economic growth rate, −14.66% and −15.68%, respectively. Many countries are facing different degrees of recession risk. Against this backdrop, China has kept its economy stable and moving forward, becoming the major economy with the highest economic growth rate of 32.35% during this period. Remarkably, in 2022, China exceeded global GDP per capita for the first time. There is no doubt that China's economic system has a strong ability to resist and adapt when subjected to external shocks that are difficult to avoid. As a vital component of the national economy, enhancing the intrinsic resilience of its system not only improves the efficiency of agricultural production and quality of agricultural products and ensures national food security, but also has great significance for sustainable economic development, promoting the development of agricultural modernization and building a strong rural country [1].

Resilience first appeared in the field of physics and refers to the ability of a system to recover its original state after being subjected to an external shock. With the continuous development of research, scholars have had various perceptions of the resilience concept at different times. Holling [2] first introduced resilience into the ecology field, focusing on ecosystems' ability to recover their original state after some external perturbation. In terms of economics, Comfort [3] was the first to combine resilience with economics, arguing that economic resilience begins to work within a city or region only after the emergence of external shocks and emphasizing the system's ability to repair and renew itself. This repair process is nonlinear. From a social welfare perspective, Alberti and Marzluff [4] argue that economic resilience is a capacity to maintain undisturbed socio-economic structures, well-being, and relationships in the face of external shocks. Furthermore, Su [5] considers economic resilience as an ability to withstand external risks and cope with economic instability, focusing on the resistance of economic resilience. The most academically recognized concept of economic resilience is the adaptive resilience proposed by Martin et al. [6], which is a dynamic adjustment capacity to external shocks, including four aspects: resistance, recovery, reorganization, and renewal. In the field of agriculture, the primary studies include agroecological resilience [7], agricultural production resilience [8], agricultural development resilience [9], and economic resilience of farm households [10]. As for agricultural economic resilience, researchers have focused on the measurement and influencing factors [11,12], while some scholars have also conducted studies on high-quality development [13] and agricultural competitiveness [14].

As an essential driving force for the development of China's agricultural modernization, rural industrial integration has a substantial impact on the development of agricultural economic resilience by integrating the factor resources of various sectors across borders, extending agricultural industrial chains, expanding industrial functions, promoting the

formation of new business models, and leading the transformation of farming operations. Existing studies have mainly explored industrial integration in rural infrastructure construction, industrial chain, technological innovation, industrial structure, and other aspects. When regions face the risk of external uncertainty, the first to bear the brunt is the industrial structure [15]. Improving industrial integration can help promote the optimization of regional industrial construction and industrial development, which in turn contribute to enhancing the adaptive adjustment ability of the agricultural economic system when facing risks. On the one hand, the development of rural industrial integration drives the rural infrastructure and public services, enhances the resilience of agricultural production when facing natural risks, and improves the efficiency of the farm output [16]. On the other hand, rural industrial integration optimizes the regional agricultural development approach by extending the whole agrarian industry chain and promoting the integration of agricultural production, processing, and marketing, which leads vertically to horizontal and advanced to backward [17]. Meanwhile, rural industrial integration helps promote technological innovation in traditional industries and optimize and upgrade regional industrial structures [18].

According to the existing studies, we found the following limitations: on the one hand, agricultural economic resilience is becoming an important research topic in the field of agriculture, but it is still in its initial stage. Most of the existing literature deals with the resilience of agricultural development from the dimensions of agroecology, family, developmental resilience, and competitiveness, and there is little literature to discuss the underlying mechanisms affecting agricultural economic resilience in depth. On the other hand, most existing studies have looked at specific aspects of industrial integration in agricultural economic development, and there exists a lack of research that explores the impact on the various stages of agricultural economic resilience from the perspective of rural industrial integration and empowerment. Based on this, this paper intends to explore the relationship between rural industrial integration and agricultural economic resilience by using balanced panel data of 30 provincial administrative regions in China from 2000 to 2020, measuring the agricultural economic resilience of Chinese provinces and cities through a multidimensional indicator system approach, and conducting empirical tests with individual fixed-effects and mediating-effects models. The marginal contributions of this paper are mainly in the following two aspects: first, we quantitatively measure the level of agricultural economic resilience in each region of China and explore the impact effects and role boundaries of agricultural economic resilience in different food-producing areas of China as well as in various stages of resilience through the perspective of rural industrial integration empowerment by dimensions. Second, regional industrial structure optimization is selected as a mediating variable to explore further the impact mechanism of rural industrial integration on agricultural economic resilience and provide a valuable reference for decision making to strengthen China's agricultural economic resilience.

The rest of the paper is organized as follows. Section 2 presents the theoretical analysis and research hypotheses. Section 3 briefly introduces the research design, including the econometric model's setting, the variables' selection and description, and the data sources. Section 4 reflects the analysis of the empirical results. Section 5 summarizes the main research findings and insights, revealing the shortcomings and future research outlook.

2. Theoretical Analysis and Research Hypothesis

2.1. The Direct Impact of Rural Industrial Integration on Agricultural Economic Resilience

Rural industrial integration is an effective way to realize the modernization of agriculture and rural areas and is an important driving force for the high-quality development of Chinese agriculture. According to Jiang's study [19] on the development of rural industrial integration, industrial integration is a comprehensive development process that aims at enriching farmers, expanding agriculture as a means of revitalizing the countryside, and forming industrial aggregates by promoting the flow of production factors and giving rise to new business models. First of all, rural industrial integration is conducive

to agriculture resisting the uncertainty of the external environment and stabilizing the structure of the agricultural system itself, thus enhancing the resilience of the agricultural economic system to recovery. On the one hand, the nature of rural industrial integration determines the higher requirements for infrastructure and public social services, which reduce the disturbance of agriculture impacted and enhances the agricultural economic resilience. In addition, the development of new business models such as leisure agriculture, sightseeing agriculture, rural tourism, and rural e-commerce by the government and enterprises through the rural industrial integration development projects must be conditioned with higher infrastructure construction standards [20]. This meets a substantial demand for transportation, electric power, and communication facilities. Further, the extensive construction and use of agricultural infrastructure can directly reduce the natural risks of agricultural production, promote agrarian production efficiency and economic growth, and contribute to agricultural economic resilience [16]. On the other hand, rural industrial integration promotes the deep integration of agriculture with the main links of agricultural production, processing, and storage through the whole process of the farm output by creating an entire agricultural industry chain to achieve vertical integration of agriculture [17]. This effectively solves the problems of low production efficiency, difficult transportation, high processing costs, and low profits for agricultural products. At the same time, it optimizes the agricultural development approach. Therefore, it provides resilience to recover from shocks to agriculture.

