The Rural-Urban Interaction in China:

A Causal Analysis by Using the Panel Data from 31 Provinces

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Abstract: This paper examines the interactive relationships between China's rural economy and urban economy with provincial panel data from 2000 to 2009 of 31 provinces. A modified Granger Causality Test is employed to be applied to the short time period panel data. China's rural sector and urban sector are found significantly dependent to each other. However, we observe that the development of urban economy will play an important role in the development of rural economy in the long term, but the development of rural economy can't stimulate the development of urban economy efficiently at present, so the good interaction between China's urban and rural economy does not exist, poverty in rural area maybe the most significant reason. Such a phenomenon could be understood from the perspective of household demand shift and implies that more resources should be invested in the rural sector. We analyze the problem and argue that to stress the importance of the urban economy blindly may result in the stagnation of the whole economy. Therefore, eliminating the obstacles of rural-urban interaction is the efficient path for the sustainable development of the economy.

Key words: Rural-Urban Interaction; Causality; Inequality; Demand

1. Introduction

Since the Reform and Opening-up in 1978, China has achieved an unbelievable success in economic development. Meanwhile, China is also facing a stunning rise in the rural-urban inequality, which is concerned by the economists and scholars in and abroad. The rural-urban inequality has changed little during the period of 1978 to 1984, but is larger and larger after 1985: Measured by the per-capita income (the ratio

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is the disposable income of urban residents to the per-capital net income of rural residents), the gap increased from 1.72 to 3.33 during the period of 1985 to 2009. From the perspective of per-capita consumption, the rural-urban consumption ratio rose from 2.12 to 3.07 during the same period. The two methods above are widely used by the scholars, but many of them believe the inequality is under-estimated from the two methods. Accompanying the increase, the rural-urban inequality is creating many social problems. As a consequence, greater pressure for policy innovation and political reform is coming. The phenomenon illustrates the rural-urban inequality is not only a serious economic issue, but also an important social problem.

Due to the reasons above, many economists have devoted their efforts to explaining the rural-urban income gap. Cai and Yang (2000) study China's rural-urban income gap from the perspective of institutions. Lu and Chen (2004) regard urban-biased economic policies as the most important cause of the increasing rural-urban inequality. Other scholars analyze this problem from the perspective of labor migration (Li, 1999) and rural infrastructures (Lin, 2001). Recently many economists who are interested in China's agricultural problems pay attention to the perspective of finance (Zhu and Li, 2006; Zhong and Tang, 2005; Xu and Gao, 2005; Yao, 2004). The existed researches could provide us with theoretical support on our empirical analysis and the final conclusions.

Although there are lots of papers on researching the rural-urban inequality in China, few of the researches have noticed the importance of rural-urban interaction in the analysis of rural-urban relationship. Tacoli (1998) complains "most development theory and practice have focused on either 'urban' or 'rural' issues with little consideration of the interrelations between the two". Unfortunately, even by now very limited economic researches analyze the rural-urban inequality problem from the perspective of interaction, so we would like to try to research the issue from this perspective. However, Von Braun (2007) has carried out an excellent job. He divides the rural-urban linkages into two classes, including spatial flows and sectoral flows. The spatial flows consist of migration and remittances, goods, services and waste, information and resources. The sectoral flows are related to crop and livestock, input market, high-value agriculture trade, peri-urban and multifunctional agriculture. If those channels for rural-urban interaction could function well, there would be a virtuous circle between the rural and urban economic growth. Rural growth can results in both the increased demand for farm inputs (like fertilizers and farm equipment) and the increased demand for manufactured goods and services (Diao et al. 2007; de Ferranti et al 2005; Mellor 1995). Those increased demand will boost the economic growth in the urban area. Analogously, the growth of the urban economy means higher demand for agricultural goods (grains, milk, meet, eggs and so on) and more importantly the increased demand for rural labor (Chowdhury et al. 2005). Both the demand for agricultural goods and rural labor may lead to economic growth in the rural areas. Nevertheless, the particular way of China's rural and urban economic developing is different from the way of many developed countries, so some questions should be answered: Will the economic developing in urban areas stimulate the economic developing in rural areas? What's the probable result of expanding urban economy blindly? How could the coordinated development of urban and rural economy realize so as to eliminating the rural-urban inequality? In this paper, we will try to research and answer these questions.

