

Urban-rural Social Security Imbalance and Consumption Inequality: A Study Based on the Dynamic Panel Data Model

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Abstract—This paper explores the influence of the urban-rural social security imbalance on the consumption inequality with the dynamic panel data model, using the Chinese provincial panel data from 2000 to 2016. According to the empirical result, the urban-rural social security imbalance has positive correlations with the urban-rural consumption inequality. Lessening the urban-rural social security imbalance contributes to reducing the consumption inequality between the city and the country. Because of the regional difference in the economic institutions and geographic conditions, the influence of the urban-rural social security imbalance on the urban-rural consumption inequality has apparent regional differences. The urban-rural income inequality and children's dependency ratio gap have positive correlations with the urban-rural consumption inequality, while the elderly dependency ratio gap between the city and the country has negative correlations with the urban-rural consumption inequality.

Keywords—urban-rural social security imbalance; the consumption inequality; China; Theil Index

I. INTRODUCTION

Since the reform in 1978, China's economy has developed rapidly. But at the same time, the gap in the living standards between the urban and rural residents is still too large. In 2016, the per capita consumption of the urban residents was 21320 yuan, while that of the rural residents was only 10063 yuan. The consumption gap between the urban and rural areas not only affects the sustained and healthy development of Chinese economy, but also may lead to serious social problems.

The problem of economic imbalance is becoming more and more prominent. The social security system is an important institution to promote the equality of all members of society. However, in China, the urban residents enjoy comprehensive social security services, while the development of the rural social security system lags behind. There is severe imbalance in the level of social security between the urban and rural areas. In this article, we explore the impact of the urban-rural social security imbalance on the consumption inequality.

Several authors have studied the link between the social security and the consumption. Some studies show that the effect of the social security on the consumption is uncertain or

negative (Bruce and Turnovsky (2013) [1], Bagchi (2015) [2], Heijdra and Mierau (2012) [3], Laitner and Silverman (2012) [4], etc.) Wang (2017) examines the relationship between the Chinese social security and the consumption of the urban residents based on the general equilibrium theory, and proves that the increase of the social security expenditure could increase the consumption in the steady state [5]. Liu and Lu (2017) finds that the rural social security has positive effect on the consumption and has threshold effects [6]. Lv, Xu and Wei (2018) studies the regional difference in the effects of the social security on the consumption gap [7].

The existing literature about the social security and consumption lay a good foundation for the future research, but they ignore the impacts of the social security imbalance on the consumption inequality. Thus, we use the Theil index to reflect the social security imbalance and consumption inequality between the urban and rural areas, and analyze the effects of the urban-rural social security imbalance on the consumption inequality based on the Chinese panel data.

The remainder of the paper proceeds as follows. Section II describes the Theil Index and the model. Section III describes the panel data set and provides summary statistics of the variables. Section IV presents in detail the results of estimation. The final section, Section V, concludes with a summary of the empirical results and discusses policy implications.

II. MODEL

A. Theil Index

We use the urban-rural income Theil Index to reflect the income inequality between the city and country. The urban-rural consumption Theil Index represents the consumption inequality between the city and country. The urban-rural social security Theil Index represents the social security imbalance between the city and country. Take the urban-rural consumption Theil Index (CT) as an example to show the calculation method:

$$CT = \sum_{i=1}^2 \left[\frac{X_{it}}{X_t} \times \lg \left(\frac{X_{it}/P_{it}}{X_t/P_t} \right) \right] \quad (1)$$

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where CT is the urban-rural consumption Theil Index. X_{it} is the consumption of the urban residents ($i=1$) or rural residents ($i=2$) in time t . X_t is the total expenditure of the urban and rural residents in time t . P_{it} is the population of the urban area ($i=1$) or the rural area ($i=2$). P_t is the total population of the urban and rural areas in time t .

Equation (1) could be turned into the follows:

$$CT = \frac{E_{1t}P_{1t}}{E_{1t}P_{1t} + E_{2t}P_{2t}} \times \lg \left[\frac{E_{1t}P_{1t}}{E_{1t}P_{1t} + E_{2t}P_{2t}} / \frac{P_{1t}}{P_{1t} + P_{2t}} \right] + \frac{E_{2t}P_{2t}}{E_{1t}P_{1t} + E_{2t}P_{2t}} \times \lg \left[\frac{E_{2t}P_{2t}}{E_{1t}P_{1t} + E_{2t}P_{2t}} / \frac{P_{2t}}{P_{1t} + P_{2t}} \right] \quad (2)$$

where E_{1t} is the per capita consumption of the urban residents. E_{2t} is the per capita consumption of the rural residents. $E_{1t}P_{1t}$ is the total expenditure of the urban residents. $E_{2t}P_{2t}$ is the total expenditure of the rural residents.

