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The Impact of Population Ageing on Rural Revitalization- Evidence from China's Yangtze River Economic Belt

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Abstract: *The Yangtze River Economic Belt is an important demographic and economic region in China, and an empirical study of this region can provide a good understanding of the actual situation in China. This paper uses the panel data of the Yangtze River Economic Belt from 2011 to 2020 and establishes a comprehensive evaluation index system for rural revitalization. Drawing conclusions after empirical research using the entropy value method and panel Tobit model: (1) During the decade from 2011 to 2020, the level of rural revitalization in all 11 provinces and cities of the Yangtze River Economic Belt has been improving, and the growth rates are not significantly different. (2) In general, population Ageing has promoted the development of rural revitalization in the Yangtze River Economic Belt. (3) The regions' empirical results show that the population Ageing's promoting effect on rural revitalization is only produced in downstream Jiangsu, Zhejiang and Shanghai while inhibiting the effect on the middle and upstream regions.*

Keywords: *Population ageing, Rural revitalization, Yangtze River Economic Belt, Regional differences*

1. Introduction and literature review

China is now facing a severe problem of population Ageing. According to the NBSC data, the population aged 65 and above will reach 13.5% in 2020, and the three significant trends of Ageing, childlessness and non-marriage will accelerate. At the same time, China's urban-rural income ratio will be about 2.5 in 2021. How to carry out rural revitalization is the focus of China's work in the next period, while a large number of rural villages in central and western regions are facing the problems of a significant outflow of young adults, insufficient knowledge reserve and professional skills of the elderly, and slow progress of rural revitalization.

Population Ageing is a new problem that has emerged since the human race entered industrial society. The root cause is the demographic transition from "high birth rate - high mortality" to "low birth rate - low mortality" with the development of industrial society. There is a wealth of academic research on population Ageing, and scholars have studied various aspects of population Ageing. Population Ageing affects a wide range of economic and social activities such as industrial upgrading [1], consumption [2], agricultural output [3], economic growth [4], housing demand [5], savings rate and tax burden [6-7]. In practice, however, there is no unanimous opinion on these effects, and scholars with positive or negative views have given their empirical processes and theoretical mechanism analysis. Some scholars have also studied the spatial distribution of population Ageing [8-9], and there are significant differences among regions in China. Therefore, we must take this factor into account in our empirical studies.

Regionally, He argues that the key to implementing rural revitalization strategy is for the central and western rural areas [10]. Guo et al. also argued that in terms of regional selection, key areas of deep poverty and decline should be taken as the key areas for rural revitalization [11]. Then, in terms of evaluation system, many scholars have conducted research based on various methods [12-13]. These studies have undoubtedly helped our research.

In summary, most academic circles study population Ageing or rural revitalization independently or just introduce and summarize one as a macro background without in-depth studying the relationship between them. The few articles that combine the two are mostly path or theoretical analysis, lacking empirical research. Therefore, this study will aim to fill these gaps

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2. Research hypothesis

The population ageing firstly brings about a decrease in the proportion of the labour force population, resulting in a certain degree of labour shortage; the shortage of labour forces enterprises and the government to carry out industrial upgrading, replacing labour-intensive industries with capital as well as technology-intensive industries, which in turn promotes rural industrial upgrading; secondly, the population Ageing affects people's consumption demand, the reason being that the elderly are more of consumers, consume more on medical and nursing care, and the consumption structure changes from survival to development or enjoyment [14], which in turn promotes rural consumption upgrading. In contrast, industrial and consumption upgrading is equivalent to upgrading both the supply and demand side of the countryside, thus promoting rural revitalization. Based on this, the paper proposes that.

H1: Population ageing as a whole will promote the level of rural revitalization.

At the same time, due to China's uneven internal development, there is a massive gap between the rural areas in the eastern coastal region and the rural areas in the central and western inland in terms of resource endowment and financial stock, coupled with the different logics of population ageing in the two regions, one is a typical social phenomenon arising from demographic transformation, while the other is a passive result of the massive outflow of young adults. For regions with high human capital stock and good economic development, population ageing will promote industrial and consumption upgrading, promoting rural revitalization. For regions with backward resources and poor economic development, population ageing will, on the contrary, hinder the development of local rural revitalization. Based on this, the paper proposes that.

H2: There are regional differences in the impact of population ageing on rural revitalization.

