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Rural Economic Development Based on Shift-Share Analysis in a Developing Country: A Case Study in Heilongjiang Province, China

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Abstract: Identification of local priorities within each potential sector and implementation of a targeted development policy would definitely accelerate rural economic growth. In this sense, it is useful to examine each region's industrial structural evolution compared to the whole economy and aggregate industries. Shift-share analysis has been confirmed as a useful method to measure regional economic differences and analyze the contribution of industrial structure. This paper selects five representative counties in Heilongjiang province and applies shift-share decomposition to analyze the change in rural economic development from 2000 to 2018. The change of economic growth in each selected county is decomposed into three components: national growth effect, industrial structure effect, and competitive effect, taking the national level as the reference. The results showed the following: (1) the trend of rural economic growth fluctuated greatly for nearly 20 years, distinguished by a mismatch of industrial structure with competitiveness for the selected counties; rural economies with an inappropriate industrial structure did not experience strong growth, despite high competitive potential. (2) The low-end agricultural structure and secondary industry structure led to the loss of each competitive effect; the tertiary industry structure based on economic structure servitization was rational, but the competitive effect did not work out. (3) Finally, this paper provided differentiated suggestions in accordance with local resources and priorities of the selected counties, so as to avoid excessive convergence and the lack of characteristics in industrial structure in rural transformation.

Keywords: rural economic development; shift-share analysis; industrial structure; competitive effect; China

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1. Introduction

In the 21st century, China is facing the pressure of sustainable agricultural development, changes in consumer demand, and the challenges of globalization [1,2]. Meanwhile, the traditional agricultural structure has transformed from a core of food production to the modern agricultural structures of diversification, marketization, and premiumization [3]. China's grain production has been stable at more than 600 million tons since 2013, despite being subject to the constraints of decreasing high-quality farmland, lack of agricultural water, and a shortage of working-age population. In addition, these constraints have been exacerbated by smallholder operation mode, aging production facilities, climate change, and multiple disasters [4]. In this context, a 2017 Chinese government report proposed a strategy of rural revitalization, emphasizing the priority given to the development of agriculture and rural areas.

Under the influence of urbanization, industrialization, and globalization, the traditional agricultural areas in China have undergone a transformation process since 2000. Current studies on implementing the rural revitalization strategy have focused mainly on rural spatial reconstruction and rural land arrangement from village-level or discussion

on industry convergence from a theoretical perspective [3,5,6]. In fact, the core of rural revitalization is industrial revitalization. Different characteristics of rural areas need targeted development paths in practice. It is crucial that local well-positioned industries are utilized, rather than relying on unclear positioning and excessive industry convergence in the countryside. In contrast to the level of urbanization and industrialization in the southeast coastal and the mid-west regions of China, the traditional agricultural area in northeastern China has made the greatest contribution to national food security, while attempting to coordinate the food security role with the promotion of farmers' income. Heilongjiang province is the largest grain-producing province in China, and it has a different rural evolution path due to its prominent position in food production and food security during the past 20 years.

Considering its clarity and simplicity of the shift-share method especially its analysis advantages of regional economic differences, this paper examines the characteristics of industrial change at county-level in Heilongjiang province from 2000 to 2018, tries to find out the competitive or weak sectors compared to the national level, and finally provides suggestions for differentiated rural policy-making. This study is conducive for local government to examine the effectiveness of existing rural policies, so as to formulate more targeted measures to guide rural transformation. Developing countries are still in the process of rural transformation, and we hope our study will provide a reference for rural economic development in developing countries.

The rest of this paper is organized as follows: Section 2 reviews the literature. Section 3 describes the methodology and data. Section 4 presents the empirical results of the shift-share analysis. Section 5 discusses the adopted method, the change of rural population, and provides policy recommendations for the selected counties. Section 6 summarizes the conclusions.

2. Literature Review

Rural areas of the developed world have experienced economic cycles, trade fluctuations, new technological applications, migration flow, policy changes, and environmental change during the past 50 years [7]. Under the influence of globalization, urbanization, and industrialization, large migrant flows have resulted in rural populations being left behind and the hollowing of villages [8]. The decline in the rural economy and society is an inevitable process in the transition from an agricultural economy to urban–industrial and knowledge economies [9,10].

From the perspective of the global economy, the close link between agriculture and rural development has been weakened gradually, although agriculture was once the driving force of rural economies in most rural areas [11]. In the process of rural transformation, the proportion of agriculture in gross domestic product (GDP) decreases; the importance of agricultural output and employment also gradually decreases, accompanied by the transfer of the agricultural labor force to non-agricultural sectors; and the proportions of secondary and service industries in GDP increase simultaneously [12]. Over the past 55 years, the global proportion of the rural population has shown a trend of continuous decline (with an average decline of 42.2%), and the proportion of the working population in primary industry has also decreased [13]. Although the share of traditional agriculture in the rural economy has gradually declined, the basic role of agriculture for food security and its core position in international trade disputes has remained unchanged [14].

Rural transformation is inseparable from the development view of urban bias, in which polarization theories, including the growth pole theory [15] and the core-edge theory [16], focus on urban social and economic development. Rural factors of production flow into non-agricultural industries and urban areas in large quantities, and rapid urban economic development often comes at the expense of rural or underdeveloped peripheral areas [17,18]. As the rural population shrinks, rural areas face challenges such as a shortage of young laborers, a shrinking local market, and economic recession, making it difficult for family-run workshops and small businesses that rely on local markets to survive.

Furthermore, due to the stagnancy of the rural economy and the desire amongst the rural population to experience the urban lifestyle, a large number of educated young people choose to leave the countryside, resulting in so-called brain drain. For example, 30,000 manufacturing jobs were lost in rural Iowa from 2000 to 2003, accounting for more than 10% of the state's total employment [8]. In 2016, more than half of the population aged 20–30 in rural areas in China chose to seek better development opportunities in cities, and about 30% of the rural migrant population had a high school degree or above [4].

Under the influence of global trade and production networks, traditional agriculture is facing unprecedented challenges. The entry of large-scale international agricultural enterprises, with their advantages in capital, technology, management, and marketing, has had a significant impact on agricultural industrialization operations in developing countries, particularly for agricultural and sideline product processing enterprises [19,20]. These independent farms have been gradually replaced by large agricultural companies, and local small-scale enterprises have found it difficult to compete with international enterprises due to backward production techniques and low-end products [21,22]. Some multinational companies have transferred high–polluting intensive industries to suburban and rural areas in developing countries, resulting in environmental pollution and ecological damage in the countryside [23]. Rural economies in some developing countries have been marginalized by globalization and modernization [5].