2. Data and Methodology

Basing on the analysis above, we try to research the rural-urban income gap from the perspective of interaction between China's urban and rural economy. A modified Granger Causality Test is employed to be applied to the short time period panel data.

2.1 The Data

2.1.1 The official macro data are provided (both the disposable income of urban residents and the per-capital net income of rural residents) by National Bureau of Statistics of China (http://www.stats.gov.cn/), which could well support our purpose. In general, the data from NBSC are authentic and accurate. The results of empirical analysis will be believable by using these data.

2.1.2 We use income as the indicator instead of per-capita consumption reflecting the economic development so as to test the inter linkages between the rural economy and the urban economy. The reason why we use income instead of consumption as the interested variable is that, as argued by Dercon (2002), consumption is a better indicator for measuring poverty in the long-run. Because risk-averse households prefer less variable consumption, consumption is much smoother than income. For example, if the current income increase is not sustainable, households will not increase their consumption obviously. Therefore the consumption movement may reflect the long-term welfare change instead of short-term. In this paper, we will consideration the issue in the short-term (2000-2009), so income may be the better choice to reflect the economic behaviors of the households than consumption.

2.1.3 The openness of international trades is the controlled variable. One reason is minimize the measurement error caused by omitted variables; the other and important reason is that products from urban sectors not only require the needs of rural residents, but also meet demands from the foreigners. Similarly, products from rural sectors not only supply to the consumers in the cities, but also export to many other countries. From the analysis above, we believe there is an important relationship between international trades and rural-urban economy, so openness of international trades is a variable that must be considered. In this paper, the measurement of the variable is the China's total export-import volume divided by GDP.

2.1.4 A 10-year provincial panel data will be built, the time period is 2000-2009. However, a serious trouble is that the modern China's System of National Accounts has only been established for about thirty years, consequently the quality of the old data are not good enough. With the development and reform of NBSC, the quality of the data is better than before. In order to make full use of the recent high quality data, we decide to use the data from 2000 in a form of provincial-level panel to test the mutual influence between the rural and urban economy. We use the data from 31 provinces of China (excluding Hong Kong, Taiwan and Macao), there are 310 observations.

2.1.5 As is shown in Table1, *UI* represents the disposable income of urban residents, *RI* represents the per-capital net income of rural residents, *GDP* represents GDP of each province, *Trade* represents the total volume of trade in each province, *Tratio* is the ratio of *Trade* to *GDP* (We will use the logarithm of all the variables data in the empirical analysis due to the good economic significance.).

Table1. Summary Statistics of the Data

Variable	*Obs.*	*Mean*	*Std.Dev.*	*Min*	*Max*
UI	*310*	*10414.42*	*4407.13*	*4724.11*	*28837.78*
RI	*310*	*3603.35*	*1937.76*	*1330.81*	*12482.94*
GDP	*310*	*6548.79*	*6587.73*	*117.46*	*39482.56*
Trade	*310*	*3386.28*	*7416.71*	*8.77*	*49850.32*
Tratio	*310*	*0.32*	*0.39*	*0.04*	*1.71*

Note: The data are available in the China Statistics Yearbook. The units of per-capita consumption are Yuan. We calculate *Tratio* basing on the data of *Trade* and *GDP*.

2.2 The Methodology: The Modified Granger Causality for Panel Data

Following the considerations above we will try to test the rural-urban interrelations with the data of China, which is a typical dual economy in the world. Since the data only cover ten years, it is not proper to use the classical Granger Causality test. But a special methodology developed by Perez-Moreno (2010), which is designed for the short-term panel data according to the core spirit of the classical Granger Causality Test, can be adopted to implement our analysis. It helps us to do a Granger Causality analysis with the short time period panel data.

The underlying idea of Granger's classic method is that, if a certain variable x causes other variable y, then the past information of x could explain and predict y efficiently. In other words, the lagged values of x in a regression of y on its own lagged values and other explanatory variables should significantly improve the forecasting power of the model. If the past values of y help explain x, then y is supposed to be a causal factor of x. Following such a spirit, we can apply it to the case of panel data.

