

An Empirical Study on the Growth of Rural Residents' Income in Hubei Province, China

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Abstract

In recent years, despite of its significant progress in economic and social development and poverty reduction, China still faces many challenges to reduce residual poverty and promote per capita income, especially in rural area. As a central agricultural province, the average level of rural residents' income (RI) in Hubei province has experienced a noticeable increase in recent three decades, but is still lower than the country's average level and the counterpart in urban area. The main aim of this paper is to examine the rural residents' income situation in Hubei and what we can do to boost their income. Based on the existing literature and theories about the growth of rural residents' income or income distribution, we firstly examine what can be determinants of rural household income in general. Then we go over the income situation of Hubei rural residents from 1978 to 2012. Next OLS and PCR model are set up to test whether and how tentative factors can influence rural residents' income in Hubei. At last, with the result of the econometric analysis and the economic theory, some suggestions are listed to boost the growth of RI in Hubei.

Keywords: Rural Residents, Residents' income, PCR model, Income increase

1. Introduction

1.1 Background to the research

Since initiating the "reform and opening up" policy in 1978, China has witnessed unprecedented economic growth that has stimulated a notable increase in per capita income and a decline in poverty. The economy, which has become the second largest in the world since 2010, has performed well in recent years and is increasingly playing an important and influential role in the global economy. China is also the first developing country to achieve the United Nations Millennium Development Goal of reducing by half the number of its people living in extreme poverty and hunger. Its reform-driven economic growth, together with a well-funded national poverty reduction program, has brought about a major reduction in poverty.¹

However, despite of its significant progress in economic and social development and poverty reduction, China still faces many challenges to reduce residual poverty and promote per capita income, especially in rural area. Disparities in income among provinces and between urban and rural areas have been widening, though both the urban and rural residents' income have been illustrating a significant augment since 1978. Urban incomes are now around three times higher than rural incomes, and poverty remains primarily a rural phenomenon. Between 50 and 55 per cent of the population resides in rural areas, where about two-thirds of the population is engaged in farming, forestry, animal husbandry and fishing. About 40 per cent of total employment in China is in rural areas. The poorest rural households tend to derive a large share of their income from agricultural activities, which often show low levels of productivity and net profits. Besides, the increasing migration of rural male laborers to urban and eastern coastal areas has sharply extended the feminization of rural labor and agriculture, thereby worsening the growth gap between urban and rural residents' income. Hubei, where I come from, is a province of the People's Republic of China, which is located in Central China. Provided with rich agricultural resources, especially the large plain with fertile farmland and thousands of lakes, it is a big agricultural province and an important production base for primary products in China.

The GDP in primary industry in Hubei was 45.3 billion dollars, make up of 12.8% of Provincial GDP. So Hubei came to be known as “a land flowing with fishes and rice” all along. Hubei had a total resident population of 57.79 million in 2012, in which rural population was 26.87 million. Rural residents’ average annual income per capita in Hubei in 2012 is 7851.7 Yuan, which is 71 times higher than that in 1978, and the average annual growth of it reach 13.96%. On the other hand, Hubei rural residents’ per capita income is lower than the national average level 7917 Yuan. The growth rate of it is 5% lower than the counterpart in urban area in Hubei and this income inequality is more likely to be widening. Thus Hubei can be a typical sample for us to study the stimulative and restrictive effect on the growth of rural residents’ income.

1.2 Conception clarification

At the beginning of the study, we should clarify two concepts who the “Rural resident” is and what the “Rural residents’ income” is.

1.2.1 Rural resident

It is not an easy task for social scientists to define who “rural resident” is in China. In most developed countries, the rural resident can be interpreted as a “farmer”, which means a person engaged in agriculture and is a concept about occupation. In some undeveloped economies, they consider the rural residents as “peasants”, which, to some extent, can be a pejorative word. However, when it comes to China, neither of them is a precise interpretation because of its unique historical changes and the status quo of institution in this communist country. Specifically, Chinese system of household registration has been contributing to a rural-urban division and categorizing all Chinese into two different identities, “rural” and “non-rural” residents. So even some residents, with the “rural” household registration, have engaged in nonagricultural positions for a long time, they are still rural residents in Chinese law. To ensure the availability and continuity of the data for my research, the rural resident in my thesis is the person with rural identity according to the system of household registration of China.

1.2.2 Rural residents’ income

Rural resident’s income is the target and only one dependent variable for this study. In order to define the rural resident’s income precisely, three concepts should be discussed first: rural residents’ gross income, rural residents’ net income and rural residents’ per capita net income. According to the *Hubei statistical yearbook* (2012), rural residents’ gross income is the total amount of rural residents’ and their household member’s income from any source in certain period, which can be divided into 4 parts: wage income, income of household business operation, income from property and transfer-payment income.

Rural residents’ net income, or rural residents’ disposable income, is rural residents’ gross income minus all taxes and fees in the same period. More specifically, Rural residents’ net income refers to the total income of the permanent residents of the rural households during a year after the deduction of the expenses for productive and non-productive business operation, the payment for taxes and the payment for collective units for their contracted tasks, which can then be spent for investments in productive and non-productive construction, for consumption in daily life and for savings deposit and its equation is as follow:

Net income = Gross income – Taxes and fees – Depreciation of productive fixed assets – Other payments

It is a comprehensive indicator to show the actual level of the income of rural residents. It includes not only the income from the productive and non-productive business operation, but also the income from the non-business operation, such as the money remitted or brought back by the members of the household who are in other places, the government relief payment and various subsidies. It includes not only the money income, but also the income in kind. But the income from borrowing from banks, friends and relatives is excluded.

