

# The impact of transfer payments on urban-rural income gap

——Based on fuzzy RD analysis of China's  
midwestern counties data

Lei Genqiang, Huang Xiaohong, Xi Penghui\*

---

In this paper, using 1054 counties data of 15 provinces in Midwestern China from 2000 to 2007, we analyze the impact of transfer payments on urban-rural income gap. By choosing Develop-the-west Strategy that is a quasi-natural experiment and using regression of discontinuity of location, the result shows that local government in western China pays more transfer payments than in the central region, however, the income gap between urban-rural residents in the western region increases by 20%. The widening effects are robust in different bandwidth situation such as distance or latitude and longitude. Meanwhile, the mechanism analyses find that urban residents benefit more than rural residents from transfer payments. Therefore, we believe that transfer payments should be more targeted to invest in rural areas, at the same time, the central government should rationalize the structure of transfer payments as soon as possible, and correct the urban bias and structure bias of local fiscal expenditure.

**Keywords:** transfer payments, urban-rural income gap, regression of discontinuity

---

## 1. Introduction

Since the tax reform in 1994, the basic pattern with the revenue centralization and expenditure decentralization in the relationship between the central and local allocation gradually formed. Local government has undertaken the responsibility of providing most of public service in local region. The transfer payment system that is also known as the fiscal transfer payment system or local transfer payment system from central to local has been established and gradually perfected. Since the large difference between different local government financial, the government in the poverty-stricken areas appear to be inadequate and the ability to regulate the income gap is minimal, which heavily depends on the central transfer. The data from the ministry of finance show that the transfer payment from the central government to local government in 2014 reaches

---

\* Lei Genqiang (email: leigenqiang@126.com), Professor, School of Economics, Xiamen University, China; Huang Xiaohong (email: hxhxmu@163.com), Ph.D. Candidate, School of Economics, Xiamen University, China; Xi Penghui (email: xph90322@163.com), Ph.D. Candidate, School of Economics, Xiamen University, China.

4.66 billion yuan. In 2015, it is expected to reach 5.1 billion yuan.<sup>1</sup> Nevertheless, China's long term Gini coefficient is higher than the international warning line with 0.4. The Gini coefficient of residents issued by National Bureau of statistic in 2014 is 0.469 and the income gap between urban-rural is still serious, which indicates that on the one hand, the current income distribution in China still has a lot of convergence space, and on the other hand, we should also examine the impact of current transfer payment system on income gap. At the beginning of the year of 2015, the State Council issued the "opinions on the reform and promotion of transfer payment system from central to local", which is committed to further improve the transfer payment system, especially to promote the inter regional equalization of basic public services as the main target and to promote the sustained and healthy development of economy and society. Therefore, the research on the transfer payment's effect on the income gap between urban and rural areas has important theoretical and practical significance, which is related with the implementation of fiscal policy to promote the balanced development of regional economy and also is directly related with the prospect and future of China's economic growth.

The current literature in this area mainly takes the residents of metastatic income as the breakthrough point and analyzes the direct regulating function of transfer payment on income distribution (Wang and Caminada, 2011; Albouy, 2012). However, the transfer income does not only contain the direct central subsidies, but also the subsidies from local levels. In fact, the local governments rely heavily on the higher transfer payment. From the perspective of local government implementing the transfer payments purely, research on the role of income redistribution of higher levels could be focus on, but such studies are rare. The current literature can be divided into three categories. First is about transfer payment with the policy target on resident income. Meng (2013) evaluates the policy effect of "8-7 poverty assistance", estimates with the income of national poverty county as the breakpoint and suggests that the poverty county farmers income significantly increase by 38%. From the perspective of poverty gap in county farmers, the poverty alleviation policy and poverty subsidies are still not effective (Yao and Wang, 2009; Park and Wang, 2010). Second is on the effect of transfer payment structure on regional income. Lu and Chen (2012) used the method of marginal revenue analysis and found that the general transfer payment subsidies benefit the poor area more while the failure of equitable distribution is possible in the marginal benefit distribution of special transfer payments. Third is on the effect of transfer payment on local government behavior. Wagener (2000) finds externality exist in the implementation of central policy by local government through the theoretical model, which has an effect on the policy implementation. He and Dong (2015) suggest that the transfer payment play an incentive effect on improving people's livelihood based on Residents' happiness maximization to analyze the mechanism of transfer payment on expenditure behavior. Zeng and Hu (2009) theoretically analyze the fiscal system in China and suggest that the central, provincial and municipal government expenditure have the urban bias, which makes the country and township governments with the financial difficulties have to take the responsibility of providing public goods

