



Research on the Simultaneous Growth of GDP Per Capita and Resident Income in Guangdong Province Based on Linear Regression Analysis

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Abstract. In this study, we analyzed the data of urban and rural residents' income in Guangdong Province from 1978 to 2020 in terms of both absolute and relative differences. The results show that although the urban-rural gap has been expanding, the rate has slowed down. The regression analysis of urban and rural residents' per capita disposable income and its disparity with per capita GDP was also carried out to establish regression models. The results show that the growth of urban per capita disposable income (UPDI), rural per capita net income (RPFI) and urban-rural income gap are positively correlated with the growth of GDP per capita, and we further analyzed the reasons for the widening of the urban-rural income gap and accordingly put forward relevant suggestions to narrow the urban-rural gap.

Keywords: Guangdong Province · Per Capita Disposable Income · GDP Per Capita · Regression Analysis

1 Introduction

The urban-rural income gap refers to the difference in income between urban residents and rural residents in a certain economic context in a certain period of time, and includes both absolute and relative income gaps. Since the reform and opening up, China's economy has been growing gradually, and Guangdong is in a coastal area with a better geographical location, the economy is developing very fast and the living standard of the residents is improving, the GDP per capita has grown rapidly from 370 yuan in 1978 to 96,138 yuan [6]. However, the development of the countryside often lags behind that of the towns, and the gap between the disposable income of the residents is increasing, and with the change of time, this gap will inevitably affect the economic development of Guangdong Province, and at the same time, this imbalance will also become a hidden danger for social stability [1]. The development of a country and a city is faced with two important problems: one is to make a bigger "cake" and the other is to distribute the "cake". Obviously, Guangdong Province, as the frontier of reform and opening up, has made certain achievements in making the "cake" bigger, but has received certain restrictions in distributing the "cake". Reducing the gap between urban and rural areas is a challenge we must address for the sake of economic development and social stability.

Therefore, after analyzing the absolute and relative differences between urban and rural residents' incomes using relevant data, this study further adopted the method of one-dimensional linear regression to analyze the correlation between urban and rural residents' incomes and their differences with per capita GDP. Finally, according to the results obtained, we gave some relevant suggestions, taking into account the current development situation of Guangdong Province and the relevant experience of other provinces and cities.

2 Materials and Methods

2.1 Data Source

In this study, data from 1978–2020 in the Guangdong Statistical Yearbook were selected. The per capita disposable income of urban residents (UPDI), the per capita net income of farmers (RPFI), the difference between urban and rural per capita income, and the standard deviation of urban and rural per capita income were used as indicators to measure the income situation of urban and rural residents in Guangdong Province, while the per capita gross domestic product (GDP per capita) of Guangdong Province was used as an indicator to measure the economic development of Guangdong Province.

2.2 Research Method

This study adopted a combination of qualitative and quantitative methods to analyze the income differences between urban and rural residents in Guangdong Province in terms of absolute differences using two indicators, the difference between urban and rural per capita income and the standard deviation, and in terms of relative differences using two indicators, the extreme difference rate and the coefficient of variation. Among them, the

Absolute differences: in this study the absolute urban-rural income differences in Guangdong Province from 1987–2020 were measured by the extreme difference (R) and the standard deviation (S). The formulas are as follows.

$$R = Y_{\max} - Y_{\min} \tag{1}$$

$$S = \sqrt{\frac{\sum (x_i - \bar{x})^2}{N}} \tag{2}$$

Where, Y_{\max} and Y_{\min} represent the maximum and minimum values in the per capita income of town residents and the per capita income of rural residents, x_i and \bar{x} represent the i th data and the average of both, and N is the number of data studied.

Relative differences: In this study, the relative urban-rural income differences in Guangdong Province from 1987–2020 were measured by the extreme difference rate (I) and the coefficient of variation (CV). The formulas are as follows.

$$I = \frac{Y_{\max}}{Y_{\min}} \tag{3}$$

$$CV = \frac{S}{\bar{x}} \quad (4)$$

Where, Y_{\max} and Y_{\min} represent the maximum and minimum values in the per capita income of town residents and the per capita net income of farmers, and S and \bar{x} represent the standard deviation and the average of both.

This study adopted the method of regression analysis. The UPDI, the RPI, and the urban-rural income gap were selected as the dependent variables, and the per capita GDP of Guangdong Province was selected as the independent variable. The correlation degree between the independent and dependent variables was firstly examined, and three linear regression equations were established in the case of their correlation to analyze the relationship between each of the three and GDP per capita.