Secondly, the integration of rural industries enhances the adaptive adjustment ability of the agricultural economic system after the impact by bringing into play agricultural multifunctionality. Specifically, the play of agricultural multifunctionality can boost farmers' income and enhance the adaptive adjustment ability of the agricultural economic system. By creating business models such as "Internet+," farm carnivals, leisure farms, and recreational agriculture, rural areas not only improve the value creation capacity of agriculture, but also generate more employment opportunities and positions, transfer the agricultural working population, and effectively promote farmers' income. The transformation of agricultural economic development to commercialization and diversification has reduced the sensitivity and vulnerability of agriculture to business risks [21], which helps drive agricultural economic growth and improve agricultural economic resilience.

Finally, the innovation and promotion of agricultural technology make production factors, tools, and methods more suitable for agricultural production and contribute to forming new paths for agricultural economic development. It is known to all that technology is the power source of industrial integration. During the growth of agricultural products, the production and supply of agriculture are prone to broken chains due to the seasonality and vulnerability of the agricultural output and the continuity and sustainability of consumer demand, leading to instability of farm markets and thus spreading market risks [22]. Moreover, the promotion of agricultural technology helps to connect supply and demand markets and increase the sustainability of agricultural revenue, as well as to cope with the risks of agricultural production caused by sudden and severe climate change. Besides, developing smart agriculture, using information services such as the Internet of Things, big data, and cloud computing to achieve intelligent production and circulation of agricultural products, and integrating various e-commerce platforms, such as Taobao, Jingdong, Pinduoduo, and so on, to open markets for agricultural products, drive agricultural sales, and expand the influence of agrarian brands, provides new agricultural economic growth paths, enhancing the transformation and innovation capacity of agriculture, and improving agricultural economic resilience [19].

Based on this, the first research hypothesis of this paper is proposed:

H1: *The integrated development of rural industries can promote the resilience of the agricultural economy.*

2.2. The Mediating Role of Industrial Structure Optimization on Rural Industrial Integration and Agricultural Economic Resilience

The integration of rural industries enables the advanced elements and technological innovation interpenetration in the primary, secondary, and tertiary sectors by extending the whole industrial chain, such as agriculture, industry, and cultural tourism, in order to facilitate the internal reorganization of agriculture and promote the upgrading of industrial structure. As a result, it can drive the development of the agricultural economy, improve the dynamic adaptive capacity and transformation and innovation capacity of agriculture facing risks, and enhance the resilience of the agricultural economy.

At first, the extension of rural industrial chains strengthens the close links between agricultural production and other related industries, promotes the internal integration of farming industries, and improves the optimal allocation of production factors [23]. This is conducive to reducing the transaction costs of various links, improving the efficiency of agricultural production and operation in the region, and providing strong risk response and resilience to the agricultural economic system. Furthermore, extending the agricultural industry chain can help cultivate new industries and new business models. Through the integration of "planting, breeding, and processing", "production, supply, and marketing", and "tourism, entertainment, and shopping", the internal structure of agricultural production can be tightened, and the added value of agricultural products is able to be improved [24]. It can effectively mitigate the vulnerability impact of agricultural production while maintaining the coherence of the production chain and providing new ways for agricultural economic development, thus enhancing the resilience of the agricultural economy.

Second, when agricultural economic systems are subject to shocks, new technologies are often required to adapt to changes in the internal and external environment, thus providing a path for economic development [25]. Traditional industrial economic theory suggests that the uptake of new technologies is a sectoral process, and economic growth results from a sequential turnover of dominant industrial sectors [26]. Through the introduction of advanced production factors, such as modern agricultural technology, big data, and advanced management systems, the integrated development of rural industries can enhance industrial efficiency, promote the optimization of regional industrial structure, reduce the business risks of farmers, and improve the risk resistance and innovation transformation capacity of the agricultural economic system [27]. For instance, the introduction of sensing technology in the production of agricultural products, big data, and cloud computing technology in the sales process, and product traceability and positioning technology in the after-sales service environment can not only help agricultural production to prevent future natural risks in advance, but also improve the efficiency of accurate consumer matching of high-quality products while increasing the safety and reliability of agricultural production.

Last but not least, the development of rural industrial integration can help upgrade the agrarian industrial structure to form a diversified industrial system. Through the integration of primary, secondary, and tertiary industries, developing agricultural products processing and manufacturing, tourism services, recreation and health, and agricultural e-commerce promotes the diversification of industrial structure, expands the scope and mode of a farming operation, and improves the dynamic adaptability of agriculture. Cross-fertilization between different industries is more likely to produce breakthrough innovations [28]. Hence, it enables the agricultural economic system to avoid violent fluctuations facing external shocks and to form new economic growth patterns and paths after the shocks gradually fade away, enhancing the resilience of the agricultural economy.

Based on this, the second research hypothesis of this paper is proposed:

H2: *Integrated rural industrial development enhances the agricultural resilience economy by promoting the optimization of the rural industrial structure.*

Based on the above literature, the theoretical mechanism diagram is constructed based on analyzing the impact of agricultural industry integration and industrial structure optimization on the resilience of the agricultural economy, as shown in Figure 1.