---

<sup>1</sup> Source: "Ministry of finance budget department: tax return from central to local and budget of transfer payment in 2015", Ministry of finance, March 24, 2015.

and to strengthen the urban-rural income gap. Due to the asymmetric information, Yin and Zhu (2011) find that as a result of government pursuing economic growth rate rather than the welfare of residents, governments with public service oriented have the financial expenditure bias with deviating from the goal of construction. Important progress has made in the current literature, shortcomings still exists. First, the model design in the empirical analysis of the current related research still has the endogeneity problem of the urban and rural residents income in the implementation of transfer payments. It is due to the interference of other factors, the consistent estimates is difficult to be obtained, which reduces the credibility of conclusions and policy recommendations. Second, the policy evaluation of transfer payment focuses on the poverty alleviation to farmers' income, which makes it necessary to verify the different effect of transfer payment on income gap between urban and rural areas. Third, manipulation is possible in making the residents income as the breakpoints and it is necessary to verify the empirical results with the strong exogeneity of instrumental variables. Fourth is that the current literature about the urban and rural income gap is based on the national or provincial level, the county level is still to be further studied.

Therefore, as for the important problem of endogenous, this paper tries to use the most effective design in the quasi-natural experiments, which is also called the Regression of Discontinuity. In line with the assumption of RD model, it can be more effective to deal with the impact of endogenous problems and can also improve the accuracy to deal with impact of endogenous problems. It is still relatively rare to use the model to analyze the fiscal problems. This paper selects the execution variable that has the distance of RD function with the western geographic dividing line, which can capture the unobserved factors that is related with western dividing line in a certain sense. More convincing county data can be used to analyze the regulation effect of transfer payment on urban-rural income gap. Empirical results show that China's transfer payment regulating the regional financial balance will expand the income gap between urban and rural areas. The mechanism analysis results show that the transfer payment has a significant promoting effect on the urban residents income while has a minor effect on rural residents income. Whether the empirical conclusions that are obtained according to the regression of discontinuity in the middle and western regions are applicable to effect of transfer payment on other regions is the further research. There is no effective empirical evidence or institutional differences to deny the applicability of this argument. Since the expending gap in the urban-rural income is not only the hidden trouble in our social stability, but also the important academic content. The regression of discontinuity that has a focus on transfer payment can, to a certain extent, enrich the extents and methods in the field.

## **2. The theoretical analysis of transfer payment's effect on income gap between urban and rural areas**

In the background of fiscal decentralization, the unequal rather than the scarcity is focused on. The regulation of income redistribution and the effective processing of competition between local governments are root in the appropriate intervention

of central government, which forms the transfer payment (Oates, 2005). As for the backward area, the state formally proposed the strategy of large-scale development of western region. The central government gradually increased the capital investment strength to the western region since 2000. The accumulative central financial has the transfer payments to the western region for 8.5 billion yuan, accounting for 40% of the total transfer payments over the same period.<sup>1</sup> The central government clearly put forward to increase transfer payments, special grant funds, subsidies in ethnic minority areas, rural tax reform subsidies, township financial difficulties subsidies on western region, which aims at to directly achieve gap convergence effect of regional development and residents income.

Theoretically, transfer payments are given to function of balancing regional financial resources and equalizing public services (Boadway and Shah, 2007). However, after the tax system reform, the practical significance on the separation system is not formed. With the pressure of central financial centralization and local expenditure, as well as with the restriction of household registration system in the long-term urban-rural dual structure, population cannot fully flow, which makes the transfer payment of central to local government be the important tool to ensure the local residents enjoy basic public services. Thus, this paper uses the non-completely free flowing fiscal decentralization model constructed by Wagner (2000) and Liu (2011). The difference is that we begin with the local government transferring for higher government as the final executors and theoretically analyze the effect of local government behavior on the transfer payment's function of reducing urban and rural residents income gap.