Rural residents’ per capita net income, or rural residents’ net income per person, is the mean net income of the rural residents. In this thesis, I mainly use “rural residents’ per capita net income” to measure Hubei rural resident’s income level. Without additional notation, all the “**rural resident’s income**” (RI) in this paper actually mean the “rural residents’ per capita net income” in one year.

Since price levels have changed over time, when I calculating the growth rate of rural residents’ income, I will adjust the nominal income to **real** income, which actually means the income expressed in 1978 price level with official Hubei provincial consumer price index. **The real RI** is the value adjusted by inflation rate.

1.3 Research object and methodology

The main aim of this paper is to determine what factors contribute to or limit the growth of the rural residents' income in Hubei. There are three questions, which motivate me to do this research and thesis:

- a) What is the income situation for rural residents after 1978 in Hubei?
- b) What are the factors that can contribute to the increase or decrease of the rural residents' income in Hubei?
- c) What can we do to boost the rural residents' income in Hubei?

In order to answer the questions, I will review the existing literature and the current state of research and theory about the growth of rural residents' income or income distribution, and go over the status quo of RI in Hubei, thereby summarizing and obtaining the possible determinants of Hubei rural resident's income. Then I will use the econometric model to examine the determinants or independent variables. At last, with the analysis of the model's result, the advice for improving RI in Hubei will be given.

More specifically, the remaining part of the thesis is structured as follow: Section 2 provides a deeper literature review on the topic and the current state of research. In this section, different income distribution theories and the concept of Dual-Sector model are introduced. I go over some Chinese Scholars' paper about the growth of RI. Section 3 gives an overview of current status of RI in Hubei. First, the growth rate and the trend of Rural and Urban residents' income in Hubei will be demonstrated. Subsequently, I will compare the RI and other concerned data in Hubei with other central province in China. Then the rural residents' income structure in Hubei is analyzed. In section 4, the factors that can influence the RI are discussed and the dependent variables for RI are determined. Such as farming Acreage per capita, GDP of Hubei, education, Government Expenditure on Agriculture, Total power of agricultural machinery, Urbanization rate etc. Then in section 5 the econometric model is developed to examine the dependent variables in last section. At the last section, I will summarize the factors that contributing to the growth of RI in Hubei and limiting factors, and give some suggestion for boosting the growth of RI in Hubei.

Based on the historical data, the empirical analysis method is mainly applied to the research that analyzing the status quo of RI in Hubei and the factors influencing it, accompanied with the comparative analysis method. With the econometric model, the factors that contributing to the growth of RI is examined by the quantitative analysis including: ordinary least squares (OLS), regression analysis and Principal Components Analysis(PCA), thereby determining whether the factors have the positive effect on the growth of RI and how much the effect is. Then according to the result of the econometric analysis and the economic theory, I make some suggestion to boost the growth of RI in Hubei.

2. Literature review

One of the main tasks of this thesis is to answer the following question: What determines the rural residents' income and its development in Hubei? In order to answer this question, we should learn some study and theory about determinants of rural household income in general:

2.1 Factor Determining income distribution theory

In economics, factor payments are the income people receive for supplying the factors of production: land, labor or capital. Classical economists such as Adam Smith, Thomas Malthus and David Ricardo were mainly concerned with factor income distribution, that is, the distribution of income between the main factors of production, land, labor and capital. According to the factor determining income distribution theory, rural residents' income can depend on the quantity and quality of their factors of production. Therefore, Farming Acreage per capita and total power of agricultural machinery in Hubei can be an important variable for rural resident's income.

2.2 Transfer of rural surplus labor (Urbanization)

Most scholars argue that the labor redundancy is a key factor what constrains on the rural economic growth and residents' income. The famous Lewis model (Lewis, 1954) provides a good framework for evaluating the success of a developing economy, and for explaining the ways in which the fruits of economic development are spread. Within a competitive market economy, it is only when the economy emerges from the first, labor-surplus, classical stage of the development process and enters the second, labor-scarce, neo-classical stage that real incomes begin to rise generally. Up to that point the benefits of economic growth can accrue in the form of the absorption of surplus labor and not in the form of generally rising real incomes. When economic reform commenced there is no doubt that China was an extreme example of a labor surplus economy.

Huixin Jin et al. (2013) believe that the appropriate placement of rural surplus labor force will inject a powerful driving force to China's economic development, especially to rural economic growth, and it is conducive to turn the population burden into human resources advantages. Justin Yifu Lin(2002), a prominent Chinese economist, confirmed that successful and proper transferring of rural surplus labor and urbanization can be a pivotal approach to boost rural residents' income.

2.3 Human capital investment

The source of rural poverty in China is not the shortage of income or consumption, but the "capability poverty" induced by the scarcity of education, social insurance, health, Medicare and economic opportunity in rural China. According to Romer, P. M. (1994)'s endogenous growth theory, investment in human capital, innovation, and knowledge can be significant contributors to the growth of personal income. Barro, Robert J. et al. (2004) found that human capital investment can improve the capability of individual, thereby boost their personal income indirectly. Weijun Yang (2006) claim that relatively higher education level is conducive to boost rural residents' wage or salary by developing their productivity. Additionally, good education is helpful to enhance rural residents' life quality and health and nutrition outcomes. Theodore W. Schultz (1971) also believe that investment in Human capital, such as education, pre-job training and improving health condition, is a vital way to enhance rural residents' income.