Since the 1990s, studies on rural transformation in developed countries have focused on multifunctional agriculture [24,25]. Research has found that the function of agricultural production in Europe has been transformed to the coexistence of ecological, cultural, social and agricultural functions [26,27]. The role of agriculture not only ensures food security, but also promotes industrial transition, social stability, poverty reduction, ecological conservation, and cultural inheritance [28]. New business forms, such as leisure agriculture and sightseeing agriculture, have recently appeared, changing the rural productive landscape to a consumptive landscape, and thus reconnecting formerly depressed agriculture with the rural economy [29,30]. Wilson put forward a multifunctionality decision-making funnel for different farm ownership types [31]. From a territorial point of view, multifunctional agriculture is identified as the main facilitator of sustainable rural development, on account of higher production of both commodity and non-commodity outputs that a farm may provide in rural marginal areas [32]. The transition towards multifunctional agriculture is pushed by processes or a boundary shift, aiming at boosting both differentiation and diversification strategies at farm level [33]. Quaranta and Salvia found that economic diversity enhanced rural resilience [34]. Promoting industrial integration and multifunctional agricultural development has emerged as a growing trend in rural economies, and represents the chosen path for rural reconstruction in the context of globalization [35,36]. In fact, more than half of European farmers were actively involved in multifunctional rural development practices [28].

Studies on rural transformation in developing countries are still in the process of rural transformation. Sharma et al. used the off-farm labor ratio to describe the regional differences in the Indian countryside, and divided rural areas into high, higher, lower, and low economic diversity types [37]. Stola studied the agricultural and non-agricultural functions of Polish rural areas based on indexes of land structure, employment structure, number of beds in tourism, and recreation centers [38]. More than 70% of the population of Vietnam live in rural areas, and have had to face uncertainties due to a lack of technology and skill, and inappropriate agricultural policies [39]. In China, Yu et al. used the improved cluster analysis model to divide the countryside in Beijing into typical, exurb, suburban, and urbanized types [40]. Weng et al. used the Delphi method to classify the rural economy in Fujian province into developed, more developed, less developed, and developing types [41]. Ge et al. divided traditional rural types in Huanghuaihai plain into a leisure agriculture county, modern market-oriented county, and suburban county, according to the factors of agricultural production organization and spatial development [42].

Three kinds of county (namely, traditional agricultural county, remote village, and urban–rural fringe area) are typically selected for the study of rural transformation from both developed and developing countries. Rural economic recessions often occurred at the geographical edge of Europe due to location and natural resource dependence [43]. Similarly, rural areas distant from big cities in Canada tended to suffer from rural recessions due to low population density and low capacity for radiation reception from the urban knowledge economy [44]. In the past 50 years, the rural population has decreased in the traditional agricultural heartland within the Great Plains of the United States, while the rural population of leisure counties and health counties increased, peaking in 2010 [18]. Typically, villages experiencing hollowing in China have been located in farming areas, including in the remote northern regions and developed counties on the east coast [45]. In addition, the urban–rural fringe area is also used as a typical indicator of the rural transformation process [46–48]. In their interaction with globalization, urbanization, industrialization, and other factors, the social and economic structures of the urban–rural fringe area have undergone constant change [49,50]. In addition to industrial structure evolution, secondary industry in urban core areas has gradually spread to the countryside, and industrial activities have been the direct driving force for marginal areas [51].

Shift-share analysis has largely been used to examine the difference of regional economic development and analyze the characteristics of industrial structure evolution since 1960s, due to the fact that the statistical information required is very elementary and the analytical possibilities that it offers are quite large [52]. Results allow the causes of economic growth or decline to be interpreted normally from three factors of influence: national, sectoral and regional (local) [53–55]. Goschin used a shift-share analysis to explore regional growth in Romania after its accession to the European Union (EU) [56]. Liu et al. indicated the spatial features of the agricultural economic growth in farming, forestry, animal husbandry and fishery at county level in the Beijing–Tianjin–Hebei region in China from 2000 to 2014, by applying a shift-share model [57]. In this paper, we apply the shift-share method to investigate the industrial change characteristics of traditional agricultural areas in northeastern China, to provide differentiated suggestions for rural policy making and to avoid excessive industrial convergence within counties.

Figure 1 is a flowchart of empirical analysis steps.

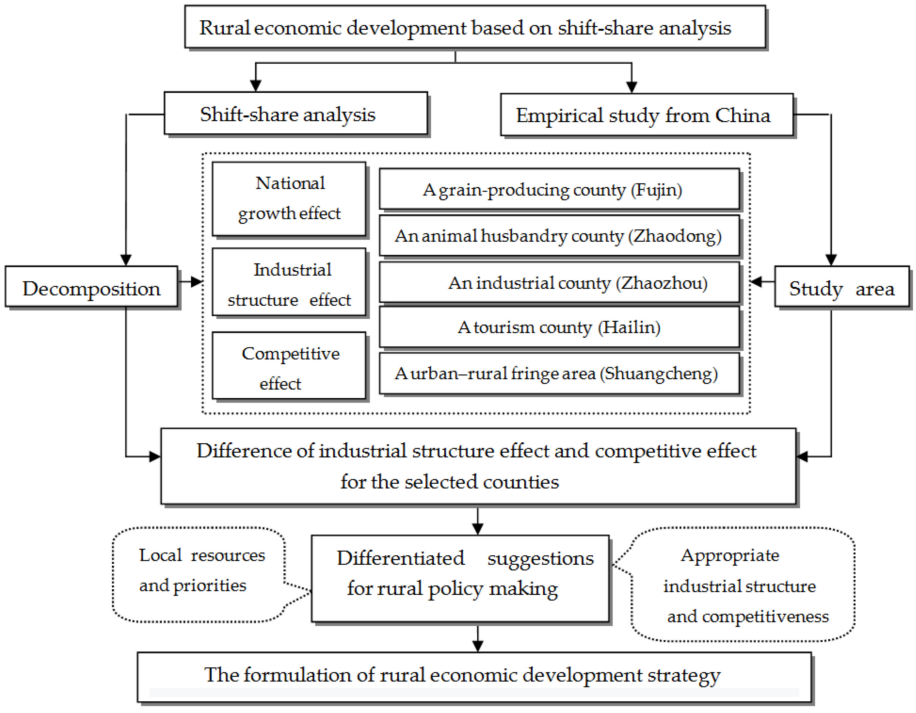


Figure 1. Steps of empirical analysis.