B. Model

The basic model is:

$$CT_{i,t} = \beta_0 + \beta_1 ST_{i,t} + \beta_2 YT_{i,t} + u_i + \varepsilon_{i,t} \quad (3)$$

where $CT_{i,t}$ is the urban-rural consumption Theil Index. $ST_{i,t}$ is the urban-rural social security Theil Index. $YT_{i,t}$ is the urban-rural income Theil Index. Equation (3) is a static model. To take the consumption inequality inertia into consideration, we construct the dynamic model:

$$CT_{i,t} = \beta_0 + \beta_1 ST_{i,t} + \beta_2 YT_{i,t} + \beta_3 CT_{i,t-1} + u_i + \varepsilon_{i,t} \quad (4)$$

We get the extended static model by introducing the children’s dependency ratio gap between the city and the country (CHI) and the elderly dependency ratio gap between the city and the country (OLD) into the explanatory variables:

$$CT_{i,t} = \beta_0 + \beta_1 ST_{i,t} + \beta_2 YT_{i,t} + \beta_3 CHI_{i,t} + \beta_4 OLD_{i,t} + u_i + \varepsilon_{i,t} \quad (5)$$

The extended dynamic model is:

$$CT_{i,t} = \beta_0 + \beta_1 ST_{i,t} + \beta_2 YT_{i,t} + \beta_3 CHI_{i,t} + \beta_4 OLD_{i,t} + \beta_5 CT_{i,t-1} + u_i + \varepsilon_{i,t} \quad (6)$$

III. DATA

The overall sample is the panel data of 31 provinces, municipalities and autonomous regions in China from 2000 through 2016. The whole country is divided into three regions: the east, the midland and the west. The descriptive statistics of the variables are summarized in Table I.

We use the per capita transfer-payment income to represent the social security level of the urban and rural residents. The children’s dependency ratio gap between the city and the country is the difference between the rural children’s dependency ratio and the urban children’s dependency ratio. And the elderly dependency ratio gap between the city and the country is the difference between the rural elderly dependency ratio and the urban elderly dependency ratio. The data of the per capita consumption, per capita transfer-payment income, per capita income, population, the children’s dependency ratio,

the elderly dependency ratio, the consumer price index, etc. are from the Statistical Yearbook of China. The nominal variables are transferred into the real variables through the CPI.

TABLE I. DESCRIPTIVE STATISTICS

Variables	Unit	Mean Value
Urban per capita consumption	Yuan	11554.63
Urban per capita transfer - payment income	Yuan	3770.471
Urban per capita income	Yuan	16149.62
Urban population	10000 persons	1995.883
Urban children's dependency ratio	%	18.602
Urban elderly dependency ratio	%	11.167
Rural per capita consumption	Yuan	4590.157
Rural per capita transfer-payment income	Yuan	650.617
Rural per capita income of the rural residents	Yuan	5957.015
Rural population	10000 persons	2240.255
Rural children's dependency ratio	%	28.526
Rural elderly dependency ratio	%	13.032

IV. EMPIRICAL RESULT

A. The Empirical Analysis Based on the National Level

Table II summarizes the results of regression of (3) and (4) with the national data. All the estimates are statistically significant at 5%. According to the Hausman test result, the fixed-effects regression (FE) is more efficient than the random-effects regression (RE). In the dynamic panel data model, Difference GMM (D-GMM) and System GMM (S-GMM) are respectively used in the regression, and the Sargan test result shows the instrument variables are valid. There is no overidentification problem. According to the test result of AR(2), there is no autocorrelation of the errors. Compared with D-GMM estimation, S-GMM estimation is more efficient.

The estimates of the coefficient of the urban-rural social security Theil Index range from 0.0305 to 0.0768, and are significant 1%. This means the social security imbalance between the city and country has positive effects on the consumption inequality. The larger the urban-rural social security imbalance, the larger the consumption inequality between the city and the country. Between 2000 and 2016, the Chinese urban-rural social security index decrease gradually, which implies the degree of the inequalities decreases. In 2002, China carried out reforms in the rural social security system. In 2003, some provinces began to implement New Rural Cooperative Medical system. In 2014, China realized the combination of social endowment insurance for the urban and rural residents. The rural social security develop very fast. The social security expenditure of the country develops faster than that of the city, and this reduces the urban-rural social security imbalance. The increase of the rural social security expenditure can reduce the precautionary saving of the rural residents and

increase the consumption. Thus the decrease of the urban-rural social security imbalance can reduce the urban-rural consumption inequality.