2.4 Industrialization of agriculture

In *Transforming Traditional Agriculture*, W. Schultz (1964) said, "The economic growth starting from traditional agricultural economy is rather costly." And the source of the lower level of the rural residents' income is the low productivity in traditional farming. He also asserted that the key point of transforming traditional agriculture is to change and develop the investment in rural human capital. Junji Song (2004) thinks that the mainly approach of the growth of rural residents is the industrialization of agriculture. Laizi Li's research (2000) demonstrated that in China the rate of industrialization in rural area has positive effect on local residents' income.

2.5 Government Expenditure on Agriculture

Although agriculture is a private activity, a large amount of government resources are spent on the sector. In China, agriculture is not only a kind of economic sector, but also play the role of "social stabilizer". A number of scholars agree that government Expenditure on Agriculture is a good approach to boost rural residents' income. Justin Yifu Lin (2003) argues that the government of China should put more financial support in agriculture. Hongyu Zhang (2004) supported that in order to ensure the sustainable augment of rural residents' income in China, it is important to set up a stable agriculture-support financial institution and improve government expenditure on agriculture.

3. An overview of Rural Residents' Income (RI) in Hubei Province

3.1 The change of RI in Hubei Province

The rural reform carried out at the turn of the 1970s/1980s has opened a new chapter for China's rural areas. In accordance, RI in Hubei has embarked on a fast track to growth. Since initiating the "reform and opening up" policy in 1978, regardless of adjusting for the inflation, RI in Hubei demonstrates an increasing trend in general. Hubei's RI ascends from 110.5 yuan in 1978 to 7851.7 yuan in 2012, whose growth rate accounts to %. When it is adjusted by the inflation rate, real RI in Hubei in 2012 was 1239.2 yuan, which is 10.21 times higher than that in 1978. Table 3.21 shows the nominal and real RI and their growth rate form 1978 to 2012 in Hubei.

From 1978 onward, the change of RI in Hubei can be divided into four periods. The first period was from 1978 to 1984. The family farming system abandoned for 20 years was restored and beginning of rural enterprises, this period was the takeoff period of Hubei's rural economy and witness the fastest growth of RI. The nominal RI rapidly augments from 110.5 in 1978 to 392.3 in 1984. The average annual growth rate of nominal RI reach 24.53% and that data of the real RI was 21.37%.

The second period was from 1984 to 1993. During this period, the center of national reform has moved from rural area to urban area and then the government expenditure on agriculture has also been decreasing gradually. With the rise of price of agricultural means of production which was caused by the relatively high inflation rate, the growth of RI experienced a hard time for the whole country. What's worse, after the Tian'anmen Square event in 1989, the government economic policy became quite conservative.