Consider the following four models:

$$UI_{it} = \beta_0 + \beta_1 UI_{it-1} + \beta_2 RI_{it-1} + \beta_3 Tratio_{it-1} + \varepsilon_{it} \quad (1)$$

$$UI_{it} = \beta_0 + \beta_1 UI_{it-1} + \beta_2 Tratio_{it-1} + \varepsilon_{it} \quad (2)$$

$$RI_{it} = \beta_0 + \beta_1 RI_{it-1} + \beta_2 UI_{it-1} + \beta_3 Tratio_{it-1} + \varepsilon_{it} \quad (3)$$

$$RI_{it} = \beta_0 + \beta_1 RI_{it-1} + \beta_2 Tratio_{it-1} + \varepsilon_{it} \quad (4)$$

i represents samples of each province, t represents time sample (2000-2009), ε represents random error term.

Model (1) and Model (2) are rival models to test whether the per-capital net income of rural residents (*RI*) is a causal factor of the disposable income of urban residents (*UI*). Model (1) adds the past information of *RI* compared to Model (2). If *RI* is a causal factor of the *UI*, then the variable RI_{it-1} should significantly improve the forecasting power of the model. Similarly, Model (3) and Model (4) are employed to check whether *UI* is a causal factor for the dynamics of *RI*. If the variable UI_{it-1} improves the forecasting power of the model significantly, we believe *UI* is a causal factor of *RI*.

A key issue is how to test whether the forecasting power of a model has been significantly improved by the new variables. A sum-difference test is useful to solve

this problem. Denote φ_{1it} as the forecasting error from Model (1) and φ_{2it} as the forecasting error from Model (2). If the added explanatory variable does not improve Model (1) at all, then $|\varphi_{1it}| = |\varphi_{2it}|$. The null hypothesis is

$$H_0: \varphi_{1it}^2 = \varphi_{2it}^2$$

If the null hypothesis is rejected, we should accept the model with models with new variable. Define

$$Sum_{12it} = \varphi_{1it} + \varphi_{2it}$$

$$Dif_{12it} = \varphi_{1it} - \varphi_{2it}$$

To test the null hypothesis is equal to test whether $\delta = 0$ from the regression

$$Sum_{12it} = \alpha + \delta Dif_{12it} + \varepsilon_{it}$$

If δ is significantly different to 0, then the null hypothesis that Model (1) and Model (2) have the same forecasting power is rejected. So the forecasting power of the model has been significantly improved by the added variable (RI_{it-1}). It means that *RI* is a causal factor of *UI*. Through the similar way we can test whether the *UI* is a significant reason for the changing of *RI* with Models (3) and (4).

The specific analytical procedure is: first, We divide our sample into two sub samples with the first one covering the period from 2000 to 2004 and another one covering the period between 2005 and 2009; second, basing on the two sub samples, we estimate the four models, 8 groups of results will be realized, since the data come from each province in China, not random selection, fix effect (FE) is the better method than random effect (RE); third, test the forecasting of models, do the Sum-Difference Test, then we can get the results on the causality between *RI* and *UI*.

3. Empirical Results and Policy Implications

3.1 **Empirical Results of Rural Urban Interaction**

The sub sample regression results are presented in Tables 2 and 3. It seems that the urban economy and the rural economy have significant influence on each other. In Table2, the estimated models reflect that UI_{it-1} is a positive explanatory variable of UI_{it}, but RI_{it-1} is not a positive explanatory variable of UI_{it}. The results won't tell us whether *RI* will impact *UI*, we should do the Sum-Difference Test to get the further conclusions.

Table2. Sub Sample Regression Results of Models (1) and (2)

Independent Variables	*Dependent Variable:* UI_{it}			
	Model (1)	*Model (2)*	*Model (1)*	*Model (2)*
	2000-2004	*2000-2004*	*2005-2009*	*2005-2009*

UI_{it-1}	*0.9265***	*0.9999***	*0.7295***	*0.9713***
	(0.0810)	*(0.0266)*	*(0.1691)*	*(0.0086)*
RI_{it-1}	*0.1311*		*0.2536*	
	(0.1394)		*(0.1745)*	
$Tratio_{it-1}$	*0.0261*	*0.0275*	*0.0242*	*0.0278*
	(0.0185)	*(0.0180)*	*(0.0224)*	*(0.0277)*
Constant	*-0.2283*	*0.1458*	*0.5924****	*0.4245****
	(0.4723)	*(0.2546)*	*(0.1934)*	*(0.1033)*
R^2	*0.9523*	*0.9515*	*0.9716*	*0.9696*
Number of Observations	*124*	*124*	*155*	*155*
Number of Groups	*31*	*31*	*31*	*31*

Notes: *, ** and ***denotes the significance at the 10, 5 and 1percent level respectively and robust standard errors are in parentheses. FE means the fixed-effect model for panel data analysis.