TABLE II. REGRESSION RESULTS OF THE BASIC MODEL BASED ON THE NATIONAL DATA

	Static Panel Model		Dynamic Panel Model	
	FE	RE	D-GMM	S-GMM
CT _{t-1}			0.5139*** (42.57)	0.5742*** (34.94)
ST	0.0768*** (14.40)	0.0753*** (14.63)	0.0331*** (17.73)	0.0305*** (13.11)
YT	0.7968*** (19.68)	0.7775*** (22.21)	0.5340*** (16.57)	0.5153*** (55.22)
Constant	-0.0063*** (-3.53)	-0.0050** (-2.37)	-0.0111*** (-13.14)	-0.0131*** (-36.67)
Hausman		20.4900*** (0.0001)		
R ²	0.7746	0.7744		
F	849.11***			
Wald		1783.01***	65526.6***	71999.8***
AR(1)			-2.2250 (0.03)	-2.2120 (0.03)
AR(2)			1.7422 (0.082)	1.7049 (0.09)
Sargan			28.0250 (1.00)	29.7080 (1.00)

Note: Numbers in the parentheses of the static panel model are t-statistic values. Numbers in the parentheses of the dynamic panel model are z-statistic values.

* Significant at 10%.

** Significant at 5%.

*** Significant at 1%.

The estimates of the coefficient of the lagged urban-rural consumption Theil Index is 0.5139 and 0.5742 respectively, which implies the past consumption inequality between the city and the country could enlarge the current consumption inequality. The estimates of the coefficient of the urban-rural income inequality ranges from 0.5153 to 0.7968, which implies the income inequality between the city and the country is an important factor affecting the consumption inequality.

Table III summarizes the results of regression of (3) and (4) with the national data. The Hausman test result shows the estimation result of the fixed effects model is more efficient than that of the random effects model. Both the D-GMM and S-GMM regression results pass the Sargan test.

The estimates of the parenthesis of the urban-rural social security Theil Index is positive and significant at 1%, which is consistent with that of the basic model. These estimates range from 0.0199 to 0.0700, which are smaller than those of the basic model. The estimates of the parenthesis of CT_{t-1} is in consistency with those of the basic model. The estimates of the parenthesis of the urban-rural income Theil Index range from 0.45 to 0.8, which are higher than those of the urban-rural

social security Theil Index. This implies the influence of the urban-rural income inequality on the consumption inequality is larger than that of the social security imbalance.

TABLE III. REGRESSION RESULTS OF THE EXTENDED MODEL BASED ON THE NATIONAL DATA

	Static Panel Model		Dynamic Panel Model	
	FE	RE	D-GMM	S-GMM
CT _{t-1}			0.5113*** (-15.45)	0.5835*** (-28.84)
ST	0.0700*** (-12.57)	0.0688*** (-12.96)	0.0236*** (-9.27)	0.0199*** (-8.94)
YT	0.7732*** (-19.04)	0.7539*** (-21.42)	0.4948*** (-9.48)	0.4704*** (-18.9)
CHI	0.0001 (-1.16)	0.0001 (-1.13)	0.0004*** (-9.42)	0.0006*** (-16.5)
OLD	-0.0006*** (-3.9200)	-0.0006*** (-4.1200)	-0.0005*** (-6.0100)	-0.0005*** (-5.1900)
Constant	-0.0040* (-1.7500)	-0.0026 (-1.0800)	-0.0103*** (-6.1300)	-0.0148*** (-15.6500)
Hausman		19.1600*** (0.0018)		
R ²	0.7824	0.7821		
F	440.720***			
Wald		1853.99***	34929.4***	31678.81***
AR(1)			-2.5646 (0.01)	-2.6156 (0.0089)
AR(2)			1.4784 (0.139)	1.3279 (0.1842)
Sargan			27.0908 (1.000)	29.7172 (1.000)

Note: Numbers in the parentheses of the static panel model are t-statistic values. Numbers in the parentheses of the dynamic panel model are z-statistic values.

* Significant at 10%.