3. Data, method, model

3.1 Data sources

All relevant data in this paper are obtained from provincial statistical yearbooks and the official website of the National Bureau of Statistics. Based on the data availability, 11 provinces and municipalities directly under the central government in the Yangtze River Economic Belt between 2011 and 2020, with a total of 110 samples, were selected for this paper.

3.2 Method

3.2.1 Indicator Construction

Table 1: System of rural revitalization.

System	Secondary indicators	Tertiary indicators
Rural revitalization	Industrial prosperity	Primary Industry Output
		The Secondary and tertiary industry output value
		Internet penetration rate
		Fiscal revenue per capita
	Ecological Livability	Number of hospital beds (10,000 people)
		Forest cover
		Pension insurance coverage
		Green space per capita
		Sanitary toilet penetration rate
	Countryside Civilization	Education expenditure per capita
		Number of Libraries
		Broadcast coverage
	Effective Governance	Community spending/GDP
		Public safety spending/GDP
		Social security and employment expenditure/GDP
	Living well	Per capita income
		Urban-rural income gap

The system of rural revitalization established in this paper is an evaluation system of the five objectives of China's rural revitalization strategy and then combined with the specific requirements according to the National Rural Revitalization Strategic Plan (2018-2022) and the existing research [15-

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16], which constructs five secondary indicators and 17 tertiary indicators, as shown in Table 1.

3.2.2 Model

Since the explanatory variable of this paper, rural revitalization, is a composite index generated by us using the entropy value method, it is by nature a restricted variable, i.e., there exists a certain range of values, ranging from 0 to 1. Conventional linear regression is not appropriate, so this paper establishes a panel Tobit model for empirical analysis, and the formula of the benchmark regression is as follows.

$$Rural\ Revitalization_{it} = \beta_0 + \beta_1 old_{it} + \phi controls_{it} + \theta_i + \lambda_t + \varepsilon_{it} \quad (1)$$

Where i is the province, t is time, Rural Revitalization$_{it}$ denotes the explanatory variable, rural revitalization index, old$_{it}$ denotes the explanatory variable population Ageing, controls denotes each control variable, θ_i, λ_t denotes the province and time fixed effects, ε_{it} is a random error, β_0, β_1 are correlation coefficients.

3.3 Variable

1). Explanatory variable: The explanatory variables of this paper are rural revitalization, which is synthesized by the indicators selected by the authors, covering five aspects: prosperous industry, ecological livability, civilized countryside, effective governance and affluent living, the details of which have been introduced at the content of indicator construction in the previous chapter.

2). Explanatory variable: The explanatory variable of this paper is population Ageing, which is measured using the percentage of the elderly population over 65 years old in each province and city in the Yangtze River Economic Belt.

3). Control variables: Combined with previous studies [17], fiscal revenue, fixed asset investment amount (hereinafter referred to as fixed investment), trade openness, and economic development level are selected as control variables in this paper. Fiscal revenue is measured by the logarithm of government revenue in the sample period of the province; fixed asset investment is measured by the logarithm of fixed asset investment in the sample period of the province; trade openness is measured by the logarithm of foreign direct investment in the sample period of the province; economic development level is measured by the logarithm of GDP per capita in the sample period of the province. Descriptive statistics of each variable are shown in Table 2.

Table 2: Descriptive statistics of each variable.

Variables	N	Mean	Std	Min	Max
Rural revitalization	110	0.339	0.095	0.184	0.643
Ageing	110	11.685	2.315	7.622	17.080
Financial revenue	110	7.940	0.557	6.65	9.112
Fixed investment	110	9.847	0.622	8.351	10.99
Trade openness	110	15.792	1.304	13.1	18.011
Economic Development Level	110	10.849	0.486	9.681	11.956

4. Empirical Results and Analysis

4.1 Baseline regression results

Table 3 shows the regression results of the Tobit model. The results of model 1 show that the coefficient of population Ageing is 0.03 and is significant at the 1% level, indicating that for the whole population ageing plays a role in rural revitalization. Hypothesis 1 of this paper was verified. Model 2 is the regression result with all the control variables added. The coefficient of population ageing is 0.009, which decreases but still significantly affects rural revitalization. The possible reason is that the labour shortage brought by population ageing forces rural areas to improve the scale of agricultural production and agricultural technology. From the results of the control variables, the increase in fiscal revenue can promote rural revitalization. The possible reason is that the increase in fiscal revenue makes the local government invest more in rural areas, which is conducive to the industrial development and infrastructure construction of rural areas, and thus improves the local rural revitalization index. The coefficient of fixed asset investment is -0.023, and the coefficient of trade openness is -0.012, but neither of them is significant, probably because the increase of trade openness and fixed asset investment mostly affects cities, while the positive effect on villages is smaller, or even because the local government

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focuses too much on cities and reduces the resources to villages. The coefficient of the economic development level is 0.09, and its coefficient passes the significance test at the 1% level, indicating that the increase in economic level will significantly promote the level of rural revitalization in the region.