From Table3, we can observe that RI_{it} is positively influenced by RI_{it-1}, and the result of Model(3) tells us that UI_{it-1} is a positive explanatory variable of RI_{it} in both time periods, it shows that UI_{it-1} also positively influences RI_{it}, the estimated coefficients are near 0.33 in both time periods. We use the log-level to denote the variables in the empirical analysis, so 0.33 can be seen as elastic coefficient, and we can draw a conclusion that in 2000-2009, the income of urban residents increased 1%, the per-capital net income of rural residents would increase 0.33% in the next year. So the changing income of urban residents is likely the reason for explaining the changing per-capital net income of rural residents, but we also need to do the Sum-Difference Test to check the causality.

Table3. Sub Sample Regression Results of Models (3) and (4)

Independent Variables	*Dependent Variable: RI_{it}*			
	Model (3)	*Model (4)*	*Model (3)*	*Model (4)*
	2000-2004	*2000-2004*	*2005-2009*	*2005-2009*
RI_{it-1}	*0.7248****	*1.2353****	*0.6537****	*0.9796****
	(0.1472)	*(0.0462)*	*(0.1538)*	*(0.0098)*
UI_{it-1}	*0.3357****		*0.3215***	
	(0.0892)		*(0.1490)*	
$Tratio_{it-1}$	*0.0493**	*0.0599*	*0.0370**	*0.0354*
	(0.0275)	*(0.0300)*	*(0.0204)*	*(0.0216)*
Constant	*-0.6715*	*-1.6555*	*0.0109*	*0.3326****
	(0.5060)	*(0.3871)*	*(0.1614)*	*(0.0955)*
R^2	*0.9340*	*0.9123*	*0.9695*	*0.9659*

Number of Observations	*124*	*124*	*155*	*155*
Number of Groups	*31*	*31*	*31*	*31*

Notes: *, ** and ***denotes the significance at the 10, 5 and 1percent level respectively and robust standard errors are in parentheses. FE means the fixed-effect model for panel data analysis.

From the results of the sum-difference test, which are presented in Table4, we can find that obvious inter linkages exists between China's rural economy and urban economy. *Models(1)and(2)* in Table4 means significance test on the difference of predictive ability with Model (1) and Model (2), and so is the latter. In both time periods, there is important difference between Models (1) and (2), because the forecasting errors of Models (1) and (2) are significantly different from each other at the 1 percent significance level in this period. The reason is that RI_{it-1} improves the forecasting power of the model significantly, which means *RI* is a causal factor of the *UI*. Similarly, Models (3) and (4) are also significantly different from each other at the 1 percent significance level in this period. It means *UI* is a causal factor of the *RI*. So we believe *UI* and *RI* interact as both cause and effect.

Table4. Results of the Sum-Difference Test

	2000-2004	*2005-2009*
Models (1) and (2)	*1.9577*** *(0.1782)*	*1.1930*** *(0.1069)*
Models (3) and (4)	*-1.0346*** *(0.0712)*	*0.5488*** *(0.0944)*

Notes: *, ** and ***denotes the significance at the 10, 5 and 1percent level respectively and standard errors are in parentheses.

3.2 Interpretation and Policy Implications

With the Sum-Difference Test we have proved the existence of the rural-urban interaction. We find that rural sector and urban sector are significantly dependent to each other. The urban economy had been showing powerful influence on China's rural economy, but the reverse is not true. Von Braun(2007) and Chowdhury(2005) believe that there should be a virtuous circle between rural and urban economy, however, the virtuous circle does not exist in China, even if exists, the interaction is relatively weak.