** Significant at 5%.

*** Significant at 1%.

According to the regression result of the dynamic panel model, the children's dependency ratio gap between the city and the country has positive relationship with the urban-rural consumption inequality. Because of historical reasons, the children's dependency ratio of the urban families has been higher than that of the rural families. Many women in the country have to quit the job and stay at home to take care of the children, and this reduces the income of the family. Besides the income constraint, the uncertainty of the future medical and education expenses increase the precautionary saving of the rural families, which will lead to the reduction of the consumption. The children's dependency ratio of both the urban families and the rural families have decreased since 2001 gradually. Because the children's dependency ratio of the rural families decrease faster than that of the urban families, the urban-rural children's dependency ratio gap is shrinking,

and this is helpful in reducing the urban-rural consumption inequality.

The elderly dependency ratio gap between the city and the country has negative effects on the urban-rural consumption inequality. The percentage of the elders who have to depend on the financial support of their children is higher in the rural area than that in the urban area. Because of the income constraint, the consumption of the rural elders is limited to the daily expenses. The urban elders are less constrained by the financial condition than the rural elders and have higher consumption level. Since 2004, the elderly dependency ratio in the rural area has been higher than that in the city. Besides, the elderly dependency ratio in the country increase faster than that in the city, and this limits the enlargement of the urban-rural consumption inequality to some extent.

B. Empirical Analyses based on the Regional Data

Due to the differences in the resources, locations and policies, the regional economic development is unbalanced in China, and there are differences in social security, income and consumption among the regions. The social security expenditure of a region is affected by its economic development. The regional social security level is the highest in

the east, the second in the midland and the lowest in the west. The impacts of the social security imbalance on the consumption inequality may differ among the regions. This section makes empirical analyses with the regional data.

The regression result of (3) and (4) is summarized in Table IV. In the regression of the static panel model, according to the Hausman test result, the random effects model is applied in the East and midland, while the fixed effects model is applied in the west. We regress the dynamic panel data model with the method of S-GMM. According to the Sargan test result, the instrument variables are valid, and all the models pass the overidentification test.

In the static panel model, the estimates of the urban-rural social security Theil Index are positive and significant statistically. The impacts of the social security imbalance on the consumption inequality are the highest in the midland, the second in the east, and the lowest in the west. After introducing the lagged consumption inequality in the model, the estimates of the parentheses of the urban-rural social security Theil index in each region are still positive, but the values of the estimates are smaller.

TABLE IV. REGRESSION RESULTS OF THE BASIC MODEL BASED ON THE REGIONAL DATA

	East		Midland		West	
	<i>Static panel model</i>	<i>Dynamic panel model</i>	<i>Static panel model</i>	<i>Dynamic panel model</i>	<i>Static panel model</i>	<i>Dynamic panel model</i>
	<i>RE</i>	<i>S-GMM</i>	<i>RE</i>	<i>S-GMM</i>	<i>FE</i>	<i>S-GMM</i>
CT _{t-1}		0.5470*** (12.2000)		0.4773** (2.3900)		0.5363*** (12.4100)
ST	0.0876** (10.7000)	0.0660*** (6.0600)	0.0942*** (10.7200)	0.0346 (1.2100)	0.0656*** (6.7200)	0.0165* (1.8700)
YT	0.6675*** (7.9700)	0.3448*** (2.6700)	0.5154*** (5.7900)	0.4333** (2.4000)	0.8793*** (14.8000)	0.5800*** (8.0500)
Constant	0.0011 (0.3600)	-0.0053** (-2.3300)	0.0020 (0.5100)	-0.0054 (-0.6300)	-0.0133*** (-3.6200)	-0.0178*** (-3.8400)
Hausman	0.7400 (0.8645)		1.7300 (0.6307)		15.4100*** (0.0015)	
R ²	0.7732		0.7289		0.6720	
F					378.9400***	
Wald	479.0400***	844.0100***	421.9800***	274.8300***		1342.1500***
AR(1)		-2.0933** (0.0360)		-1.8136* (0.0697)		-1.5916* (0.1115)
AR(2)		0.2655 (0.7906)		1.6401 (0.1010)		1.3428 (0.1793)
Sargan		9.1922 (1.0000)		5.7208 (1.0000)		10.1322 (1.0000)

Note: Numbers in the parentheses of the static panel model are t-statistic values. Numbers in the parentheses of the dynamic panel model are z-statistic values.

* Significant at 10%.

** Significant at 5%.

*** Significant at 1%.

The estimates of the lagged urban-rural consumption Theil Index are all positive and significant at 5%, which implies the

consumption inequality has habit effect, and the past consumption inequality could affect the current consumption

inequality. The estimates of the urban-rural income Theil Index are all positive and significant. The influence of the urban-rural income inequality on the consumption inequality is the highest in the west, because compared with the midland and the east, the social security expenditure is relatively low, and the income has a larger effect on the consumption.