Table 3: Baseline regression results.

	(1)	(2)
Population Ageing	0.030***	0.009***
		(0.002)
Financial revenue		0.121***
		(0.017)
fixed investment		-0.023
		(0.020)
Trade openness		-0.012
		(0.009)
Economic Development Level		0.090***
		(0.031)
N		110

We found in the above empirical study that population Ageing would contribute to rural revitalization in the Yangtze River Economic Belt. However, it needs to be taken into account that there are large differences within the provinces and cities in the Yangtze River Economic Belt and whether such differences will have an impact on our empirical results sea need further verification. Therefore, we divided the Yangtze River Economic Belt into upstream (Yunnan, Sichuan, Chongqing, and Guizhou), midstream (Hunan, Hubei, and Jiangxi), and downstream (Anhui, Zhejiang, Jiangsu, and Shanghai) after conducting panel Tobit regressions by region. Table 4 shows the regression results by region, and the results show that the impact of population Ageing on rural revitalization shows significant regional differences in terms of the coefficients of population Ageing, and hypothesis 2 of this paper is verified. The reason behind this phenomenon is that the logic of population Ageing in the downstream and the middle and upper reaches is not the same. The population Ageing in downstream is mainly due to the lower fertility rate brought about by the development of industrial society, and the local population has actually accumulated sufficient human capital to offset the negative effects of population Ageing well. In contrast, the population Ageing in the middle and upper reaches is actually because the young adults do not keep moving out, and those who stay in the middle and upper reaches are mostly older people who do not have sufficient knowledge and skills, and these older people are not productive due to their lack of knowledge and skills and do not accumulate sufficient human capital as in the lower reaches.

Table 4: Sub-regional regression results.

	(3) Downstream	(4) Midstream	(5) Upstream
Population Ageing	0.007***	-0.003	-0.005***
	(0.002)	(0.003)	(0.002)
Financial revenue	0.182***	-0.088***	0.093**
	(0.024)	(0.023)	(0.036)
fixed investment	-0.069***	0.163***	-0.097***
	(0.022)	(0.035)	(0.023)
Trade openness	-0.012	0.012	-0.036***
	(0.019)	(0.010)	(0.006)
Economic Development Level	0.103***	0.065	0.254***
	(0.033)	(0.040)	(0.017)
N	40	30	40

5. Conclusions and Discussion

Based on the panel data of the Yangtze River Economic Belt from 2011 to 2020, this paper measures the rural revitalization index of the Yangtze River Economic Belt based on the entropy value method, and uses the panel Tobit model for empirical analysis, and draws the following conclusions: 1. The level of rural revitalization in the downstream region is higher than that in the middle and upstream regions. The difference between the middle and upstream regions is smaller. 2. Population ageing does improve the level of rural revitalization on the whole, and population Ageing mainly promotes the development

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of rural revitalization through the "push-back mechanism". 3. The impact of population ageing on rural revitalization is regionally heterogeneous. The impact of population ageing on rural revitalization is regionally heterogeneous.

So, this paper proposes the following policy recommendations.: 1. Because of the inconsistent basic conditions and different levels of population development among Chinese provinces and cities, each place needs to propose a rural revitalization strategy with local characteristics and differentiation according to its population Ageing situation to promote the implementation of rural revitalization strategy in each province. 2. The empirical results of this paper show that the impact of population ageing on rural revitalization has regional heterogeneity. Population Ageing has a greater negative effect on the middle and upper reaches of the Yangtze River Economic Belt, so provinces need to promote fertility policy reform, build a fertility-friendly society and stimulate fertility on the one hand; on the other hand, they need to reduce population outflow, especially the outflow of young and middle-aged labour, to delay or reduce the degree of Ageing.

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