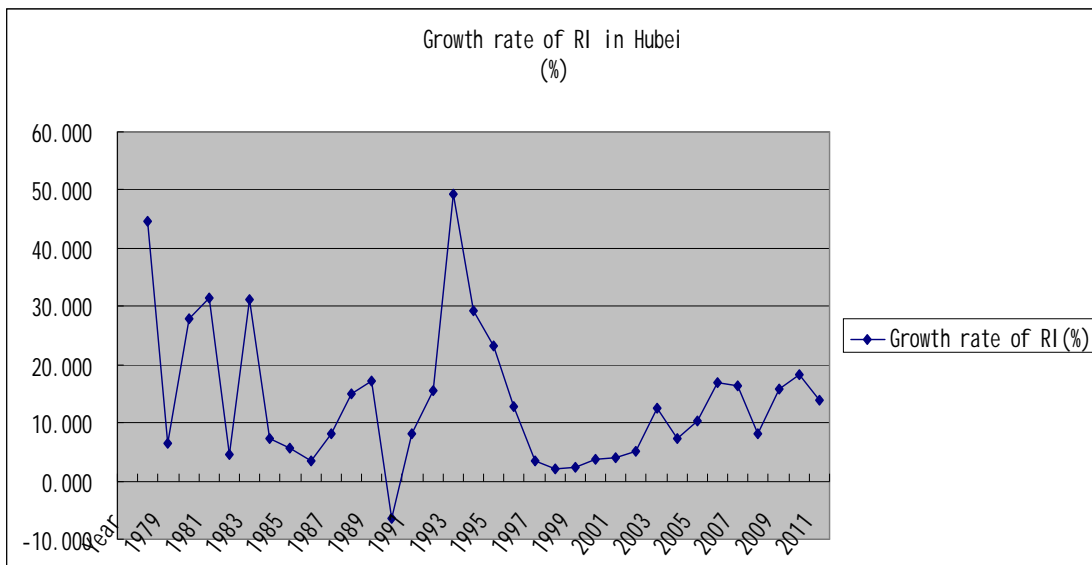
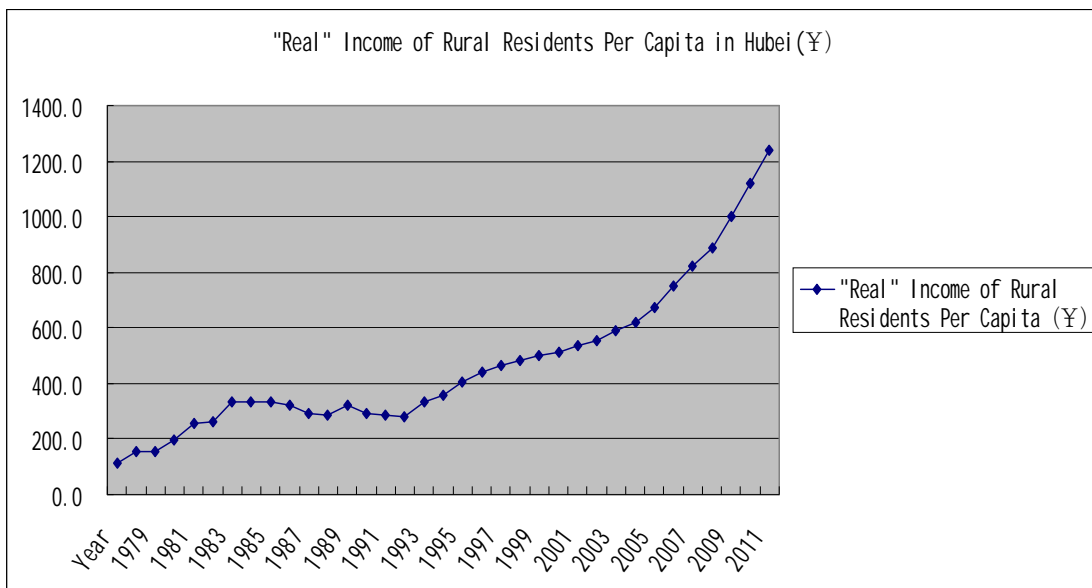
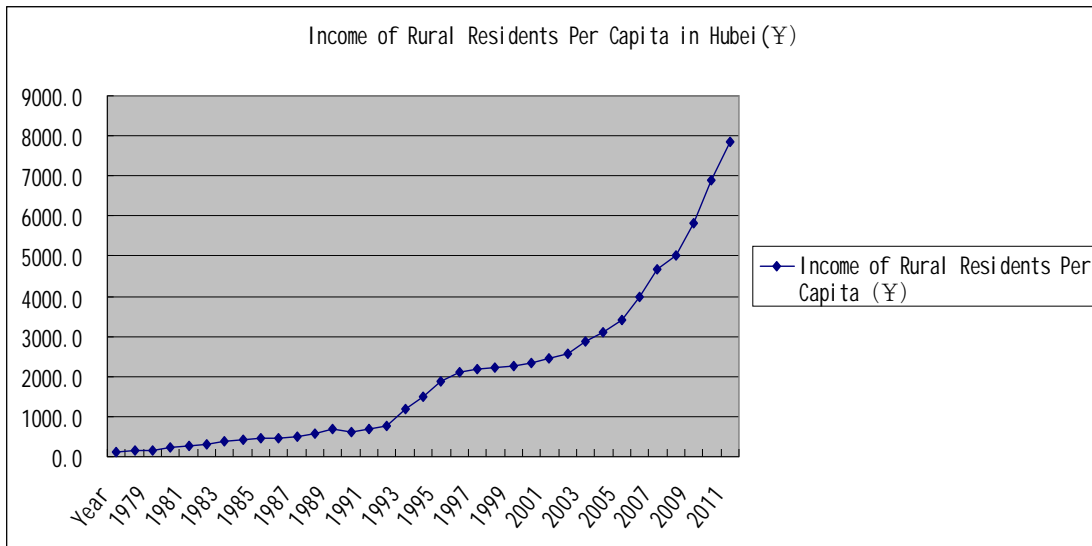
The real RI in Hubei even witnesses a consecutive three-year negative growth from 1987 to 1989 and the growth rate of real RI in 1991 break -10%. The trend was not reversed until 1992 when the former leader Deng Xiaoping paid a visit to the south and made a speech there calling for continuing the reform and open-door policy. The increase rate of the nominal RI in 1993 returned to 15.5%, while the number of real RI was still negative. The third period of RI development was from 1994 to 1997. Thanks to the good harvest in Hubei and the new agriculture-support policy, the RI in Hubei has got back to the fast growth stage since 1994. The growth rate of nominal RI in 1994 surge to 49.4% and the "real" data was 19.23%. The average annual growth rate of nominal RI in this period hit to 28.67% and the number of real RI was 12.22%. Then, the Hubei's RI development entered the fourth period which dates from 1998 to 2005. This period was characterized by steady augment of the RI whose real growth rate was stabilized in a range between 3% and 5% except two years.

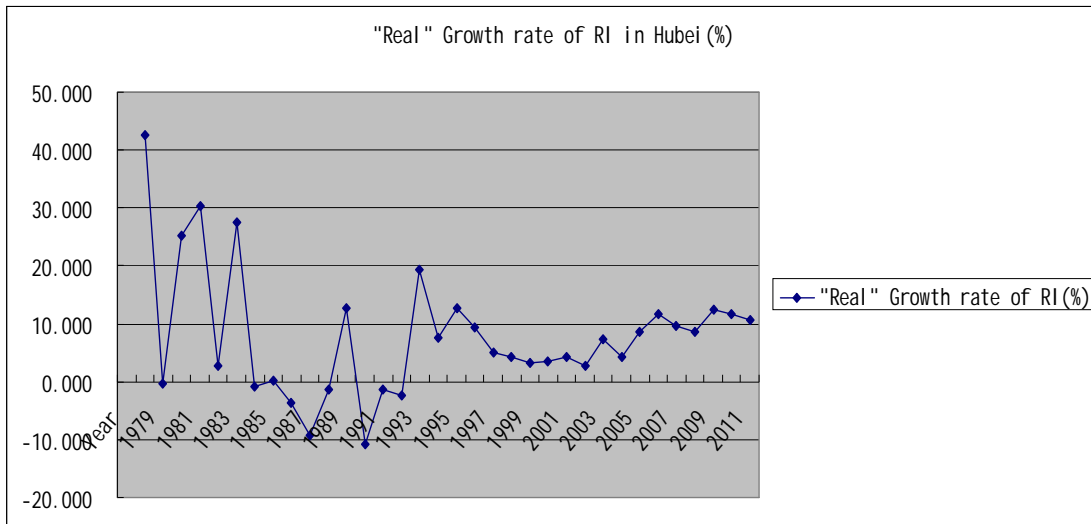
The growth of RI in Hubei that began in 2006 and stretches to the current date has entered into a new stage. The nominal RI increased rapidly from 3419.4 yuan in 2006 to 7851.7 yuan in 2012 and the real number increase from 670.8 to 1239.2. The average annual growth rate during this period of RI and real RI reach up to 14.25% and 10.47% respectively.