Estimations of the extended models are summarized in Table V. In the static panel model, according to the Hausman

test result, the fixed-effects regression is used in the three regions. In the dynamic panel model, the S-GMM method is used, and all the models pass the Sargan test. In the static panel model, the estimates of the parentheses of the urban-rural social security Theil Index are all positive and significant statistically. In the dynamic model, most estimates of the parentheses of the urban-rural social security Theil Index are positive, but only the estimate of the east is significant at 10%.

TABLE V. ESTIMATION RESULTS OF THE EXTENDED MODEL BASED ON THE REGIONAL DATA

	East		Midland		West	
	<i>Static panel model</i>	<i>Dynamic panel model</i>	<i>Static panel model</i>	<i>Dynamic panel model</i>	<i>Static panel model</i>	<i>Dynamic panel model</i>
	<i>FE</i>	<i>S-GMM</i>	<i>FE</i>	<i>S-GMM</i>	<i>FE</i>	<i>S-GMM</i>
CT _{t-1}		0.6556*** (14.8400)		0.5046 (1.2500)		0.5614*** (7.4900)
ST	0.0881*** (10.0900)	0.0502*** (7.1200)	0.0902*** (10.8400)	0.0082 (0.1500)	0.0622*** (6.0100)	-0.0016 (-0.1000)
YT	0.6025*** (6.4500)	0.1340*** (2.7200)	0.4292*** (4.9200)	0.5747* (1.6500)	0.8175*** (13.4000)	0.6213*** (3.0100)
CHI	0.0006*** (3.0200)	0.0003*** (2.8200)	0.0011*** (5.4900)	0.0005*** (3.1100)	-0.0002 (-0.8600)	0.0002** (2.5600)
OLD	0.0000 (0.0500)	-0.0002** (-2.2900)	-0.0010*** (-3.1100)	-0.0003 (-1.1600)	-0.0009*** (-3.5700)	-0.0008*** (-2.6300)
Constant	-0.0011 (-0.3400)	-0.0012 (-1.4200)	-0.0011 (-0.3100)	-0.0130 (-0.6600)	-0.0049 (-1.0200)	-0.0217 (-1.5500)
Hausman	19.8700*** (0.0013)		15.0600** (0.0101)		19.1000*** (0.0018)	
R ²	0.8171		0.7094		0.6609	
F	116.3400***		508.4900***		205.7600***	
Wald		3717.5100***		100.5400***		533.6200***
AR (1)		-3.7200*** (0.0000)		-1.2617 (0.2071)		-1.8808* (0.0600)
AR (2)		0.3300 (0.7420)		1.2856 (0.1986)		1.2478 (0.2121)
Sargan		151.0000 (0.0000)		5.0317 (1.0000)		10.6228 (1.0000)

Note: Numbers in the parentheses of the static panel model are t-statistic values. Numbers in the parentheses of the dynamic panel model are z-statistic values.

* Significant at 10%.

** Significant at 5%.

*** Significant at 1%.

The estimates of the parentheses of the lagged urban-rural consumption Theil index are all positive, but only those of the east and the west are significant statistically. These estimates are less than those of the basic model, which implies that the habit effects of the consumption inequality of each region are weakened after considering the control variables. The estimates of the parentheses of the urban-rural income Theil Index are positive and significant. Most estimates of the parentheses of the children's dependency ratio gap between the city and the country are positive and significant, and most estimates of the parentheses of the elderly dependency ratio are negative and significant, which is consistent with the estimation results of the national data.

V. CONCLUSION

In summary, the empirical results based on the Chinese provincial panel data from 2000 to 2016 provide evidence that the social security imbalance between the urban and rural areas has an important effect on the urban-rural consumption inequality. Lessening the social security imbalance between the city and the country is helpful in reducing the urban-rural consumption inequality.

The results also show that the influence of the urban-rural social security imbalance on the urban-rural consumption inequality has apparent regional differences due to the regional

differences in the economic institutions, resources and geographic conditions. Besides, both the urban-rural income inequality and children's dependency ratio gap affect the consumption inequality between the city and country positively while the elderly dependency ratio gap between the city and the country affects the urban-rural consumption inequality negatively. The urban-rural consumption inequality has the habit effects and is affected by that of the past.

Overall, the results provide new insights into the causes for the consumption inequality between the urban and rural areas in China. The empirical results imply that the improvement of rural social security level is helpful to weaken the consumption inequality between the city and the country.

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