3. Materials and Method

3.1. Study Area

Heilongjiang province is known as the largest cultivated area (15,844,000 hm^2) in China (Figure 2). It has natural advantages in agricultural production, such as higher soil fertility and an advantageous rain–heat combination during the growing season. The main crops include rice, corn, and soybean, whose combined planting area accounts for 95% of the total. In 2018, the GDP in Heilongjiang province was 1.64 trillion yuan, and the ratio of the three industries' contributions to Heilongjiang's GDP was 1.8:2.5:5.7 (the planting industry accounted for 66% of the total agricultural output value); the rural working population was 9.06 million, and about 67% of the total workforce was employed in agriculture. Based on different natural resources, location, and industrial characteristics of rural areas in Heilongjiang province, we selected a remote grain-producing county, an animal husbandry county, an industrial county, a tourism county and a urban–rural fringe area as the representative rural areas; these were Fujin, Zhaodong, Zhaozhou, Hailin, and Shuangcheng, respectively.

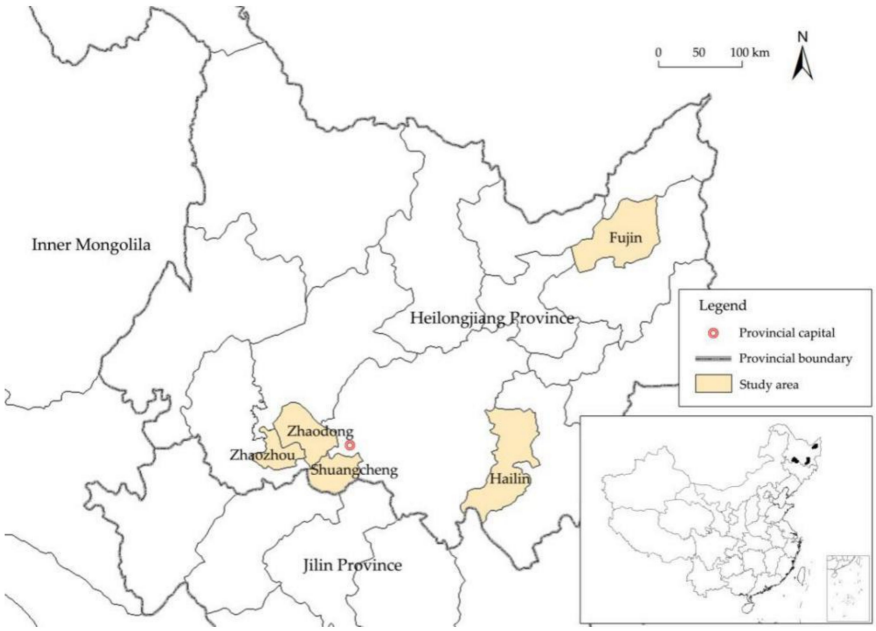


Figure 2. Map of the study area.

Generally, the primary industry in Heilongjiang province is agriculture; the leading industries of the secondary industry include farm produce processing and exploitation of minerals (due to the oil and gas resource wealth in some counties); and the leading industries of the tertiary industry focus on modern service industries, including transportation, modern logistics, and rural tourism. The proportions of GDP for given years in each county are shown in Figure 3.

3.2. Method

We estimated the industrial structure and competitive effects for the selected counties in a shift-share framework, following Liu et al. [57] and Guan et al. [58]. The change in GDP growth (ΔGDP) in each selected county from 2000 to 2018 was decomposed into three components: national growth effect (NGE), industrial structure effect (ISE), and competitive effect (CE), taking the national level as the reference. The equations are as follows.

$$\Delta GDP_{ij} = e_{ij}^{(t)} - e_{ij}^{(0)} = NGE_{ij} + ISE_{ij} + CE_{ij} \quad (1)$$

$$NGE_{ij} = e_{ij}^{(0)} \cdot R \quad (2)$$

$$ISE_{ij} = e_{ij}^{(0)} \cdot (R_j - R) \quad (3)$$

$$CE_{ij} = e_{ij}^{(0)} \cdot (r_{ij} - R_j) \quad (4)$$

$$R = (E^t - E^0)/E^0 \quad (5)$$

$$R_j = (E_j^t - E_j^0)/E_j^0 \quad (6)$$

$$r_{ij} = (e_{ij}^{(t)} - e_{ij}^{(0)})/e_{ij}^{(0)} \quad (7)$$

Where ΔGDP_{ij} represents the added value of GDP of industry j in county i at a given interval; ${e_{ij}}^{(0)}$ and ${e_{ij}}^{(t)}$ represent economic scales for industry j in county i at the base year (0) and the end year (t), respectively; NGE_{ij}, ISE_{ij} and CE_{ij} represent the national growth effect (NGE), industrial structure effect (ISE), and competitive effect (CE) of industry j in county i, respectively. NGE_{ij} denotes the value of GDP growth of industry j in county i that should be achieved according to the change rate of the industry j at the national scale at a given interval. If NGE_{ij} is positive, it indicates the industry j in county i appears to have a growth advantage; otherwise, the industry j in county i appears to have a growth disadvantage. ISE_{ij} represents the economic scale of industry j in county i based on the difference in growth rate between county i and the national level; this indicates industry j in county i has structural advantages and good growth if ISE_{ij} is positive; otherwise, industry j in county i has structural disadvantages and poor growth. CE_{ij} represents the competitive effect of industry j in county i, based on measuring the difference of the output change of industry j between county i and the national level. This reveals the advantages or disadvantages of industry j in county i; it indicates that industry j in county i is strongly competitive if CE_{ij} is positive, otherwise, industry j in county i is weakly competitive.

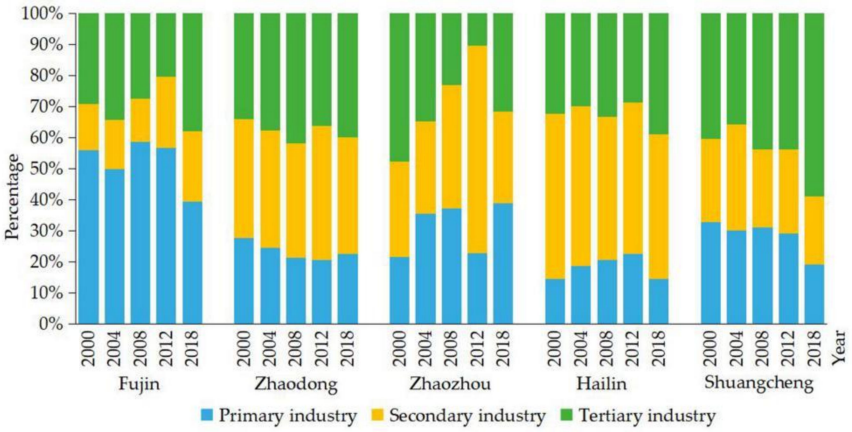


Figure 3. The proportion of the three industries' gross domestic product (GDP) in each selected county.