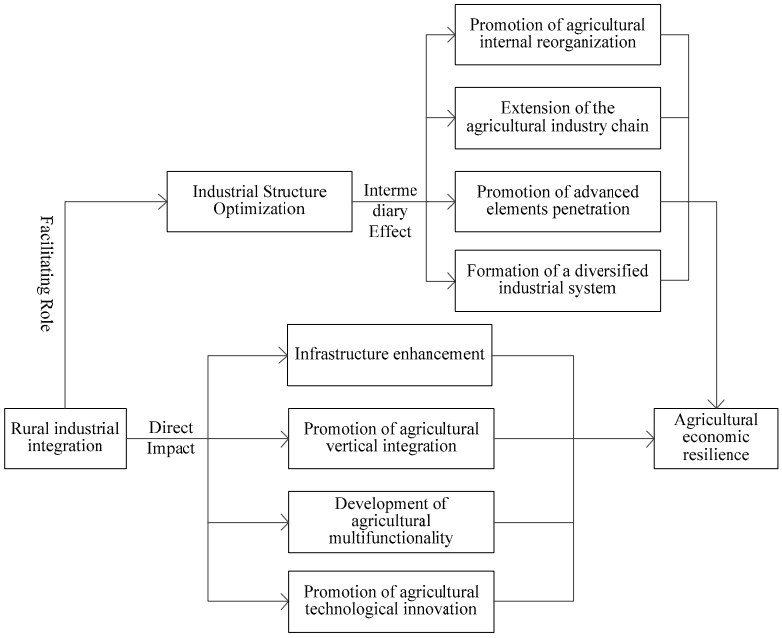

Figure 1. Mechanisms of agricultural industry integration and industrial structure optimization in agricultural economic resilience.

3. Methodology

3.1. Model Settings

To study the impact effect and mechanism of rural industrial integration on agricultural economic resilience, based on the theoretical mechanism and research hypothesis, this paper uses the data of Chinese provinces from 2000 to 2020 for empirical testing, and the model chosen is panel regression.

$$Aer_{i,t} = \propto + \beta Indinte_{i,t} + \sum \lambda_j x_{i,j,t} + \mu_i + \varepsilon_{i,t} \quad (1)$$

where $Aer_{i,t}$ is the agricultural economic resilience of region i in year t. $\propto$ represents a constant term, and β indicates the effect of rural industrial integration on agricultural economic resilience. $Indinte_{i,t}$ denotes the index of industrial integration in region i in year t. $\sum \lambda_j x_{i,j,t}$ is the control variable chosen to eliminate estimation bias. $\varepsilon_{i,t}$ shows the unobservable disturbance term. It is well known that China is a large area country, and there are specific differences between cities regarding geographic space, resource endowments, and policy making. Therefore, μ_i is set as an individual effect to eliminate the differences between cities. Based on the theoretical hypothesis proposed in this paper, the integration of rural industries will strengthen agricultural economic resilience in the region, so the coefficient of β is estimated to be positive. Moreover, the resource endowments available in the local economic development process will make regional agricultural growth somewhat resilient, and thus the constant term $\propto$ will be positive.

Further exploring the transmission mechanism of rural industrial integration on agricultural economic resilience, this paper refers to the approach of scholars Baron and Kenny [29] and MacKinnon et al. [30] to construct a mediating effects model with regional industrial structure optimization (Iso) as the mediating variable. The stepwise regression method consists of three steps as follows:

$$Aer_{i,t} = \propto + \beta Indinte_{i,t} + \sum \lambda_j x_{i,j,t} + \mu_i + \varepsilon_{i,t} \quad (2)$$

$$\mathrm{Iso}_{i,t} = \eta_0 + \eta_1 Indinte_{i,t} + \sum \lambda_j x_{i,j,t} + \mu_i + \varepsilon_{i,t} \quad (3)$$

$$\mathrm{Aer}_{i,t} = \gamma_0 + \gamma_1 Indinte_{i,t} + \gamma_2 \mathrm{Iso}_{i,t} + \sum \lambda_j x_{i,j,t} + \mu_i + \varepsilon_{i,t} \quad (4)$$

This manuscript uses the stepwise regression method to test the mediating effect. If η_1, γ_1, and γ_2 are significantly positive, it proves that regional industrial structure optimization has a significant mediating role in rural industrial integration to enhance agricultural economic resilience.

3.2. Variable Description

3.2.1. The Explained Variables

The explained variable in this paper is agricultural economic resilience (Aer). Since there is no unified measurement system for agricultural economic resilience in academia, the indicator construction model of pressure-state-response based on the principle of the PSR model by Feng et al. [31] is referred to. Comprehensive evaluation indicators are used referring to the existing research to systematically construct agricultural economic resilience in three aspects: resistance and recovery capacity, adaption and adjustment capacity, and transformation and innovation capacity [32–34].

Among them, resistance and recovery capacity (P) expresses the pressure on the agricultural economic system caused by sudden disturbances and disruptive events of external risks. Seven specific characterization indicators are selected: rural consumption capacity, Engel's coefficient of rural households, effective irrigation rate, total agricultural power per mu, crop sown area, rural education level, and agricultural fertilizer application. To be specific, rural consumption capacity and Engel's coefficient for rural households, as major indicators of the living standards of rural residents, can reflect the support of the consumption capacity of the population to the shock after an external shock has hit the regional agricultural economy. The effective irrigation rate, total agricultural power per acre, the sown area of crops, and the application of agricultural fertilizers are closely related to the production and development of the rural population and show the production conditions of regional agriculture. Strong agricultural production conditions and production capacity reinforce the resilience of the agricultural economic system in the face of external fluctuations. Moreover, the level of rural education represents the degree of farmers' education, which provides human capital and production technology for the agricultural economy to resist risks. It is beneficial in guiding the upgrading and optimization of the region's industrial structure and enhancing the stability and risk resistance of the agricultural economy's development.

Adaptation and adjustment capacity (S) refers to the ability of a region's agricultural economic system to return to a stable operating state after facing external shocks and adaptive adjustment in response to environmental changes, including three indicators: value-added index of primary industry, rural road accessibility, and rural residents' consumption expenditure level. A higher index of value added in the primary sector reflects the level of growth and contribution of agricultural production, and the flexible adjustment of the agricultural output implies a more robust adaptive adjustment capacity of the economic system. Rural road accessibility stands for the region's transportation network and transportation capacity. In the event of natural disasters or emergencies, smooth road transportation and higher efficiency in the transport of agricultural products are conducive to speeding up the flow of agricultural goods, lowering transportation costs, improving the economic efficiency of agriculture, and mitigating shocks to the economic system. Besides, the level of rural residents' consumption expenditures manifests the vitality of agricultural development, which is the driving force for the farm economy to recover to its original state under the shock.