We assume that there are only central and local government in one county. The transfer from central to local is  $T$  and the local government behavior directly affects the externalities of social production. The two regions  $i$  are 1 and 2 respectively. There are two groups  $v$  in each region, which is represented by  $u, r$ . One is the rich group that posses the fixed factor namely urban resident. The other is the floating workforce namely rural resident. The total number of floating population is:

$$\bar{L}_r = l_r^1 + l_r^2 \quad (1)$$

We define the per transfer payment provided by local government to the group  $v$  in the region  $i$ , then:

$$\bar{T}^i = T_u^i + T_r^i \quad (2)$$

In a simple market economy, the labor market is competitive. The production function of  $f(l_u^i, l_r^i)$  is strictly concave. The marginal output is the level wage. Then the average income of rural residents and urban residents can be expressed as:

$$I_r^i = f_r^i + T_r^i I_r^i = f_r^i + T_r^i \quad (3)$$

<sup>1</sup> Source: liu Qiong: "The total transfer payment from central government financial to the west is 8.5 billion", Xinhua, October 22, 2013.

$$I_u^i = \frac{f(l_u^i, l_r^i) - f_r^i \cdot l_r^i + T_u^i \cdot l_u^i}{l_u^i} \quad (4)$$

With the situation of labor is free flowing, the consumption will eventually reach a consensus.

$$I_r^1 = I_r^2 \quad (5)$$

According to the function (1) to (5), the change of transfer payment of local government leads to the changes of urban and rural income:

$$\frac{\partial I_r^i}{\partial T_r^i} = f_{rr}^i \cdot \frac{\partial l_r^i}{\partial T_r^i} + 1 \quad (6)$$

$$\frac{\partial l_r^i}{\partial T_r^i} = -\frac{\partial l_r^j}{\partial T_r^i} = \frac{f_{uu}^i + f_{uu}^2}{(f_{ur}^i + f_{ur}^2)^2 - (f_{uu}^i + f_{uu}^2)(f_{rr}^i + f_{rr}^2)} \quad (7)$$

$$\frac{\partial l_r^i}{\partial T_u^i} = -\frac{\partial l_r^j}{\partial T_u^i} = -\frac{f_{ur}^i + f_{ur}^2}{(f_{ur}^i + f_{ur}^2)^2 - (f_{uu}^i + f_{uu}^2)(f_{rr}^i + f_{rr}^2)} \quad (8)$$

According to Boadway (1982),

$$\text{let } D = -[(f_{ur}^i + f_{ur}^2)^2 - (f_{uu}^i + f_{uu}^2)(f_{rr}^i + f_{rr}^2)] > 0 \quad (9)$$

Then:

$$\frac{\partial I_r^i}{\partial T_r^i} = 1 - \frac{1}{D} [f_{rr}^i \cdot (f_{uu}^i + f_{uu}^2)] = \frac{1}{D} [f_{rr}^i \cdot (f_{uu}^i + f_{uu}^2)] \quad (10)$$

$$\frac{\partial I_u^i}{\partial T_u^i} = -f_{rr}^i \cdot \frac{\partial I_r^i}{\partial T_u^i} \cdot \frac{l_r^i}{l_u^i} = \frac{1}{D} \left[ -f_{rr}^i \cdot (f_{ur}^i + f_{ur}^2) \cdot \frac{l_r^i}{l_u^i} \right] \quad (11)$$

The equation (10) indicates that the rural residents can be possible benefited from the transfer payments. But the size of benefits is related to the externality of local government behavior. The equation (11) indicates that reaction of urban residents income level on transfer payment also depends on the interaction between urban and rural. Therefore, it only needs to be compared the changing rates of transfer payment in rural and in urban to reflect the income gap between urban and rural. We thus propose a hypothesis of this study that in the premise that the influence of other variable can be controlled, if the reaction of urban on transfer payment is more sensitive than that of rural, then local government's function of income redistribution and regulation may be influenced by the policy trade-offs, which widens the income gap phenomenon.