3 Results and Discussion

3.1 A Study of the Dynamics of Income Disparity Between Urban and Rural Residents in Guangdong Province

Overall, from 1978 to 2020, the UPDI, the RPI, the income differences and standard deviations between urban and rural areas in Guangdong Province generally follow an upward trend; however, when we used two indicators, the extreme difference rate and the coefficient of variation, to analyze the resident income in Guangdong Province over the years, we found that the differences between the resident income in urban areas and the resident income in rural areas are fluctuated. Therefore, in this study, we studied the difference between urban and rural residents' income in Guangdong Province in terms of both absolute and relative differences.

In terms of absolute difference: from Fig. 1 and related data, we can see that from 1978 to 2020, the income gap between urban and rural residents in Guangdong Province grew from 219 to 30114 yuan, and similarly, the standard deviation also grew from 109 to 15057 yuan, these data indicate that with the deepening of reform and opening up, the economic development of Guangdong Province is faster, and the income gap between urban and rural residents has been also expanding.

In terms of relative differences: from Fig. 2 and related data, we can see that the extreme difference rate of urban and rural residents' income in Guangdong Province increased from 2.133 to 2.495, and similarly, the coefficient of variation increased from 0.362 to 0.428, both indicators have increased but fluctuated.

We can broadly divide the changes into several stages: the first stage (1978–1982) the extreme difference rate decreases, indicating that the income gap gradually decreases, because at the early stage of reform and opening up, the implementation of reform and opening up started in rural areas and the household joint production contract responsibility system increased the income of farmers. The second stage (1982–1994) shows a rise in the extreme difference rate, which indicates that the income gap gradually increased, because the reform and opening up was gradually and widely implemented in urban areas during that period, which greatly liberated urban productivity Ma, and Lin [4]. The third stage (1994–1997) shows a decline in the extreme difference rate because the

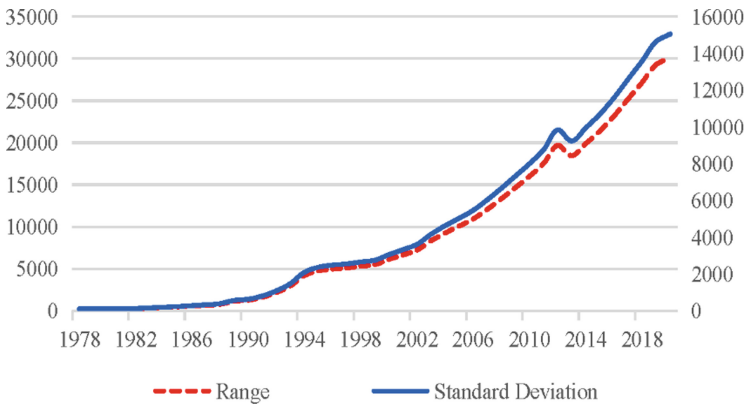


Fig. 1. Trend of urban-rural income gap and standard deviation in Guangdong Province, 1978–2020

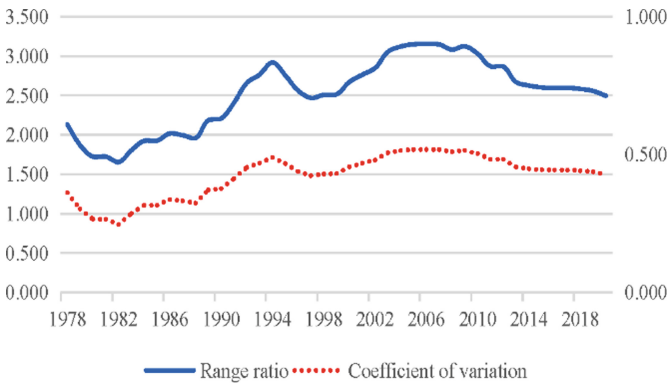


Fig. 2. Trends of urban-rural income extreme difference rate and coefficient of variation in Guangdong Province, 1978–2020

state adopted macroeconomic control policies to avoid the urban-rural gap from continuing to grow. The fourth stage (1997–2009) the extreme difference rate increased again because of the deflationary situation. In the fifth stage (2009–2020), the extreme difference rate decreases to varying degrees because of the gradual development of trade and the increasing attention paid by the state to the problem of urban-rural gap, the three rural issues begin to be solved, and the work of the war against poverty is gradually launched.