Transformation and innovation capacity (R) indicates the measures and countermeasures taken by the government, enterprises, society, or farmers to resolve external risks

to drive agricultural economic development into a new development mode or path. The manuscript looks at three dimensions of resource, human, and energy inputs, and selects three factors to measure: financial support for agriculture, human capital stock, and rural electricity consumption. Notably, the magnitude of financial support for agriculture reveals the extent to which the government attaches importance to and supports the agricultural economy. Innovation in agriculture requires a large amount of investment in scientific and technological research and development and the construction of modern facilities, etc. The stock of human capital reflects the specialized knowledge and high-quality labor force needed to transform and innovate the agricultural economy. Rural electricity consumption captures the electricity consumption in rural areas, where production patterns are gradually moving towards intelligent and modernized development, which creates a vast dependence on and demand for electricity supply. Hence, capital, workforce, and energy, as indispensable factors for transformative and innovative development and sustainable development of agriculture, are of great significance in assessing the transformative and innovative capacity of the resilient agricultural economy.

The specific evaluation indicators are shown in Table 1, and the entropy weighting method is applied to analyze the weight of each indicator to obtain the agricultural economic resilience indicators (Aer).

Table 1. Agricultural economic resilience evaluation indicators.

Target Layer	Indicator Layer	Explanation of Indicators	Indicator Properties	Weights
Resistance and Recovery Capacity (P)	Rural consumption capacity	Consumer price index (CPI)	Positive	0.398
	Engel's coefficient of rural households	Household food consumption index of rural residents	Negative	0.015
	Effective irrigation rate	Effective irrigated area/cultivated area	Positive	0.054
	Total agricultural power per mu	Total power of agricultural machinery/arable land area	Positive	0.044
	Crop sown area	Total crop area sown	Positive	0.056
	Rural education level	Years of education per capita in rural areas	Positive	0.039
	Agricultural fertilizer application	Fertilizer application of agricultural fertilizer discounted amount	Positive	0.060
Adaptation and Adjustment Capacity (S)	Value-added index of primary industry	Primary Industry GDP Growth Index	Positive	0.014
	Rural road accessibility	Rural delivery routes	Positive	0.049
	Rural residents' consumption expenditure level	Amount of per capita consumption expenditure of rural residents	Positive	0.060
Transformation and Innovation and Capacity (R)	Financial support for agriculture	Local finance expenditure on agriculture, forestry and water affairs	Positive	0.030
	Human capital stock	Number of students enrolled in undergraduate and graduate schools of higher education	Positive	0.037
	Rural electricity use	Electricity consumption of rural residents for production and living	Positive	0.143

3.2.2. Core Explanatory Variables

The core explanatory variable is rural industrial integration (Indinte). Since there is no unified and transparent standard for measuring rural industrial integration, academics currently mainly use the comprehensive index method and the coordinated development

index method to measure the development level of industrial integration. In this paper, drawing on the research and methods of Jiang [19] and Wang [35], the comprehensive index method is used to measure the industrial integration evaluation index system, which includes 3 primary indicators (integration basis, integration mode, and integration effect), 11 secondary indicators, and 18 tertiary indicators. Specifically, the integration basis mainly shows agriculture's human, financial, and material resources. The integration method is based on extending the agricultural industry chain and expanding agrarian multi-function. The former refers to the extension of agriculture to secondary and tertiary industries to help realize the organic integration of all links of the industrial chain, while the latter primarily relies on the new industrial forms formed by the natural, ecological, and cultural resources in rural areas to extend the value of agriculture. The integration effect is manifested in four aspects: farmers' income increase, agricultural efficiency increase, urban and rural construction, and ecological environment. The description of each index is shown in Table 2.

Table 2. Rural industrial integration evaluation indicators.

First Grade Indicators	Second Grade Indicators	Third Grade Indicators	Indicator Properties
Integration basis	Workforce literacy	Quality of rural labor force (percentage of elementary school × 6 + percentage of middle school × 9 + percentage of high school × 12 + percentage of college and above × 16)	Positive
	Policy support	Agriculture, forestry, and water expenditure of consumption	Positive
	Finance support	Agricultural insurance degree (agricultural premium income/value added in agriculture, forestry, and fisheries)	Positive
	Market demand	Growth rate of per capita consumption expenditure	Positive
	Foundation support	Investment in rural fixed assets (billion yuan)	Positive
Integration mode	Agricultural industry chain extension	Value added of primary industry to GDP ratio	Positive
		Total power of agricultural machinery (kW)	Positive
		Agriculture, forestry, animal husbandry and fishery total production of total agricultural machinery power (kW) value growth rate (%)	Positive
	Multifunctional expansion of agriculture	Proportion of rural non-farm employment (rural private sector employment rural self-employment/rural population)	Positive
		Food production per capita (kg/person)	Positive
Integration effect	Farmers' income increase	Disposable income of rural residents (yuan)	Positive
		Wage income as a percentage (wage income of village residents as a percentage of disposable income)	Positive
	Agricultural efficiency increase	Primary industry labor productivity (value added in primary sector/employment in primary sector)	Positive
		Agricultural land productivity (gross agricultural output/cultivated land area)	Positive
	Urban and rural construction	Income ratio between urban and rural residents (per capita disposable income of urban residents/per capita net income of farmers)	Positive
		Ratio of consumption levels of urban and rural residents (consumption level of urban residents/consumption level of farmers)	Positive
	Ecological environment	Fertilizer load factor (hm^2/t) (area sown under crops/application of fertilizer)	Positive
		Forest cover (%)	Positive

3.2.3. Mediating Variable

The mediating variable in this paper is the optimization of regional industrial structure (Iso). According to the industrial structure theory, with the continuous development of the

economy and the process of social reproduction, the techno-economic linkages between industries are constantly changing, bringing a qualitative leap to the traditional agricultural production methods and business models, and helping to mitigate the dramatic fluctuations of the agricultural economic system due to external shocks [27]. Drawing on the approach of Sun et al. [36], this research selected the ratio of the output value of secondary and tertiary industries to regional GDP to portray the optimization of industrial structure.

3.2.4. Control Variables

To verify the impact of rural industrial integration on agricultural economic resilience more comprehensively, and to exclude the interference of other factors and increase the goodness of fit of the model, environmental regulation level (regulation), external opening level (open), soil erosion control (erosion), per capita water resources (perwater), and market potential (people) are selected as control variables.