### 3. Empirical model and data description

#### 3.1. The empirical model

Using OLS regression to analyze the formula (12), the subscript  $i$  represents

the country and  $t$  represents the year. Among them, Transfer represents the transfer payments, the estimation of  $\varphi$  represents the effect of transfer payment on urban-rural income gap.  $X$  is the control variable, which controls the provinces and time effect.  $\xi$  is the error term. However, the OLS regression still cannot be accurately controlled the unobservable or unmeasured variable, such as geography resources, local customs and habits, consumption habits, culture, religion, which is likely to affect the income level of local residents. Therefore,  $\varphi$  would inevitably overestimate or underestimate its effect on income gap between urban and rural.

$$Gap_{it} = \omega + \varphi Transfer_{it} + \nu X_{it} + \mu_i + \eta_t + \xi_{it} \quad (12)$$

In order to overcome the endogeneity problem, referring to the idea of Almond about the effect of heating influence with the sub boundary of north and south on life value, this paper uses the fuzzy regression of discontinuity with the sub boundary of Midwest.<sup>1</sup> FRD thinks the breakpoint is non deterministic, which relies on the non-continuity of treatment probability of perform variable. The execution variable is the location while the processing variable is whether the transfer payment can be enjoyed. However, the processing variable does not strictly depend on the geographic location, which means the breakpoints changes of transfer payment is not strictly determined by western region. In the practical work, the west region of Hunan Province, Enshi area in Hubei Province, and Yanbian area in Jilin Province in the central province enjoy the western development policy as western region. Therefore, the discontinuity in the geographical can be regarded as the instrumental variables in the processing state and 2SLS regression estimation can be used.

$$Transfer_{it} = \alpha + \beta West_i + \delta F(distance)_i + \gamma X_{it} + \mu_i + \eta_t + \varepsilon_{it} \quad (13)$$

$$Infrastructure_{it} = \alpha_1 + \beta_1 West_i + \delta_1 F(distance)_i + \gamma_1 X_{it} + \mu_i + \eta_t + \zeta_{it} \quad (14)$$

$$Tax_{it} = \alpha_2 + \beta_2 West_i + \delta_2 F(distance)_i + \gamma_2 X_{it} + \mu_i + \eta_t + \psi_{it} \quad (15)$$

$$Gap_{it} = \theta + \lambda Transfer_{it} + \pi F(distance)_i + \kappa X_{it} + \mu_i + \eta_t + \zeta_{it} \quad (16)$$

The first stage regression equation is (13) and the second stage regression equation is (16).  $\beta$  captures the discontinuity effect of central government's transfer payment on western.  $\lambda$  represents the effect of transfer payment on income gap between rural and urban, which is the coefficient of the paper focuses on. The sample we use in this paper is the adjacent county in the western geographic division line. The social and economic characteristics of countries and cities surrounding the boundary line are considered the same. Western counties are regarded as the processing group, which means the value of west is 1 while the central regions are regarded as the controlling group, which means the value of west is 0.  $F(distance)$  represents the RD function form with the distance as executive variable, which can capture the relative unobserved factors in the

<sup>1</sup> The regression model of discontinuity is one of the most advanced quasi-natural experiment design in the empirical methods. It has been highly valued and applied in many fields, such as economics, political economics, education, biology and behavior, but it is seldom used in the field of finance and taxation at present.

boundary line of central and western boundary in a sense. It is reflected as the function of controlling geographic location. Moreover, although the non parametric statistic method does not depend on the specific function form, the data is required to actually reflect the actual geographic information of each observed value (Black, 1999) and the model is required to be with a large number of observation samples that are close to the critical value (Imbens and Lemieux, 2008). Due to the restriction of detailed data information, this paper refers to the relatively flexible semiparametric regression of discontinuity model suggested by Dell (2010). In order to ensure the robustness of empirical results, the form with different orders are used and the individual characteristics that do not change with time and that change with time are controlled. At this time, the separated error term is independent with key variables. Moreover, with the premise hypothesis that the distribution of the controlled variable around the critical value is continuity, only the optimal bandwidth needs to be controlled. Whether other variables are controlled or not would have no greater impact on the regression results. However, the selection of optimal bandwidth can only be close to the critical values of executive variable in the actual operation. Therefore, the controlled variable can be added in the regression to improve the estimation efficiency.