The dynamics of the rural-urban interaction can be understood from the perspective of household demand shift. At the beginning period of economic development, when the household income is low, people's demand for agricultural goods grows rapidly while the demand for manufactured goods increases at a relatively slow speed. When people become much richer, their demand for agricultural goods will be saturated but the demand for manufactured goods will rise increasingly.

From Table5 we can see that in the period from 2000 to 2004 the income of China's urban residents was still at a low level (only 7747 Yuan, about 56 percent of the income in the second period), which means that their demand for foods and other agricultural goods would increase rapidly with the income growth. During the first period the rural residents were much poorer than the citizens, so they spent more money on food instead of manufactured goods. Consequently the growth of the urban

sector resulted in obvious increase in demand of agriculture products; however, the rural sector growth could not give rise to substantial increase of the demand for manufactured goods.

In the period from 2005 to 2009, the income of the urban inhabitants increased by about 78 percent relative to the period from 2000 to 2004. The income of the rural dweller also experienced an enormous increase by 65 percent from 2530 Yuan to 4179 Yuan. Although the income of the urban citizens increased rapidly, their demand for agricultural products did not increase at the same speed. Actually as revealed by Engel' Rule, their demand for agricultural goods should increase slower and slower. In this period, the rural residents' demand for manufactured goods grew increasingly, so the impacts of the rural sector could have stimulated the urban growth with increasingly stronger power. Yet the positive effects of the rural economy on the urban economy are not realizing thoroughly, too low rural income and too large rural-urban gap are harmful to the economic growth. In order to make full use of the rural-urban interaction and to realize a virtuous circle of the economy, more resources should be invested into the rural area at the present stage. Then the income of the rural residents could be improved and the rural-urban inequality will be alleviated, consequently, the urban economy could also be stimulated.

Table5. Per-Capita Annual Income and Engel's Coefficient of Urban and Rural Households

Year	Per Capita Annual Disposable Income of Urban Households (Yuan)	Per Capita Annual Net Income of Rural Households (Yuan)	Engel's Coefficient of Urban Households (%)	Engel's Coefficient of Rural Households (%)
1990-1994	2262.2	864.4	52.2	58.4
1995-1999	5112.2	1993.2	46.6	55.2
2000-2004	7747.4	2530.6	38.0	47.2
2005-2009	13799.0	4179.2	36.8	43.4

Notes: 1. The table is calculated according to the data provided by NSBC. 2. The income is temporary value without considering inflation.

We should also pay attention to one reality: since the Reform and Opening-up, the income of residents in both rural and urban areas has increased greatly, correspondingly, urban residents' long-term demands for food, agriculture products and consumable have been met stepwise. However, China is still a developing country of middle income at the moment, the residents in urban areas are not as wealthy as the ones in lots of developed countries. Therefore, urban residents' demand from the rural sector can't reach the saturation in short term, so the development of urban economy will play an important role in the development of rural economy in the long term. On the other hand, in 2005-2009, the rural residents' demand for manufactured goods grew increasingly, but the rural residents' income is still much lower than urban residents, the rural residents' huge demand for manufactured goods can't take shape in the short-run, so the development of rural economy can't stimulate the development of urban economy efficiently at present. In one word, poverty in rural areas of China is the most important reason that the

interaction between rural-urban economy can't be realized. The analysis is consistent with the results of empirical test above.

4. Concluding Remarks

This paper examines the interactive relationship between China's rural economy and urban economy in order to obtain a more comprehensive understanding about China's increasing rural-urban inequality. With regard to the data quality problem of China's national accounting system, the provincial panel data in the period from 2000 to 2009 are used in the analysis. In addition, a modified Granger Causality Test is employed so as to analyze the causality problem with the short time period panel data.

The main conclusions are that China's rural sector and urban sector are found significantly dependent to each other. However, we observe that the development of urban economy will play an important role in the development of rural economy in the long term, but the development of rural economy can't stimulate the development of urban economy efficiently at present, so the good interaction between China's urban and rural economy does not exist, poverty in rural area maybe the most significant reason. Such a phenomenon could be understood from the perspective of household demand shift. The policy implication is that stressing the importance of the urban economy blindly may result in the stagnation of the whole economy. Therefore, eliminating the obstacles of rural-urban interaction is the efficient path for the sustainable development of the economy. In order to realize a virtuous circle of the economy, more resources should be invested in the rural sector.

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