In the above formula, R and R_j represent the total GDP change rate at the national level and the GDP change rate of industry j at the national level, respectively. E^0 and E^t represent the total GDP at the national level at the base year (0) and the end year (t), respectively. ${E_j}^0$ and ${E_j}^t$ represent the economic scale of industry j at the national level at the base year (0) and the end year (t), respectively. r_{ij} represents the GDP change rate of industry j in county i.

3.3. Data Sources

Data for the years from 2000 to 2018 were collected from the China Statistical Yearbook, the China Rural Statistical Yearbook, China County Statistical Yearbook, and Heilongjiang Statistical Yearbook. In addition, some data were collected from communiques on social development at various localities. Some missing data were calculated using data of adjacent

years. All the original data reported at current prices were deflated to represent a constant 2000 price.

We considered some special time points for agricultural and rural development in China; for example, the state implemented reform of agricultural tax reduction and exemption in 2004; the global financial crisis occurred in 2008; grain output, stocks, and imports increased concurrently in 2012; and industrial overcapacity was exacerbated in 2012. Hence, we divided the study phase (2000–2018) into four stages, i.e., 2000–2004, 2004–2008, 2008–2012, and 2012–2018.

4. Results and Analysis

4.1. Decomposition of the Rural Economy Based on the Shift-Share Method

According to the above Equations (1)–(7), we took the national level as the reference, chose indicators of three industries' GDP in each selected county, and estimated the industrial structure and competitive effects for the selected counties from 2000 to 2018. The shift-share decompositions of the rural economies of the selected counties are shown in Tables 1 and 2.

Table 1. Results of the shift-share decomposition of the rural economy (unit: 10^8 yuan).

County	2000–2004				2004–2008				2008–2012				2012–2018			
	ΔGDP	*NGE*	*ISE*	*CE*	*ΔGDP*	*NGE*	*ISE*	*CE*	*ΔGDP*	*NGE*	*ISE*	*CE*	*ΔGDP*	*NGE*	*ISE*	*CE*
Fujin																
PI	4.2	6.6	−4.4	2.0	15.3	11.2	−7.3	11.4	35.6	15.1	−8.7	29.3	−21.3	35.4	−17.9	−38.8
SI	2.1	1.8	0.3	0.1	2.1	3.6	0.2	−1.7	20.3	3.6	0.5	16.2	0	14.4	−1.0	−13.4
TI	5.4	3.4	0.3	1.7	3.0	7.7	1.0	−5.7	9.0	7.1	−0.1	2.1	21.9	12.8	2.0	7.1
Zhaodong																
PI	7.9	8.3	−5.5	5.1	20.3	15.5	−10.1	14.9	46.7	20.4	−11.8	38.1	−12.5	47.3	−23.9	−35.9
SI	15.2	11.4	1.6	2.2	39.1	23.8	1.5	13.8	116.9	34.8	4.9	77.2	−62.1	99.2	−6.9	−154.4
TI	18.0	10.1	0.9	6.9	51.1	23.7	3.0	24.4	72.6	39.9	−0.8	33.5	−21.4	82.9	12.8	−117.0
Zhaozhou																
PI	5.2	1.1	−0.7	4.8	3.7	4.5	−2.9	2.1	14.4	4.9	−2.9	12.3	4.1	13.0	−6.6	−2.3
SI	2.8	1.6	0.2	1.0	5.7	3.7	0.2	1.7	63.5	5.3	0.7	57.5	−53.2	38.0	−2.6	−88.6
TI	1.9	2.5	0.2	−0.7	−0.5	4.4	0.6	−5.4	4.7	3.1	−0.1	1.7	12.5	5.9	0.9	5.7
Hailin																
PI	3.3	1.6	−1.1	2.8	7.9	4.0	−2.6	6.5	20.7	6.4	−3.7	18.0	−7.6	17.8	−9.0	−16.4
SI	5.7	5.8	0.8	−0.9	13.9	10.9	0.7	2.3	44.2	14.2	2.0	27.9	11.7	38.8	−2.7	−24.4
TI	2.9	3.5	0.3	−0.9	12.8	6.3	0.8	5.6	21.3	10.3	−0.2	11.2	29.4	22.7	3.5	3.3
Shuang-cheng																
PI	14.5	9.7	−6.5	11.2	21.3	21.2	−13.9	13.9	53.9	25.1	−14.6	43.4	−10.8	56.4	−28.5	−38.7
SI	23.4	7.9	1.1	14.4	4.9	24.0	1.5	−20.6	57.9	20.1	2.8	34.9	10.4	52.6	−3.7	−38.5
TI	16.4	11.9	1.1	3.4	38.0	25.3	3.2	9.5	87.4	35.4	−0.7	52.8	140.2	85.1	13.1	42.0

Notes: ΔGDP represents the change in GDP growth, NGE represents the national growth effect, ISE represents the industrial structure effect, and CE represents the competitive effect; PI represents the primary industry, SI represents the secondary industry, and TI represents the tertiary industry.

Table 2. Cumulative results of shift-share analysis on the rural economy(unit: 10^8 yuan).

County	2000–2004				2004–2008				2008–2012				2012–2018			
	ΔGDP	*NGE*	*ISE*	*CE*	*ΔGDP*	*NGE*	*ISE*	*CE*	*ΔGDP*	*NGE*	*ISE*	*CE*	*ΔGDP*	*NGE*	*ISE*	*CE*
Fujin	11.8	11.9	−3.8	3.8	20.4	22.5	−6.1	4.0	64.9	25.7	−8.4	47.6	0.6	62.5	−16.9	−45.1
Zhaodong	41.0	29.8	−3.0	14.2	110.5	63.1	−5.7	53.1	236.2	95.1	−7.8	148.9	−96.0	229.4	−18.0	−307.3
Zhaozhou	10.0	5.2	−0.3	5.1	8.9	12.6	−2.1	−1.6	82.6	13.3	−2.2	71.5	−36.5	56.9	−8.3	−85.2
Hailin	11.9	10.9	0.1	0.9	34.6	21.3	−1.1	14.4	86.2	30.9	−1.9	57.2	33.5	79.3	−8.2	−37.6
Shuang-cheng	54.3	29.6	−4.3	29	64.1	70.5	−9.2	2.8	199.3	80.6	−12.5	131.1	139.9	194	−19.0	−35.1

Notes: ΔGDP represents the change in GDP growth, NGE represents the national growth effect, ISE represents the industrial structure effect, and CE represents the competitive effect.