3.2 The Relationship Between Urban and Rural Residents’ Income and GDP Per Capita in Guangdong Province

We can see that as the GDP per capita of Guangdong Province keeps growing, the UPDI, the RPFI, and the gap between urban and rural incomes also grow. Therefore, it is inferred that there is a relationship between GDP per capita and the latter three, and

Table 1. Correlation analysis table

		UPDI	RPFI	Urban-rural Gap	GDP per capita
UPDI	PC	1	.996**	.998**	.996**
	Sig. (bobtail)		.000	.000	.000
	N	43	43	43	43
RPFI	PC	.996**	1	.989**	.994**
	Sig. (bobtail)	.000		.000	.000
	N	43	43	43	43
Urban-rural Gap	PC	.998**	.989**	1	.993**
	Sig. (bobtail)	.000	.000		.000
	N	43	43	43	43
GDP per capita	PC	.996**	.994**	.993**	1
	Sig. (bobtail)	.000	.000	.000	
	N	43	43	43	43

** . At 0.01 level (double tail), the correlation was significant.

correlation and regression analyses are used to further explore the relationship between GDP per capita and the latter three.

3.2.1 Related Analysis

First, SPSS25.0 was used to analyze the correlation between the UPDI, the RPFI, urban-rural income gap and GDP per capita, and the results are clearly presented in Table 1.

From Table 1, the Pearson correlation coefficients of the UPDI, the RPFI, urban-rural gap and GDP per capita are 0.996, 0.994 and 0.993, respectively, which are all greater than 0.9, and meanwhile, P is all close to 0. We see a strong correlation between the three and GDP per capita.

Further, SPSS25.0 was used to make a scatter plot based on the data related to the UPDI, the RPFI, urban-rural income gap and per capita GDP in Guangdong Province, as shown in Fig. 3. It can be seen that the first three are positively correlated with per capita GDP, respectively, according to which we can further do a one-dimensional linear regression analysis.

3.2.2 Regression Analysis

The regression analysis of resident income and GDP per capita in Guangdong Province yielded an analysis of variance table, a regression coefficient analysis table, and three models.

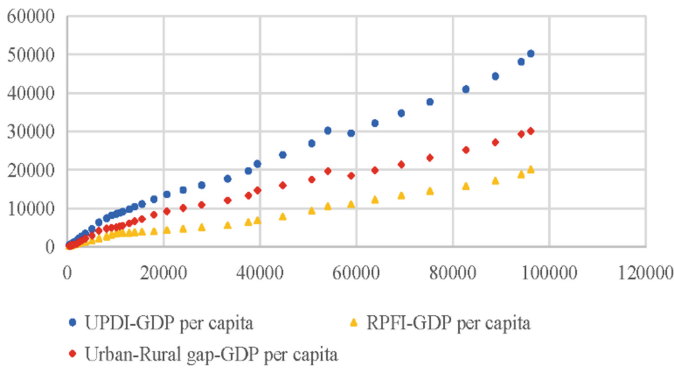


Fig. 3. Scatter plot of population income and GDP per capita

Table 2. Analysis of variance (ANOVA) table

Models		Sum of squares	df	F	p
1	regression	9022625104.279	1	5236.566	.000
	Residuals	70643167.589	41		
	Total	9093268271.869	42		
2	regression	1308899082.944	1	3464.257	.000
	Residuals	15491017.584	41		
	Total	1324390100.528	42		
3	regression	3458473707.344	1	2931.458	.000
	Residuals	48370948.567	41		
	Total	3506844655.912	42		

From Table 2, the F-test statistics of the three models are 5236.566, 3464.257 and 2931.458, while P is close to 0. Therefore, it indicates that there is a linear correlation between the UPDI, the RPFI and urban-rural income gap with per capita GDP in Guangdong Province, respectively.