Table 3.21 An overview of Hubei rural residents' income since 1978

Year	Income of Rural Residents Per Capita (¥)	Price Index (Base year=1978)	"Real" Income of Rural Residents Per Capita (¥)	Growth rate of RI (%)	"Real" Growth rate of RI(%)
1978	110.5	100.00	110.5		
1979	159.7	101.30	157.7	44.499	42.644
1980	170.0	108.19	157.1	6.425	-0.352
1981	217.4	110.46	196.8	27.936	25.305
1982	286.1	111.45	256.7	31.563	30.389
1983	299.2	113.35	264.0	4.604	2.855
1984	392.3	116.64	336.3	31.095	27.401
1985	421.2	126.43	333.2	7.380	-0.941
1986	445.1	133.39	333.7	5.671	0.162
1987	460.7	143.39	321.3	3.489	-3.731
1988	497.8	170.64	291.8	8.071	-9.184
1989	571.8	198.45	288.2	14.864	-1.235
1990	670.8	206.78	324.4	17.306	12.577
1991	626.9	216.92	289.0	-6.541	-10.907
1992	677.8	237.74	285.1	8.119	-1.351
1993	783.2	281.49	278.2	15.544	-2.412
1994	1170.1	352.70	331.7	49.399	19.233
1995	1511.2	423.24	357.1	29.157	7.631
1996	1863.6	463.03	402.5	23.319	12.723
1997	2102.2	477.84	439.9	12.802	9.304
1998	2172.2	470.20	462.0	3.332	5.012
1999	2217.1	459.85	482.1	2.064	4.360
2000	2268.5	455.26	498.3	2.319	3.353
2001	2352.2	456.62	515.1	3.688	3.378
2002	2444.1	454.79	537.4	3.907	4.324
2003	2566.8	464.80	552.2	5.020	2.760
2004	2890.0	487.57	592.7	12.594	7.334
2005	3099.2	501.71	617.7	7.238	4.216
2006	3419.4	509.74	670.8	10.330	8.593
2007	3997.4	534.21	748.3	16.906	11.551
2008	4656.4	567.86	820.0	16.485	9.581
2009	5035.3	565.59	890.3	8.137	8.571
2010	5831.8	582.00	1002.0	15.820	12.556
2011	6897.9	615.75	1120.2	18.280	11.796
2012	7851.7	633.61	1239.2	13.828	10.620

Source: 1978-2012 Hubei Statistical Year Book





3.2 The change of income source of rural residents in Hubei Province

As we mentioned above in Section 1.22, in China, according to the difference of income sources, RI can be divided into four parts: wage income, income of household business operation, income from property and transfer-payment income. As for Hubei, nearly 100% of RI comes from the first three parts except transfer-payment income and we do not take transfer-payment income into account when we discuss income source of rural residents in Hubei Province.

As the table 3.22 shows, since the reform and opening up the income structure of rural residents in Hubei has experienced unceasing changes, and the ratio of each income source to per capita net income has fluctuated greatly which showed an overall transition from the unitary structure (mainly depends on income of household business operation) to the diversified structure (depends on both income of household business operation and wage income). In 1993, the net income of rural household business operation achieved 646.61 Yuan which was 82.56% of the per capita net income while wage income was only 105.89 Yuan and 13.52% of the total; in 2005, the absolute amount of rural household business operation net income increased to 2049.19 Yuan but only took up 66.12% of the per capita net income of rural residents which decreased by 16.44% from that of 1990, while the wage income increased to 941.54 Yuan and accounted for 30.38% of the per capita net income which increased by 16.86% from the 1990 level; comparatively speaking, the ratio of property transferred income to per capita net income had increased during this period, but never exceeded 10%, thus only had insignificant influence, additionally, it changed irregularly due to the joint-influence of economic, social and cultural aspects of different areas on its source and component. Therefore, due to the less contribution of property transferred income to per capita net income and its irregular change caused by the imperfect social security system, financial investment system and other relevant systems in China, it is reasonable to utilize the ratio of wage income to per capita net income to evaluate the structural change of rural residents' income in Hubei which is in accordance with the actual conditions of China.