As shown in Table 1, agricultural economies (representative of primary industry) of the five counties were positive and fluctuated under a series of agricultural policies during the first three stages; each county's agricultural economy exceeded the national level during 2008–2012, under the encouragement of a 4 trillion yuan bailout plan launched by the Chinese government to cope with the 2008 global financial crisis. Subsequently, due to the cessation of the above rescue policy and operation of market mechanisms to resolve overcapacity, four counties experienced negative values of agricultural economic growth, and the gap in agricultural economic growth between the selected counties and the national level increased.

The added values of GDP of the secondary industry in the five counties were positive and unstable during the first three stages. Similarly, they were higher than that of the national level from 2008 to 2012. This industry benefitted substantially from the national macro-control policy, particularly for the animal husbandry county, Zhaodong, whose agricultural product processing industry showed apparent growth advantages. Due to the impacts of the macroeconomic operating cycle and overcapacity, the values of GDP growth for secondary industry declined for both the animal husbandry and industry counties. Furthermore, the added values of GDP for the other three counties were also lower than that of the national average from 2012 to 2018.

Generally the tertiary industry in the five selected counties, including the added value of GDP, the industrial structure share, and competitiveness share, showed apparent growth advantages.

As shown in Table 2, according to the cumulative results of shift-share analysis on the rural economy, the added values of GDP in Fujin were slightly lower than its share components during the first two stages ($11.8 \times 10^8/11.9 \times 10^8$ yuan and $20.4 \times 10^8/22.5 \times 10^8$ yuan, respectively); the added values of GDP in both Zhaodong and Hailin were higher than their respective share components ($41.0 \times 10^8/29.8 \times 10^8$ yuan, $110.5 \times 10^8/63.1 \times 10^8$ yuan and $11.9 \times 10^8/10.9 \times 10^8$ yuan, $34.6 \times 10^8/21.3 \times 10^8$ yuan, respectively); and the added values of GDP in both Zhaozhou and Shuangcheng were higher or lower than their respective share components during the first two stages. The added values of GDP in all of the selected counties were substantially higher than their respective share components during the third stage, despite inappropriate industry structures. A differentiated trend occurred during the fourth stage: counties with tourism resources, such as Hailin, or a location advantage, such as the urban–rural fringe area, Shuangcheng, showed good development potential, with positive added values of GDP (33.5×10^8 yuan and 139.9×10^8 yuan, respectively) despite being lower than their respective share components (79.3×10^8 yuan and 194×10^8 yuan, respectively). During 2012–2018, the added value of GDP of the grain-producing county, Fujin, was only 0.6×10^8 yuan, and GDP growth for both the animal husbandry and industry counties were negative (-96×10^8 yuan and -36.5×10^8 yuan, respectively).

In addition, the results indicated definite change trends in industrial structure components (all negative, except Hainlin during the first stage) and competitiveness components (from positive to negative, except Zhaozhou during the second stage) for the five selected counties. These results confirmed that a rural economy under an inappropriate industrial structure will eventually experience rural recession despite a positive competitive effect. Comparatively speaking, irrespective of the perspective (i.e., GDP growth, industrial structure component, or competitiveness component) during the fourth stage, the urban–rural fringe area, Shuangcheng, showed a less negative effect, indicating that urban–rural fringe area had apparent advantages in rural transformation. In contrast, the animal husbandry and industrial counties showed generally declining trends in GDP growth, industrial structure, and competitiveness. The grain-producing county did not have the advantage of rural transformation.

Furthermore, Figure 4 shows the growth rates of per capita GDP in the selected counties. The growth rates of per capita GDP in most selected counties were close to that of the national level; only the growth rate of per capita GDP in Zhaozhou, an industrial

county, peaked during the third stage due to the stimulation of the rescue policy in 2008, before falling sharply during the next stage. It confirmed that rural industrial development is closely related to the status of regional industrialization development [59]. Since 2000, northeastern China as the old industrial bases, distinguished by urban economic recession, has become a representative sample of urban shrinkage [60]. It is not surprising that Zhaozhou county's economic development is affected by regional economy.

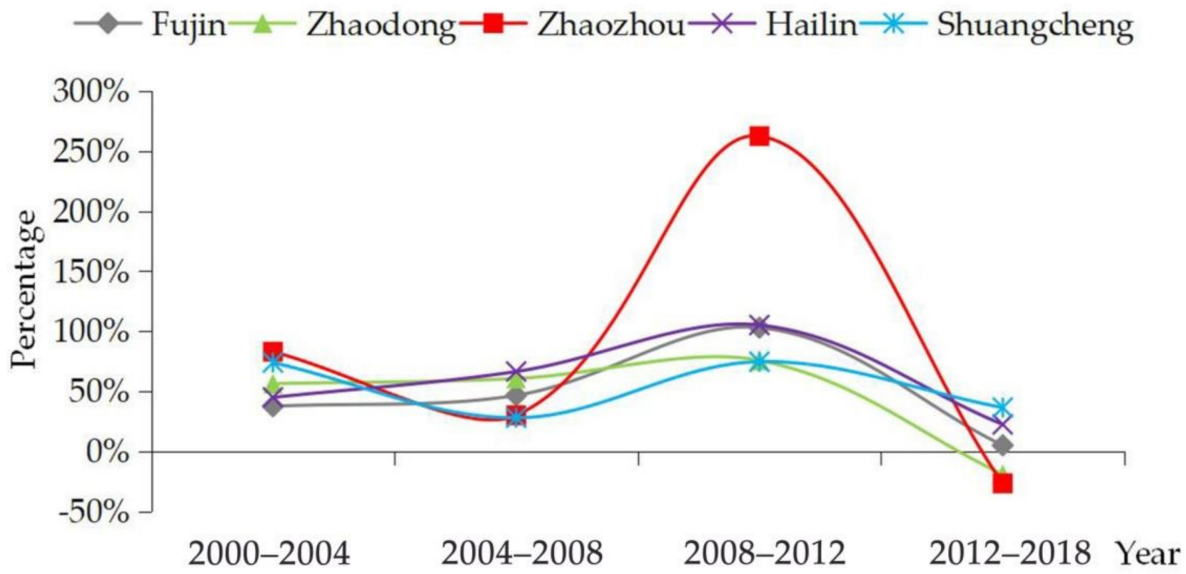


Figure 4. The growth rates of per capita GDP in the selected counties.

As shown in Figure 5, the growth rate of per capita agricultural output of Fujin showed an inverted U-pattern and peaked during the third stage; the curves of the animal husbandry, industrial, and tourism counties all showed an inverted N-pattern and alternated from peak to trough. The growth rate of per capita agricultural output in the urban–rural fringe area was relatively stable.