From Table 3, at a confidence level of 95.0%, the regression constant for model 1 is 1778.343 and the regression coefficient is 0.491, the regression constant for model 2 is 520.536 and the regression coefficient is 0.187, and the regression constant for model 3 is 1257.807 and the regression coefficient is 0.304. The regression constants and regression coefficients of the three models are within the corresponding confidence intervals, and the corresponding significance test p are close to 0. Therefore, the three models are significant, and three one-dimensional linear regression equations are derived.

$$Y_1 = 1778.343 + 0.491X \tag{5}$$

Table 3. Regression coefficient table

Models		UC		SC	p
		B	Std. Error	Beta	
1	(Constant)	1778.343	265.393		.000
	GDP per capita	.491	.007	.996	.000
2	(Constant)	520.536	124.278		.000
	GDP per capita	.187	.003	.994	.000
3	(Constant)	1257.807	219.608		.000
	GDP per capita	.304	.006	.993	.000

The equation represents the linear relationship between the UPDI and per capita GDP. Where, Y_1 represents the UPDI and X represents the per capita GDP.

$$Y_2 = 520.536 + 0.187X \quad (6)$$

The equation represents the linear relationship between the RPFII and GDP per capita. Where, Y_2 represents the RPFII and X represents the GDP per capita.

$$Y_3 = 1257.807 + 0.304X \quad (7)$$

The equation represents the linear relationship between urban-rural income gap and GDP per capita. Where, Y_3 represents the urban-rural income gap and X represents GDP per capita.

According to the above equations, it can be concluded that: for every RMB 1 increase in GDP per capita in Guangdong Province, the UPDI will increase by RMB 0.491, the RPFII will increase by RMB 0.187, and the gap between urban and rural residents will increase by RMB 0.304. The growth of GDP per capita has a certain effect on the RPFII, a great effect on the growth of the UPDI, and a great effect on the income gap between urban and rural areas. In other words, growth in GDP per person alone could not overcome urban-rural income gap and ensure balanced economic and social development. Furthermore, if targeted measures are not taken to close the urban-rural income disparities by the relevant departments, the problems would become more serious.

4 Conclusions

Firstly, this study investigated the dynamic difference between urban residents' income and rural residents' income in Guangdong Province in terms of absolute difference and relative difference. As the economy of Guangdong Province develops, the absolute difference in residents' income becomes larger, but its relative difference keeps fluctuating. It is because with the increase of economic openness, the rural development is slower than the urban one, which causes that difference. As the state pays attention to the urban-rural difference, a series of measures were taken to adjust it, so the urban-rural difference decreases in different periods.

Secondly, this study further did a correlation analysis between GDP per capita and the UPDI, the RPF, and urban-rural income gap. We concluded that GDP per capita is more effective in raising the UPDI than the RPF, thus forming the result of increasing urban-rural disparity.

Based on the above conclusions, combined with the measures taken by the country and other regions, this study gives the following recommendations.

4.1 Improve Economic Development

The experience of reform and opening up made us understand that only through continuous economic development can we afford to make the development of towns and villages gradually balanced. Therefore, the most basic and necessary way to reduce the difference between urban and rural residents in terms of income is to vigorously develop the economy of Guangdong Province. And we can develop the economy by guiding industries to high-tech industries and optimizing the industrial structure [5].

4.2 Appropriate Policy Tilt to Rural Areas

Throughout the process of urban-rural income disparity fluctuation, the state has taken many measures to prevent the urban-rural income disparity from continuing to grow, such as the implementation of the household joint production contract responsibility system, macroeconomic regulation and control, and the battle against poverty. The policies adopted by the government largely influenced the urban-rural income gap. Therefore, while developing the economy of Guangdong Province as a whole, the government should pay particular attention to the development of rural areas. For example, we can increase government subsidies for agriculture, encourage “importing and going out”, bring in more talents and technologies, and encourage residents to study in cities and towns.

4.3 Leverage Rural Advantages

The rural areas can make use of this major feature of agricultural products to create a series of healthy and green brands of agricultural products, use modern technology for high-quality production, promote their own agricultural products to the whole country and even the world with the help of the Internet, and open up a road to wealth suitable for the rural areas [2]. In addition, Guangdong Province is strategically located, and each rural area can create a series of tourist attractions with cultural significance based on local culture and history and customs, forming a new industrial model.

4.4 Integrated Urban and Rural Development

Promote joint development of urban and rural areas, cities should play a leading role, taking the city as the center, radiating each surrounding countryside and driving the development of the surrounding economy. Promote the urbanization of the countryside, realize the transformation of the identity of farmers, realize the transformation of the way of life, improve the quality of residents' lives, and realize the common prosperity of urban and rural areas.

4.5 Integrate Resources and Complementary Advantages

Based on the principle of complementary advantages, and taking reference from the method of narrowing the gap between urban and rural residents in Zhejiang Province, we can adopt the form of “school-enterprise cooperation” or “demonstration base” to improve farmers’ ability to use new technologies while students can put into practice what they have learned in the classroom, which will form a win-win situation.

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