Table 3.22 The structure of rural residents' income in Hubei

Year	RI	Wage income		Income household operation		of business Transfer-payment income		Income from property	
		Number(¥)	Ratio	Number(¥)	Ratio	Number(¥)	Ratio	Number(¥)	Ratio
1993	783.2	105.89	13.52%	646.61	82.56%	28.04	3.58%	2.66	0.34%
1994	1170.1	147.78	12.63%	969.31	82.84%	32.65	2.79%	20.24	1.73%
1995	1511.2	192.38	12.73%	1234.35	81.68%	51.08	3.38%	33.40	2.21%
1996	1863.6	272.64	14.63%	1478.95	79.36%	68.58	3.68%	43.42	2.33%
1997	2102.2	337.61	16.06%	1677.77	79.81%	76.94	3.66%	9.88	0.47%
1998	2172.2	396.21	18.24%	1652.18	76.06%	109.70	5.05%	13.90	0.64%
1999	2217.1	496.41	22.39%	1596.53	72.01%	107.53	4.85%	16.41	0.74%
2000	2268.5	547.62	24.14%	1617.89	71.32%	83.48	3.68%	19.51	0.86%
2001	2352.2	582.64	24.77%	1676.18	71.26%	80.45	3.42%	12.94	0.55%
2002	2444.1	662.11	27.09%	1694.49	69.33%	73.32	3.00%	14.18	0.58%
2003	2566.8	706.90	27.54%	1785.21	69.55%	59.04	2.30%	15.66	0.61%
2004	2890	755.16	26.13%	2051.61	70.99%	67.05	2.32%	16.18	0.56%
2005	3099.2	941.54	30.38%	2049.19	66.12%	91.74	2.96%	16.74	0.54%
2006	3419.4	1234.40	36.10%	1938.80	56.70%	153.87	4.50%	92.32	2.70%
2007	3997.4	1527.01	38.20%	2150.60	53.80%	199.87	5.00%	119.92	3.00%
2008	4656.4	1806.68	38.80%	2467.89	53.00%	251.45	5.40%	130.38	2.80%
2009	5035.3	1958.73	38.90%	2578.07	51.20%	342.40	6.80%	156.09	3.10%
2010	5831.8	2332.72	40.00%	2857.58	49.00%	390.73	6.70%	250.77	4.30%
2011	6897.9	2904.02	42.10%	3297.20	47.80%	475.96	6.90%	220.73	3.20%
2012	7851.7	3533.27	45.00%	3548.97	45.20%	549.62	7.00%	219.85	2.80%

Source: 1993-2012 Hubei Statistical Year Book

4. An empirical analysis for RI in Hubei

4.1 Selection of Variables, Data and Methodology

In this section, I would like to set up an econometrics model to explain the growth of RI in Hubei and the RI should be the explained variable. The choice of explanatory variables is guided both by the economic theory and by the empirical context which are discussed in the literature review. The standard variables taken to determine rural resident's income level are following factors: the Gross Output of Primary industry(X1), the Gross Output of Secondary industry(X2), the Gross Output of Tertiary industry(X3), the Industrialization level in rural area(X4), Urbanization level(X5), Total power of agricultural machinery(X6), Farming Acreage per capita (X7), Government Expenditure on Agriculture(X8), Price index of agricultural products(X9), Average Education years in Rural area(X10). Among these independent variables, the Industrialization level in rural area(X4) is the ratio of rural residents who work in Township and Village Enterprises to total number of the rural population. Urbanization level(X5) is the percentage of nonagricultural population in Hubei. All the variables are focus on Hubei Province area.

All the selections of variables are based on the assumption that what contribute to Hubei's RI is: the growth of Hubei's economy(X1, X2, X3), the improvement of the Industrialization level and Urbanization level in Hubei's rural area(X4, X5), the development of means of production(X7, X8), the augment of government expenditure on farming (X9) and the development of human capital(X10). All the data used in this empirical study are adjusted by the inflation rate and are from 1978-2012 *China Statistical Year Book*, *Hubei statistical yearbook* and *China rural Statistical Year Book*. SAS, Excel and SPSS13.0 are used to deal with these data. In this part, we use two econometrics model, firstly ordinary least squares (OLS) and then principal component regression (PCR) methods, to estimate the effects of X1—X10 on individual's annual income for rural residents in Hubei.

The empirical results show that principal component regression (PCR) model is a more appropriate way to study the determinants of growth of RI.

4.2 Econometrics model analysis

4.2.1 OLS model

The OLS model for RI in Hubei is established:

$$\ln Y_t = \beta_0 + \sum_{i=1}^n \beta_i \ln X_{it} + \varepsilon_t$$

Where $\ln Y_t$ is the natural logarithm of Hubei's RI in t year (t = from 1978 to 2012), and $\ln X_{it}$ is a vector of the natural logarithm of explanatory variables mentioned above (X1 to X10) in t year. β is the vector of unknown parameters to be estimated, and ε_t is a random disturbance term which is assumed to satisfy the usual properties of mean zero and constant variance.

Table 4.2a The Matrix of Correlation Coefficients

	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10
X1	1.000									
X2	0.950	1.000								
X3	0.953	0.990	1.000							
X4	0.835	0.845	0.846	1.000						
X5	0.952	0.950	0.959	0.946	1.000					
X6	-0.557	-0.726	-0.733	-0.460	-0.593	1.000				
X7	0.688	0.692	0.764	0.718	0.761	-0.440	1.000			
X8	0.847	0.859	0.844	0.544	0.747	-0.650	0.585	1.000		
X9	0.883	0.935	0.927	0.716	0.871	-0.730	0.604	0.855	1.000	
X10	0.843	0.889	0.841	0.816	0.871	-0.606	0.438	0.724	0.860	1.000

Source: SPSS 13.0

Note: X1: the Gross Output of Primary industry, X2: the Gross Output of Secondary industry, X3: the Gross Output of Tertiary industry, X4: the Industrialization level in rural area, X5: Urbanization level, X6: Total power of agricultural machinery, X7: Farming Acreage per capita, X8: Government Expenditure on Agriculture, X9: Price index of agricultural products, X10: Average Education years in Rural area.