Environmental regulation level (regulation): The level of environmental regulation refers to the relevant rules on environmental protection made by the region while developing the economy. With the rapid economic growth, a substantial environmental cost everywhere has been paid. Problems such as land desertification, ecological resource scarcity, and overuse of environmental factors have erupted continuously. In contrast, good natural environments and ecological resources are the core foundations and prerequisites for agricultural development. Improving the level of environmental regulation can help improve the agricultural production environment and promote the green technological progress of enterprises [12]. In this paper, the ratio of investment in environmental pollution control to regional GDP is used to characterize the level of environmental regulation.

External opening level (open): The level of external openness of a region reflects the degree of economic external openness of that market, and stable external trade helps to promote economic development, drive the flow of agricultural production factors, promote the optimization of agricultural industry structure, and promote the development of agricultural trade innovation [37]. This paper selects the ratio of total regional imports and exports to GDP to portray the level of foreign openness.

Soil erosion control (erosion): Soil erosion control indicates the adjustment of land use structure and the adoption of soil erosion control measures in accordance with the requirements of regional economic development and land suitability. Although indiscriminate deforestation and blind expansion of the arable land area, overgrazing, and heavy input of chemical fertilizers and pesticides can bring short-term agricultural economic growth to a certain extent, damage to the ecological environment such as water resources and soil will lead to incredible challenges to sustainable agricultural development [38]. Soil erosion control is measured by the ratio of erosion control area to provincial and municipal area.

Per capita water resources (perwater): This indicator describes the average amount of water resources per person by population within a region for a given period of time. Natural resources such as water resources are essential for agricultural production and irrigation, and the current shortage of water resources and water pollution pose a significant challenge to agricultural production. In this paper, per capita water resources are expressed in terms of the amount of water available per capita [39].

Market potential (people): The market potential in this paper is defined as the population density within the area. With increasing population density, the increase in the labor force due to the demographic dividend has led to increased agricultural productivity and production efficiency, as well as more employment opportunities, changes in economic structure, and the transformation of traditional industries such as agriculture to high-tech sectors, driving agricultural economic growth. The market potential is measured in terms of population density, expressed through the ratio of resident population to land area [40].

3.3. Data Sources

In this paper, 30 provinces (municipalities and autonomous regions) across China from 2000 to 2020 were selected for the study (data from Tibet, Taiwan, Hong Kong, and

Macao were not used due to missing severe data), containing a total of 630 observations. The original data were mainly obtained from the China Statistical Yearbook, China Rural Statistical Yearbook, China Agricultural Yearbook, China Education Statistical Yearbook, China Information Industry Statistical Yearbook, China Environmental Statistical Yearbook, China Urban Statistical Yearbook, and provincial statistical yearbooks from 1999 to 2021. Some of the missing data were mainly supplemented by consulting the official websites of relevant government departments and by linear interpolation. To avoid heteroskedasticity due to measurement error in the data, logarithmization was used for the control variables. Table 3 shows the results of descriptive statistics for the variables of interest in this paper.

Table 3. Descriptive statistics for each variable.

Variables	Variable Name	Sample Size	Mean	Standard Deviation	Min	Max
aer	Agricultural economic resilience	630	0.213	0.121	0.021	0.662
indinte	Rural industry integration index	630	0.135	0.064	0.043	0.457
regulation	Environmental regulation level	630	0.772	0.285	0.049	1.766
open	External opening level	630	0.015	0.015	0.000	0.101
erosion	Soil erosion control	630	0.025	0.021	0.000	0.303
perwater	Per capita water resources	630	0.065	0.080	0.000	0.481
people	Market potential	630	0.054	0.066	0.004	0.802

4. Result Analysis

4.1. Regression Results

Based on the theory and the baseline model set in this paper for the empirical regression, Table 4 reports the estimated results of the impact of rural industrial integration on agricultural economic resilience. For the choice of model, the results of Hausman test showed that the *p*-value was less than 0.01, so the fixed-effects model was chosen for regression analysis in this paper. Among them, models (1) to (4) present the regression results of fixed effects without adding control variables, individual fixed effects with the addition of control variables, mixed regression, and random effects models, respectively. The results from columns (1) to (4) show that the regression coefficients of the core explanatory variable rural industrial integration (indinte) are significantly positive at the 1% level, regardless of whether control variables or fixed effects are added to the regression, indicating that the regression results of this paper are robust and reliable. It can be seen that rural industrial integration has a significant promoting effect on agricultural economic resilience. The higher the level of rural industrial integration development is, the stronger the agricultural economic resilience will be, which initially proves hypothesis 1 (H1).

In columns (1) and (2), the absolute values of the regression coefficients of fixed effects with the inclusion of control variables are different with those without the inclusion of control variables, and there is a significant difference in R^2, with the R^2 for the fixed effects with the inclusion of control variables being obviously higher than that without the inclusion of control variables. This indicates that, with the inclusion of control variables, the interference of other factors is excluded to some extent, which increases the model's goodness of fit and the extent to which the explanatory variables explain the dependent variable. Comparing columns (2) and (4), it can be found that there are the same differences in the coefficients between them, indicating that, spatially, there is a need to consider the variability in the economic resilience of agriculture between cities. The rapid development of rural industrial integration provides an opportunity and impetus to promote the internal reorganization of agriculture and upgrade industrial chains. Moreover, facilitating the penetration of advanced production factors and technological innovation in primary, secondary, and tertiary industries saves transaction costs, improves agricultural production efficiency, and optimizes rural development. At the same time, industrial integration helps to form "agriculture +" multi-industry development, improve the added value of agricultural products, create agricultural brands, provide new growth paths for agricul-

tural economic development, and enhance the resilience and innovation capacity of the agricultural economic system.

Table 4. Baseline regression results.