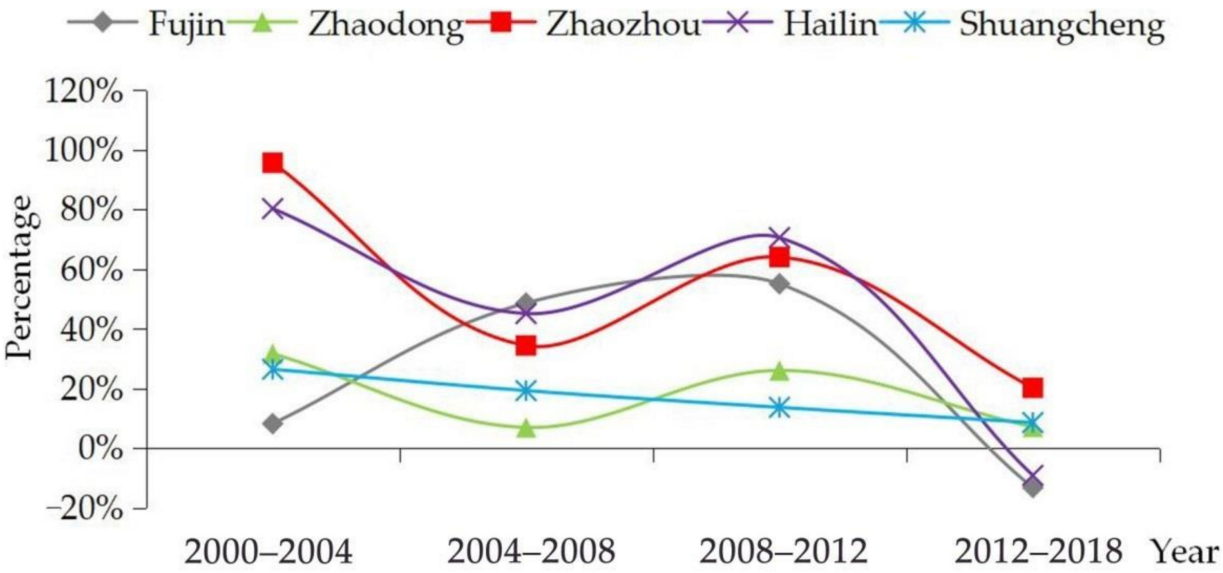


Figure 5. The growth rates of per capita agricultural output in the selected counties.

4.2. Shifts in Industrial Structure Share and Competitiveness Share

Based on the results of Tables 1 and 2, the shifts in industrial structure share and competitiveness share of the selected counties are shown in Figure 6.

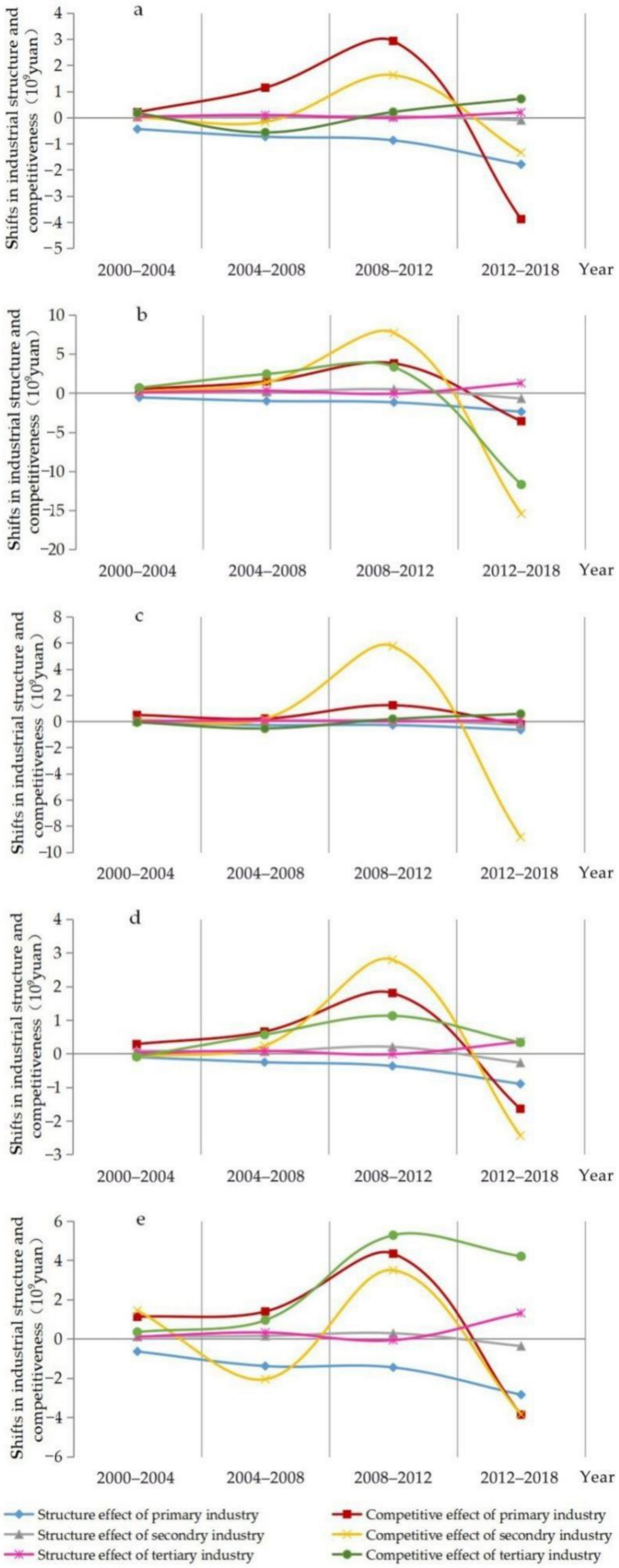


Figure 6. Shifts in industrial structure and competitiveness of the selected counties. (**a**): Fujin; (**b**): Zhaodong; (**c**): Zhaozhou; (**d**): Hailin; (**e**): Shuangcheng.

Specific analysis of the selected counties is as follows.

(1) Fujin county, as a remote grain-producing county, located in one of the three remaining black soil belts in the world, has both the largest and most productive farms in China, and its per capita cultivated land area is 10 times as much as the national average. It has suitable conditions for agricultural production, such as good irrigation and fertile soil (whose organic matter content is six times as much as that of the national average). Furthermore, the comprehensive mechanization rate of agriculture in Fujin is as high as 98%. Fujin county is famous for its abundant rice, corn, and soybeans, with an annual grain output of 1 million tons.