Table 4.2b The Parameter Estimate and their Test Output of Hypothesis

	X1	X2	X3	X4	X5	X6
Coefficient	0.459	0.398	-0.039	-0.132	0.451	-0.223
T	1.891	2.059	-0.203	-0.922	0.623	-0.892
Sig.	0.083	0.062	0.843	0.375	0.545	0.390
	X7	X8	X9	X10	intercept	
Coefficient	-0.508	0.046	-0.064	0.059	2.427	
T	-1.678	1.458	-1.474	0.818	7.717	
Sig.	0.119	0.171	0.166	0.429	0.112	

Source: SPSS 13.0

Note: The dependent variable is RI and other independent variables X1—X10 are the same as above Table 4.2a.

Putting the primary statistical data into the OLS model by SPSS13.0, we get some results. The value of R^2 is 0.996, which demonstrate a high goodness of fit in general. Table 4.2a shows the correlation coefficient among the pair of variables. The correlations between each pair of explanatory variables are quite high. Hence, in spite of the F value is as high as 200.88, if all variables are used simultaneously in the model then there is a high possibility of multicollinearity, which may lead to incorrect inferences. The result of T test and Collinearity Diagnostics illustrated in Table 4.2b confirms that most of explanatory variables share the multicollinearity. So it is essential for us to build a new model to analyze the relationship between Y and X1 to X10.

4.22 PCR model

In order to overcome this problem, the principal components of theselected independent variables are estimated following G Liu et al. (2008).Principal components analysis (PCA) is a statistical method used to transform a number of correlated variables into a smaller number of uncorrelated variables called principal components, while retaining most of the original variability in the data (see Feridun& Sezgin, 2008). I firstly determine the number of the principal components by principal component analysis and then set up the principal component regression (PCR) model (see Xu & Ding, 2008).

Table 4.22a The Principal Component Analysis

Princip al Comop nent	Initial Eigenvalues			Princip al Comop nent	Initial Eigenvalues		
	Eigen- values	% of Variance	Cumulati ve %		Eigen- values	% of Variance	Cumulati ve %
1	8.354	75.199	75.199	7	0.070	0.638	99.678
2	1.704	13.596	88.795	8	0.025	0.231	99.908
3	0.559	5.084	93.879	9	0.006	0.055	99.963
4	0.381	3.468	97.291	10	0.003	0.024	99.987
5	0.103	0.936	98.227				
6	0.089	0.813	99.040				

Table 4.22 a&b reports the results of the PCA. The eigenvalue measure the variance accounted for by the corresponding principal component. The percentage is given by the ratio of the individual eigenvalue to the trace of the correlation matrix, and calculation of all possible eigenvalues would account for all the variance of the original variables. Principal components can be ranked accounting to their ability to explain variance in the original data set. A common approach is to select only those with eigenvalues equal to or greater than one or with at least 80% cumulative explained variance.

These criteria were adopted for this study. From Table 4.22a, the first and second principal components had eigenvalues greater than one with a cumulative explained variance of 75.19% and 88.79%, respectively. Hence, the number of principal components is 2 and the factor loading matrix is as follows.

Table 4.22b Factor loading matrix

Variables	1st component variable	2nd component variable
	K_1	K_2
X1	0.963	0.021
X2	0.983	-0.135
X3	0.989	-0.063
X4	0.885	0.278
X5	0.980	0.125
X6	-0.689	0.524
X7	0.773	0.450
X8	0.843	-0.265
X9	0.927	-0.258
X10	0.878	-0.200

In above table: X1, X2, X3 are the Gross Output of Primary industry, Secondary industry, Tertiary industry respectively; X4 is the Industrialization level in rural area; X5 is Urbanization level in rural area; X6: Total power of agricultural machinery; X7 is the Farming Acreage per capita; X8 is the Government Expenditure on Agriculture; X9 is the Price index of agricultural products; X10 is the Average Education years in Rural area. As the first and second principal components were retained, two new set of variables, K1 and K2, which calculated as a linear combination of the original ten variables.

$$K_1 = \sum k_{1i} \cdot x_i \tag{1}$$

$$K_2 = \sum k_{2i} \cdot x_i \tag{2}$$

In the equation (1) and (2), K_1 and K_2 are the first and the second principal components of the five variables. k_{1i} and k_{2i} are used to denote coefficients of each variable for its corresponding principal component. Furthermore, the regression equation is established as follows, and the parameters involved in the model are estimated by ordinary least square (OLS) method. The new regression equation is: $Y = \alpha_1 K_1 + \alpha_2 K_2$ and the result of the new regression model is as follow:

$$Y = 0.343K_1 - 0.115K_2$$

(15.99) (-6.01)

$$R^2 = 0.956 \quad F = 160.011 \quad (3)$$

Equation (3) demonstrates that $R^2 = 0.956$ and $F = 160.011$, which means a high goodness of fit in this model. The parameters K_1 and K_2 also pass the t-test at a significance level of 0.005. So this model is significant statistically. Then we have the results for K_1 and K_2 as follow:

$$K_1 = 0.226X_1' + 0.128X_2' + 0.126X_3' + 0.113X_4' + 0.118X_5' - 0.072X_6' + 0.083X_7' + 0.102X_8' + 0.112X_9' + 0.103X_{10}'$$