Variable	(1)	(2)	(3)	(4)
	Fixed Effects without Adding Control Variables	**Individual Fixed Effects with the Addition of Control Variables**	**Mixed Regression**	**Random Effects Models**
indinte	0.302 ***	0.292 ***	0.569 ***	0.316 ***
	(10.44)	(9.63)	(9.70)	(10.37)
regulation		0.00405	−0.0142	0.00566
		(0.53)	(−1.12)	(0.73)
open		0.711 ***	1.625 ***	0.951 ***
		(2.59)	(5.39)	(3.54)
erosion		−0.443 **	−0.720 **	−0.588 ***
		(−2.19)	(−2.18)	(−3.03)
people		0.178 **	0.666 ***	0.253 ***
		(2.21)	(6.27)	(3.33)
perwater		0.237 **	−0.296***	0.0915
		(2.36)	(−5.58)	(1.03)
_cons	0.172 ***	0.146 ***	0.124 ***	0.147 ***
	(40.65)	(15.25)	(8.74)	(9.02)
City fixed effect	N	Y	N	Y
N	630	630	630	630
R2	0.154	0.179	0.506	0.173

Note: *** and ** represent the significance levels of 1% and 5%, respectively; standard errors are in parentheses.

As far as the control variables are concerned, the impact of the introduction of environmental regulations in China on the resilience of the agricultural economy is currently relatively insignificant. This is mainly because environmental regulation policies in China are formulated by the central government, monitored by local governments, and implemented by enterprises, intending to make polluting enterprises reduce their emissions and innovate technologically to provide a favorable environment for economic and social development. This technological innovation and adjustment of production and business activities are more internal to the secondary industry, and the interaction with agricultural economic activities needs to be improved. In addition, the role of openness degree in influencing the resilience of the agricultural economy is extremely crucial. When a city is more open, its external interaction in agriculture will be much stronger. On the one hand, it can improve the stability of agricultural production and operation in the region through foreign trade of agricultural production factors and products. On the other hand, such openness will make technology diffusion and absorption more efficient on a regional scale, gradually improving agricultural production capacity and efficiency. On the contrary, soil erosion has a negative impact on agricultural economic resilience. As soil erosion reduces the area of arable land in the region, it affects normal agricultural production and operation activities, thus leading to a decrease in the resilience of the agricultural economy in the region. Besides, the population size of the area and the amount of water resources per capita, which are essential and vital resources for agricultural production and operation, are positively affected.

4.2. Robustness Check

To ensure the robustness of the previous benchmark regression results and further examine the impact of rural industrial integration on agricultural economic resilience, the first step is to replace the core explained variable to eliminate the potential effects of a single variable on the regression results. In this paper, we consider the replacement of agricultural economic resilience in the form of rural population employment rate [41]. The industry that has been bridging China's rural areas is mainly agriculture, and since farmers have long accounted for more than half of the total population in China, rural population employment as a factor resource can represent the development trend of the rural economy

to a certain extent. Hence, the employment rate of the rural population can reflect the economic development of rural industries to a certain extent.

Second, compared with other provinces, municipalities directly under the central government enjoy more administrative resources because of their smaller administrative boundaries, which can form a higher-quality industrial cooperation mechanism in the regional context and make the interaction between industries and factors closer. Ultimately there will be more significant variability in the effect of rural industrial integration on agricultural economic resilience. Therefore, this paper excludes the samples of Beijing, Tianjin, Shanghai, and Chongqing municipalities to re-run the benchmark regressions, which can somewhat avoid the estimation bias caused by administrative resource allocation.

Finally, because the baseline regression is prone to statistical inference problems in limited sample situations and the presence of outliers that interfere with the results, based on the above issues, a total of four robustness tests are selected in this paper, namely, replacing core explained variables, eliminating municipalities, random sampling, and shrinking tails for statistical robustness testing. The results are shown in Table 5.

Table 5. Robustness test results.

Variable	(1)	(2)	(3)	(4)	(5)
indinte	1.638 ***	0.214 ***	0.292 ***	0.200 ***	0.256 ***
	(19.91)	(9.54)	(6.18)	(8.28)	(8.17)
_cons	0.490 ***	0.136 ***	0.146 ***	0.155 ***	
	(18.84)	(21.05)	(11.32)	(20.38)	
Control variables	Y	Y	Y	Y	Y
City fixed effect	Y	Y	Y	Y	Y
N	630	546	630	630	600
R^2	0.544	0.256	0.179	0.157	0.159

Note: *** represent the significance levels of 1%; standard errors are in parentheses.

Column (1) indicates the regression with the replacement of the explanatory variables results. Column (2) represents the results of excluding the sample of municipalities, and column (3) displays the results of random sampling. Column (4) illustrates the results of the regression with a 5% reduction in the tail. From the estimation results, it is clear that the direction of the core explanatory variables of the robustness test does not change, and all of them are significant at the 1% level, indicating that the baseline regression results are robust. Meanwhile, comparing the regression results in the first and third columns, it can be found that the regression coefficients excluding the sample of municipalities have become smaller, demonstrating that the effect of rural industrial integration on agricultural economic resilience is more significant in municipalities, which further strengthens the core conclusion of this paper.

Further, considering that there may be a bidirectional causality between industrial integration and agricultural economic resilience, i.e., the enhancement of agricultural economic resilience may promote the coordinated development of inter-industry cooperation, thus leading to the integration of rural industries, which triggers endogeneity problems and affects the reliability of the empirical results. To avoid this problem, this paper chooses the rural industrial integration with one period lag as an instrumental variable to be brought into the benchmark regression model for empirical testing. The instrumental variable not only meets the requirement of "correlation" with the core explanatory variables, but also fulfills the demand of "exclusivity" with the control variables, which is a reasonable exogenous indicator. Column (5) reports the regression estimation results of the instrumental variables, and it can be seen that there is still a significant positive impact of rural industrial integration on the resilience of the agricultural economy. Once again, the core findings of the benchmark regression are corroborated.