The shifts in industrial structure share and competitiveness share of Fujin from 2000 to 2018 are shown in Figure 6a. In the course of rural transformation, agricultural development of Fujin had been impacted by both domestic and foreign markets. As a result, its agricultural structure component has always been negative, and Fujin showed the biggest fluctuation of agricultural structure effect and competitive effect. In the past decade, accompanied by decreasing demand for grain, and particularly following the implementation of a policy of market pricing for grain purchasing, single planting structures without product features have led to declining agricultural competitiveness.

The secondary industry structure in Fujin based on agricultural product processing had been close to the national level for many years.

The competitive effect of secondary industry decreased recently due to low-end products and the lack of innovation. The structural component of tertiary industry in Fujin was close to the national level, but its competitive effect of tertiary industry was unstable. Figure 6a indicates that the structural component and competitiveness component of tertiary industry in Fujin showed recent improvement.

(2) Zhaodong county is not only a grain-producing county, but also one of the top 100 animal husbandry counties in China. It is a major breeding area for dairy cows, beef cattle, pigs, and poultry. As a national demonstration base for new industrialization, Zhaodong has great potential for the food processing industry.

As shown in Figure 6b, the three industry structures in Zhaodong were close to the national level during 2000–2008; only the tertiary industry structure grew better than the national average recently. From the perspective of the competitiveness component, Zhaodong had the competitive advantage of a green food processing industry, such as alcohol and biological pharmaceutical deep-processing and animal products deep-processing. Due to a lack of product innovation, its secondary industry competitiveness recently changed from being an advantage to being a disadvantage; the tertiary industry competitiveness dropped quickly and the competitiveness of the primary industry also experienced a decline.

(3) Zhaozhou county is an important development zone for peripheral oil fields. It is one of the five gas fields in China and is rich in oil and gas resources, with proven oil reserves of 156 million tons, and proven gas reserves of 100 billion cubic meters.

Generally, the components of the three-industry structure in Zhaozhou were close to the national average from 2000 to 2018 (Figure 6c), except for the third stage of 2008 to 2012, in which its industrial competitiveness based on energy and raw materials peaked in the third stage under the stimulus of the government rescue policy. The mining industry in Zhaozhou has stagnated or even declined since 2012, because of the impact of overcapacity. By 2018, its second industrial competitiveness had fallen to historic lows, and the agricultural competitiveness also declined recently.

(4) Hailin is rich in original ecological resources such as forests (with a forest coverage rate of 78%), rivers, and lakes. As a result, Hailin is a national famous ecotourism county. Most of its agricultural products are green food; the secondary industry in Hailin is forestry resource exploitation, including deep-processing of wood and biomedicine, and its leading industry in the tertiary industry is tourism.

As shown in Figure 6d, the secondary industry, dominated by wood deep-processing and biopharmaceuticals, showed a fluctuating trend shaped like a reverse U from 2000 to 2018. The tertiary industry structure based on tourism showed good potential, although

the competitiveness of the tertiary industry declined recently due to the lack of continuous innovation to meet market demand. Furthermore, its advantage of agricultural competitiveness declined.

(5) Shuangcheng is the municipal district of Harbin, the provincial capital. It has location and policy advantages compared with the other four counties. From 2000 to 2018, its three industrial structures underwent significant changes (Figure 6e). The levels of primary and secondary industrial structures were below those of the national average. In recent years, with the development of urbanization, the process of agricultural land transfer accelerated, and the agricultural structure, which was dominated by the planting industry, showed an obvious downward trend. However, the tertiary industrial structure in Shuangcheng, featuring leisure agriculture, sightseeing agriculture, and commercial logistics industry, showed apparent growth potential.

The competitiveness components in Shuangcheng fluctuated greatly. The competitiveness components of the three industries peaked in the third stage, and the competitiveness component of the secondary industry, which was dominated by the processing industry, fluctuated from peak to trough during each of the four stages.

5. Discussion

(1) In terms of the shift-share approach, in order to enhance our understanding of the regional economic difference over time, the method was widely used due to its clarity and simplicity [56], and several modifications of the basic specification have been created since 1960s in order to separate output changes from productivity gains [61], to introduce total factor productivity [62], or to incorporate the sectoral structure [63], etc. Martin et al. indicated the changes of regional economic structure during the process of economic depression, based on the employment response of major regions in the UK during the past 40 years [53]. Li et al. analyzed the changes of industrial structure and competitive effects of the old industrial base in China in different economic cycles, and proposed suggestions from path dependence to path breakthrough [54]. Moreover, both of them extended their research to regional resilience. Using the shift-share method, regional or urban economic difference has been mentioned in most studies, and more attention is paid to the industrial structure adjustment and competitiveness analysis.

By contrast, rural industries are not fully developed compared to the national and regional/urban levels. However, this does not stop us from applying the shift-share method to rural economic development. Identification of local priorities within each potential sectors and implementation of a targeted development policy would definitely accelerate rural economic growth. Recently, the difference of agricultural economic growth was studied in detail in farming, forestry, animal husbandry and fishery at county level in Beijing–Tianjin–Hebei region in China during 2000–2014 [57].

Heilongjiang province is an important grain-producing base in China. Its rural industries have evolved apparently from traditional agriculture to agricultural processing industry, service industry and other advanced industries since 2000. It is urgent to make rural industries complement each other and cultivate emerging competitive industries. So we used the shift-share analysis to examine the differences of county economy of Heilongjiang province, and tried to find out the competitive or weak sectors compared to the national level, which would help us to make targeted development policies.

It is pointed out that rural economy is affected by both the macroeconomic cycle and the agricultural production cycle, and the agricultural production cycle does not always align with the macroeconomic cycle. Therefore, we studied rural economic development considering significant agricultural policies besides macroeconomic background, and split the study period of nearly 20 years into four intervals.

We hope our study will provide a reference for rural economic development in developing countries, and we will put forward more detailed strategies for each selected counties in future studies, based on features of the agricultural economic growth in farming, forestry, animal husbandry and fishery.

(2) Seen from the correlation of regional economy, the ability of cities in northeastern China to absorb rural laborers has steadily fallen due to excess capacity since 21st century, and a large number of surplus rural laborers have been constrained to agriculture. In fact, the rationalization of the rural industrial structure relies on the coordination ability and correlation level of agriculture, rural industry, and rural service industry under certain economic conditions, among which the rational allocation of rural labor in various industries is the key factor [60]. However, as shown in Figure 7, the rural workforce of the selected counties was overly dependent on the primary industry. Only the non-agricultural population in Fujin county showed a growing trend and there was no obvious increase in non-agricultural population in the other four selected counties.