(4)

$$K_2 = 0.023X_1' - 0.085X_2' - 0.055X_3' + 0.186X_4' + 0.091X_5' + 0.401X_6' + 0.33X_7' + 0.102X_8' - 0.179X_9' - 0.143X_{10}'$$

(5)

According to equation (3), (4) and (5), we can get the new regression model by PCA:

$$Y = 5.336 + 0.136X_1 + 0.075X_2 + 0.060X_3 + 0.033X_4 + 0.165X_5 + 0.032X_6 - 0.031X_7 + 0.063X_8 + 0.086X_9 + 0.119X_{10} \quad (6)$$

In this model, Y is the rural residents' income (RI) level in Hubei province, which means "rural residents' per capita net income per year". X_1, X_2, X_3 are the Gross Output of Primary industry, Secondary industry, Tertiary industry respectively; X_4 is the Industrialization level in rural area; X_5 is Urbanization level in rural area; X_6 : Total power of agricultural machinery; X_7 is the Farming Acreage per capita; X_8 is the Government Expenditure on Agriculture; X_9 is the Price index of agricultural products; X_{10} is the Average Education years for Hubei's rural residents. All the values in the model should be adjusted by the inflation rate and keep the same price level with in 1978.

4.3 Analysis of the PCR results

The regression equation (6) shows that except X_7 Farming Acreage per capita (-0.031), all other variables have the positive effect on the growth of RI in Hubei. Based on the values of the correlation coefficients between RI and the ten explanatory variables, the coefficient is as follow in descending order: X_5 Urbanization level(0.165); X_1 the Gross Output of Primary industry(0.136); X_{10} Average Education years in Rural area(0.119); X_9 Price index of agricultural products(0.086); X_2 the Gross Output of Secondary industry(0.075); X_8 Government Expenditure on Agriculture(0.063); X_3 the Gross Output of Tertiary industry(0.06), X_4 the Industrialization level in rural area(0.033), X_6 Total power of agricultural machinery(0.032). According to this result in Hubei, Urbanization level in rural area, the agricultural output and the Human capital investment are the three most main determinants for the growth of RI. Other variables also have positive effect on RI, while their impacts are not obvious, especially for X_4 the Industrialization level in rural area (0.033) and X_6 Total power of agricultural machinery (0.032). Additionally, the more X_7 Farming Acreage the rural residents have, the less they earn in average, which imply the non-farming income is playing a more important role in RI.

5. Summary and Policy Suggestion

After the empirical analyses of the effect of 10 economic factors on the growth of RI in Hubei, this paper makes the following two conclusions:

- 1) Over the past three decades, there has been a substantial and sustained increase in rural resident's income in Hubei province, as the Statistics shows the real RI in Hubei increased from 110.5 yuan in 1978 to 1239.2 yuan in 2012, of which the average annual growth rate reach up to 10.47% . The sources of income have also diversified, in which the non-farming income is increasingly playing an important role.
- 2) In Hubei, there exists a strong positive role of response between rural residents' income and Urbanization level, Gross Output of Primary industry, Average Education years in rural area. Therefore, the development of agricultural economy is the pivotal factor to maintain the growth of RI. Accelerating pace of urbanization and encouraging the human capital investment in rural area are the fundamental approaches choice to boost RI.

In regard with our findings, we provide policy suggestions as follow that intend to increase RI in Hubei, thereby narrowing the current urban-rural income gap. The policy recommendations are related to government's support in agricultural economy, planned urbanization process, and investment in the education system for the rural areas. First is to develop the agricultural sector in rural areas. It is quite common that during a rapid development process in transition and newly industrialized economies, allocation of resources is biased towards urban area. This together with low productive agricultural sector compared with service and industry sectors lead to divergence, inequality and growing inequality within and between urban-rural sectors. Farm-activities in China are low in productivity due to backwardness of technology and distribution system. Family farms are usually in small scale and vulnerable to natural disasters. Government should provide more technical and financial supports to improve the productivity and crop diversification for family farms and set up of more agro-processing businesses in the towns and villages.

Second, accelerate the pace of well-planned urbanization in rural area (Dong, 2001). This includes investment in the development of infrastructures in rural area, and enlarging the existed Township and Village Enterprises (TVEs) and developing for new ones locally or in cities and towns within commuting distance. More public and financial support should be used for the infrastructure construction of farm living and working conditions in the rural area, including roads, irrigation, electrification, drinking water facilities, and broadband Internet service. Also, funds should be allocated from national finance instead of raising revenues from the farmers themselves for such construction.ⁱⁱ

Additionally, according to the result of this paper, income from nonfarm activities is much higher than that from farming. People with low income level should be offered more opportunities to get engaged in non-farm activities. However, the poorest rural residents might not be able to afford the cost that are needed for them to seek the jobs in urban areas, while at the same time such non-farm employment opportunities are very limited in rural areas. Thus, policies that accelerate the pace of urbanization and support local developments of TVE are strongly suggested to be carried out.

Above all else, as we can see, the flexibility of Average Education years in Rural area is 0.119, that is, every 1% increase of average education years will lead to 11.9% increase of RI in Hubei, exerting an noticeable influence on RI. The rural educational system must be transformed to provide the same opportunities for rural students as is available in urban areas. And the quality of rural schools must be upgraded to equal those of urban schools. An increasingly important issue is rural students' access to senior high school and tertiary education. The long-standing university exam system, together with skyrocketing tuition and fees, is a higher barrier to rural students, on average, compared to urban students. If their future earnings are to be promote, this unequal in schooling and opportunities to getting higher education must be eliminated.

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