4.3. Heterogeneity Analysis

4.3.1. Regional Heterogeneity

In the above, the model is set to take into account the vast territory of China and the apparent differences in the level of rural industrial integration development, agricultural economic foundation, geographical conditions, natural resources, and regional governance policies in each region. In particular, the provinces in the central region are located in the middle and lower reaches of the Yangtze River, which is one of the three major plains in China, with a favorable geographical location, a suitable environment, and sufficient rainfall, making them ideal for agricultural development. As a result, the corresponding agrarian policies have been tilted over the years, resulting in a more complete rural infrastructure and a higher agricultural mechanization level than in other regions. In addition, economic development in most provinces in the eastern region is at the forefront of the country, and the level of rural industrial integration in the east is relatively high. In contrast, the development of manufacturing and service industries in most eastern cities is the focus of local policy attention. Consequently, the growth of other sectors will crowd out agricultural development space, exacerbating the disconnect between the secondary and tertiary sectors and agriculture, and impeding sectoral linkages and the further improvement of agricultural production efficiency, leading to the fact that the impact of rural industrial integration on the resilience of the agricultural economy may be lower than that in the central and western regions. Similarly, the level of rural industrial integration in the western region is low, and the influence of other relevant factors, such as agricultural socialization services and infrastructure construction, will also make its impact effect soft. However, in general, the development of rural industrial integration will enhance the resilience of China's agricultural economy to a certain extent.

To verify whether there is a significant heterogeneous effect of rural industrial integration development on the agricultural economic resilience of different areas, this paper divides 30 provinces in China into three parts: East, Central and West, and studies the effect of rural industrial integration on agricultural economic resilience of cities in East, Central and West respectively. The empirical results are as follows in Table 6.

Table 6. Regional heterogeneity regression results.

Variable	East	Middle	West
indinte	0.324 ***	0.401 ***	0.214 ***
	(6.17)	(7.65)	(4.13)
Control variables	Y	Y	Y
City fixed effect	Y	Y	Y
_cons	0.176 ***	0.390 ***	0.0915 ***
	(6.69)	(4.40)	(7.78)
N	273	126	231
R^2	0.157	0.547	0.192

Note: *** represent the significance levels of 1%; standard errors are in parentheses.

By comparison, it can be seen that the impact effect of rural industrial integration on agricultural economic resilience in the eastern and central regions is more significant than the national average. In contrast, the impact effect in the western cities is smaller than the national average. The main reasons for the spatial divergence of this impact are as follows. On the one hand, the level of rural industrial integration in the western region is lower than that in the eastern and central areas, and the driving effect on agriculture is relatively small. Therefore, the effect of rural industrial integration on agricultural economic resilience in this region is smaller than that in the other two regions. At the same time, from the perspective of regional differences, China's agricultural economic resilience spatially shows the regional characteristic of "high in the west and low in the east" [39] and the higher agricultural economic resilience in the western region requires a higher level of rural industrial integration in this region. As a result, it is more challenging to

improve the agricultural economic resilience of this region. On the other hand, the level of openness, social infrastructure, and services in the east and central regions are higher than those in the west. Rural industrial integration can give more play to agricultural multifunctionality, optimize agricultural development, and strengthen the close connection between agriculture and other industries. Consequently, the externalities brought by the integration of rural industries in the east and central regions can be well transferred to the development of agricultural industries, and can better support the construction of an agricultural economy.

4.3.2. Dimensional Heterogeneity

Based on the above analysis, this paper further explores the variability of the impact of rural industrial integration on three different dimensions of agricultural economic resilience from the perspective of the main and non-main grain-producing areas. Among them, the main grain-producing areas refer to the Opinions on Reforming and Improving Certain Policy Measures for Comprehensive Agricultural Development issued by the Chinese Ministry of Finance in 2003. China's major grain-producing regions include 13 provinces, including Liaoning, Hebei, Shandong, Jilin, Inner Mongolia, Jiangxi, Hunan, Sichuan, Henan, Hubei, Jiangsu, Anhui, and Heilongjiang, while other areas are non-major grain-producing regions.

The regression results in Table 7 reveal that rural industrial integration contributes well to the resistance, adaptation, and transformation of agricultural economic resilience. Still, the degree of impact on each dimension has significant variability. In addition, due to geography and natural resource endowment, the dimensions of agricultural economic resilience also differ between the main grain-producing regions and non-main grain-producing regions. From the results of the total sample of rural industrial integration on each dimension of agricultural economic resilience, the regression coefficients are all significantly positive at the 1% level. Among them, rural industrial integration makes the most outstanding contribution to the resilience of the agricultural economic system, followed by transformation and finally resistance. Meanwhile, compared with the benchmark regression for the total sample, the R2 values of the resilience and transformation regressions are almost all higher than that of the benchmark regression of 0.157, suggesting more substantial explanatory power of the model in these two phases. It indicates that China's agricultural economic resilience is in the stage of adaptation and adjustment when the development of rural industrial integration is more likely to promote the recovery of the agricultural economic system from persistent external shocks to a smooth operation, while the technological innovation effect on the agrarian economy is still in its infancy.

Table 7. Dimensional heterogeneity regression results.

Variable	Total Samples				Main Grain-Producing Areas			Non-Main Grain-Producing Areas		
	Baseline Regression	Resistance	Adaptation	Transformation	Resistance	Adaptation	Transformation	Resistance	Adaptation	Transformation
indinte	0.292 ***	0.197 ***	0.802 ***	0.291 ***	−0.0589	1.154 ***	0.584 ***	0.289 ***	0.568 ***	0.215 ***
	(9.63)	(4.59)	(10.17)	(7.98)	(−1.16)	(7.74)	(5.61)	(5.00)	(6.10)	(7.04)
Control variables	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
City fixed effect	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
_cons	0.155 ***	0.131 ***	0.206 ***	0.150 ***	0.226 ***	−0.0910	0.375 ***	0.106 ***	0.215 ***	0.0693 ***
	(20.38)	(9.63)	(8.28)	(13.02)	(5.96)	(−0.82)	(4.82)	(5.42)	(6.83)	(6.70)
N	630	630	630	630	210	210	210	420	420	420
R^2	0.157	0.054	0.178	0.211	0.114	0.457	0.290	0.074	0.117	0.276

Note: *** represent the significance levels of 1%; standard errors are in parentheses.