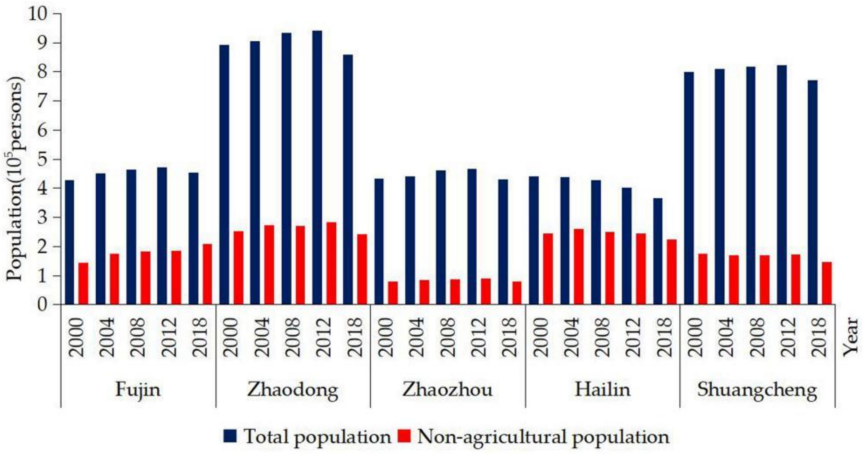


Figure 7. Rural total population and non-agricultural population in the selected counties.

Generally speaking, China's rural areas have long lacked the support of capital, technology, and relevant policies. Therefore, it is not universally feasible for these types of support to be used to promote the optimization and upgrading of the rural industrial structure [64,65]. However, the integration of agriculture and tourism provides a feasible means of promoting the optimization and upgrading of the rural industrial structure. This approach has a relatively low demand requirement and helps alleviate the shortage of scarce factors such as capital and technology. To date, the tertiary industry based on agriculture in rural areas, such as "agriculture+" or "tourism+", has not been fully utilized.

(3) Suggestions for different kinds of county economy. With changes in the diets of the population, the demand for grain and the importance of grain production have declined. Meanwhile, multifunctional agricultural demands, including ecological, landscape, tourism, and culture functions, have gradually increased. All these have important policy implications for agricultural structure adjustment and rural economic development.

Specifically, the suggestions for the selected counties are as follows.

- It is important for grain-producing counties such as Fujin to establish a diversified industrial structure, on the one hand, build a rational planting structure and increase corn, rice, soybeans, and other staple food production capacity; on the other hand, expand planting areas of economic and feed crops to meet the needs of diversified consumer demand. That is to say, market-oriented reform should be deepened to ensure the effective supply of agricultural products, especially for grain-producing counties. Additionally, the growth advantages of the tertiary industry should be fully utilized to extend the industrial chain; producer services with strong competitiveness will be supported, such as goods transportation, storage, and e-commerce services for high-quality agricultural products; and the non-agricultural population should be encouraged to engage in the business and logistics industry in connection with the green agricultural production system.

- Zhaodong county is famous for green agriculture and animal husbandry products. For this kind of county economy, the fiscal policy of the agricultural financial support system should be adjusted from being grain-oriented to having a focus on both grain and other high-value agricultural products, thus, it is feasible to construct a production and processing base for agricultural and sideline producing, and agricultural product trade, which will accelerate to form an industrial chain integrating planting (breeding), processing, and trade to improve the competitiveness of the county economy.
- Zhaozhou county should rely on local resources and industrial cluster advantages to explore enterprise transformation, such as food processing and technology-intensive industries (including biological organic fertilizer production and factory production of edible fungi). This is a feasible approach to deepening the division of labor and cooperation within neighboring regions, which may reduce corporations' costs, improve regional production efficiency, and enhance regional competitiveness. This represents both an opportunity and a challenge for Zhaozhou to form new relationships between industry and agriculture, i.e., industry promoting agriculture or industry and agriculture benefitting each other.
- The leading role of ecotourism in regional economic growth is a promising approach for Hailin. The uniqueness of leisure agricultural products and services can be strengthened, and leisure agriculture management can be improved by exploring the potential of leisure agriculture in Hailin. New methods of media advertising, including web celebrities, and live broadcasts with goods should be encouraged to expand marketing strategies and increase the influence of leisure and sightseeing agriculture. Industrial integration can also be combined with landscape reconstruction, such as in the construction of a tourist town through population agglomeration, service agglomeration, spatial agglomeration, and ecological agglomeration, thus improving accessibility to services and rural public transport.
- The keys to development of urban–rural fringe areas such as Shuangcheng are to take advantage of location and logistics conditions, actively receive industrial transfer and urban economic radiation from Harbin, and construct industrial parks to attract a greater non-agricultural population. These areas can shift from a base of grain-production, dairy product processing, and food processing to a regional service center, such as in the form of a commercial center, logistics center, and service center. Investment, taxes, transfer payments, and other industrial support of local governments can focus reasonably on secondary and tertiary industries. Building large wholesale markets can also help to create jobs, develop agricultural tourism and ecological agriculture, and optimize the employment structure of surplus rural labor.

6. Conclusions

During the past 20 years, traditional agricultural areas in China have undergone an obvious transformation process. In order to provide differentiated suggestions in accordance with local resources and potential sectors, this paper selects five representative counties in Heilongjiang province, namely, a remote grain-producing county (Fujin), an animal husbandry county (Zhaodong), an industrial county (Zhaozhou), a tourism county (Hailin), and a urban–rural fringe area (Shuangcheng), and applies the shift-share method to examine economic differences of rural areas.

The results showed that: (1) the trend of the rural economy fluctuated substantially among the selected counties, distinguished by a mismatch between the industrial structure and their respective competitive effects. As a result, the rural economy under an inappropriate industrial structure will eventually experience recession despite a potential competitiveness share. The tertiary industry structure was appropriate and showed good potential for economic structure servitization, but its competitive advantage required further improvement. (2) Different issues existed among the selected counties. As a remote grain-producing county, Fujin faced the most significant problem of a single planting structure, which was not aligned with market demand. The processing industry in Zhaodong

county, based on agricultural and animal husbandry products, lacked innovative products with high quality, which led to its declining competitiveness. The secondary industry in Zhaozhou, as an industrial county, was affected by overcapacity and required industrial transformation. Hailin's tourism industry was still at the transitional stage from low-end tourism to leisure and sightseeing agriculture. Shuangcheng had not fully utilized the regional advantages of the urban–rural fringe area, such as undertaking urban industrial transfer and economic radiation.

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