Comparing the empirical results of major and non-major grain-producing regions, we can find that the contribution of rural industrial integration to the resilience of the agricultural economic system in major grain-producing regions is remarkably smaller than that in non-major grain-producing areas, probably because of the higher degree of scale and specialization of agricultural development in the major grain-producing region, which has established a certain degree of risk coping measures. In consequence, the positive impact

of the development of rural industrial integration for its resilience has not been significant enough to be influenced by the primitive accumulation in the major grain-producing area. When the main grain-producing regions suffer severe shocks, it is not easy to recover to the original level quickly in a short time because of the high level of specialization and scale of their agricultural production. Furthermore, the food production capacity of the main grain-producing regions is gradually approaching saturation. With the relatively backward level of development of non-agricultural industries, the integrated development of rural industries in the region will, to a certain extent, suppress part of agricultural production. Thus, the resilience of the agricultural economic system is not sufficiently enhanced. On the contrary, the non-main grain-producing regions can benefit from it. Comparing the constant terms suggests that the adaptation capacity of the non-main grain-producing regions is higher than that of main grain-producing regions, so rural industrial integration can promote the adaptation of the agricultural economic system to shocks by optimizing the production structure within agriculture.

4.4. Mechanism Testing

Through the previous analysis, rural industrial integration makes a significant contribution to agricultural economic resilience. In order to further dissect this transmission mechanism, that is, whether rural industrial integration can strengthen agricultural economic resilience by influencing regional industrial structure optimization, this paper selects a regional industrial structure optimization indicator as mediating variable and conducts model robustness tests. To ensure the reliability of the regression results, the influence of some extreme values is excluded, and a 5% tailing process is carried out on the data, with specific reference to the test method of Wen et al. [42]. The results are in Table 8, where column (1) is a benchmark regression, column (2) represents the effect of industrial integration on industrial structure optimization, and the last column shows the overall effect.

Table 8. Intermediary mechanism regression results.

Variables	(1)	(2)	(3)
indinte	0.292 ***	0.0552 ***	0.276 ***
	(9.63)	(13.60)	(7.96)
iso			0.790 ***
			(3.27)
_cons	0.155 ***	0.0655 ***	0.103 ***
	(20.38)	(51.09)	(5.90)
Control variables	Y	Y	Y
City fixed effect	Y	Y	Y
N	630	630	630
R^2	0.157	0.362	0.172

Note: *** represent the significance levels of 1%; standard errors are in parentheses.

From the regression results, rural industrial integration makes a remarkable contribution to the optimization of regional industrial structure. In addition, the effect of rural industrial integration on agricultural economic resilience becomes smaller when both are put into the regression model simultaneously, and the impact of rural industrial integration acting on agricultural economic resilience through industrial restructuring accounts for 5% of the effect. It proves research hypothesis 2 (H2). This is because the development of industrial integration at the regional scale implies the extension of the agricultural industry chain and value chain, which enables the agricultural production process and finished products to face a broader spatial market and demand market. Meanwhile, the integration of agriculture with other industries will gradually promote changes in the regional industrial structure, driving more economic factors such as capital, labor, and non-economic factors such as technology, policies, and cultural concepts to gather in the agricultural market. This not only provides sufficient resources to support the development of agricultural production, but also enriches the types and functions of agricultural products, thus realizing the

transformation and upgrading of the agricultural economic structure and enhancing the resilience of the agricultural economy.

5. Conclusions and Policy Implications

There is a current surge in external uncertainties, such as frequent international conflicts, volatility in global trade markets, global climate change, and frequent natural disasters. Enhancing countries' agricultural production capacity, strengthening domestic food production capacity, and underwriting livelihood security are essential efforts to stabilize the basic domestic economy. By constructing the theoretical mechanism and using provincial panel data in China, this paper reveals that rural industrial integration has a significant positive effect on improving agricultural economic resilience. Besides, through the spatial differentiation of the impact effect, we find that the effect of rural industrial integration is relatively weaker in areas with lower levels of rural industrial integration and relatively backward social infrastructure, but the impact is also significant. From the aspect of main and non-main grain-producing regions, the development of rural industrial integration has a more substantial impact on both the resistance and transformation capacity of the main grain-producing areas but a stronger resilience enhancement of the non-main grain-producing regions. In addition, regional industrial structure optimization is an essential medium through which rural industrial integration affects agricultural economic resilience, i.e., rural industrial integration promotes agricultural economic resilience enhancement by influencing regional industrial structure. Based on the findings of this paper, the following three policy implications can be proposed.

First of all, the government can emphasize the critical role of rural industrial integration in fostering agricultural economic resilience. The institutional supply of industrial integration can be strengthened and the interaction activities of agriculture with other sectors are supposed to be enhanced. On the one hand, the integration of primary and secondary industries is a traditional agricultural development model that can expand the spatial market for agricultural products and enrich the forms of farm products. On the other hand, promoting the integration and innovation of primary and tertiary industries can enhance the added value of agricultural products by combining tourism, services, and local culture to form brand effects, thus improving the economic benefits of agriculture and reinforcing the resilience of agro-economic systems to shocks.

Secondly, there is a need to focus on the role of rural industrial integration in promoting the upgrading of the rural industrial structure. For instance, it makes it possible to optimize the layout of agricultural productivity, extend the agricultural industry chain, strengthen the cultivation of agro-head enterprises, promote the interpenetration of advanced elements and technological innovations among different sectors, push forward the internal reorganization of agriculture, facilitate the upgrading of the industrial structure, and enhance the transformative and innovative capacity of the agricultural economic system, so as to make the relationship between agricultural supply and demand achieve a new equilibrium at a higher level.

Last but not least, in the light of the heterogeneity of the impact of rural industrial integration on the resilience of the agricultural economy, it can integrate the coordinated development of regional agricultural economic resilience. It is necessary to play the role of resilient cultivation of rural industrial integration according to local conditions, apply policy tilts appropriately, as well as increase support to different degrees for the characteristics of eastern, central, and western regions, and actively guide and nurture local enterprises to form products with typical characteristics. At the same time, it carries out cross-regional docking of the agricultural industry chain in the east, center, and west, and cross-border cooperation, exchange and sharing of agricultural technology, to enhance the inter-regional correlation of the agricultural economy, realize complementarity of advantages, and coordinated regional development to strengthen the resilience of the agricultural economy.

It is worth noting that, due to the limitation of data availability, this paper only studies 30 provinces across China and does not consider the impact of Tibet, Hong Kong, Macau, and Taiwan, which is insufficient to reflect China's agricultural economic development comprehensively. In addition, we should further refine the impact of specific exogenous shocks on rural industrial integration on agricultural economic resilience in the future, and explore more factors influencing agricultural economic resilience.

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