It needs to be explained that due to the majority and complexity of western development policy, it does not only involve the significant differences of transfer payment in Midwest, but also involves the capital investment, preferential tax policies and other related industrial policies in western infrastructure construction.<sup>1</sup> In order to ensure that these policies have no influence on transfer payment on income gap between urban and rural, it is necessary to verify the whether the discontinuity points exist around the western boundary line in addition to the transfer payment. This paper summarizes the other two major variables in the western development strategy policy, namely the interpreted variable of infrastructure construction funds. This paper uses a variable of per capital basic construction investment amount and an explanatory variable of tax preferential policies in equation (15). This paper uses the indicator of macro tax burden level.

### 3.2. Data description

The State Council issued the notice “the implementation views of policies and measures on great western development” and identified the region of western development: Chongqing, Sichuan, Guizhou, Yunnan, Tibet, Shanxi, Gansu, Qinghai, Ningxia, Xinjiang, Inner Mongolia, Guangxi. The Midwest (excluding in Inner

---

<sup>1</sup> Targeted measures are implemented by the central, which includes the inclined fiscal policy, financial development policies, preferential tax policies, natural resources policy and public service policy. Related policies can be summarized into three categories: transfer payments, fund investment and tax incentives that promote the infrastructure construction. Among them, the funds in the financial development policy, resources industry and public services policy that aim to promote west development are invested in infrastructure, which includes roads, railways and water, etc. The preferential tax policy is to promote the tax preferential policies of economic and social development, which involves income tax, value-added tax, tariff, farmland occupation tax, resource tax and other taxes. For the tax incentives, the main beneficiaries are enterprise unit.

Mongolia, Xinjiang, Tibet<sup>1</sup>) in this paper contains 1054 counties in 15 provinces as the sample data.

Urban-rural income gap (Gap): According to the current literature, the urban and rural income in national or provincial and municipal should be represented with the ratio of per capital disposable income in urban and per capita net income in rural. However, the county-level data used in this paper is from “China Statistical Yearbook for regional economy” (2001-2008). This yearbook only covers the average wage income of workers in urban residents and residents per capita net income. Although replacing the urban disposable income level with the wage income would be overestimate, this paper studies the changing trend of income gap between urban and rural areas. The changing trend of income levels and disposable income levels are the same. Although there are deviations, it still illustrates the problem, which has some credibility in a certain extent. Moreover, compared with the ratio of average income in provincial towns on-the-job worker and the net income in rural residents and the ratio of per capital disposable income in provincial urban residents and the net income in rural residents, we find the correlation coefficient is 0.8226, which is significant at 1% level. It has certain representativeness to regarding the ratio of average wage income of on-the-job worker and the per capita net income in rural residents as the income gap between urban and rural areas.

Transfer: the data is from “financial statistical data in the national counties” (2001-2007).<sup>2</sup> Because the transfer payment is to maintenance the local vested interests before the tax reform and the higher income leads to more return funds and subsidy, The transfer payment used in this paper has eliminated the tax rebates and original system of subsidy.<sup>3</sup> Since the absolute amount of transfer payment cannot be directly compared, this paper selects the relative amount of transfer payment, which means that regarding the fiscal revenue (financial strength at the beginning of the period in each area) as the base to calculate the relative variation of transfer payment each year after 2000. Other control variables are from the “the social economic statistical yearbook in counties of China” and CEIC database, which has more unified macro data statistics as shown in Table 1.

<sup>1</sup> The Mongolia Autonomous Region, as the western part of China, has only a small part that is adjacent with Shanxi Province, other parts are adjacent to Hebei Province. Therefore, excluding the small part of Mongolia has no much influence in comparing with the Midwest region. The data of Xinjiang and Tibet is missing and the characteristic of discontinuity regression model is the optimal estimation of local validity, which requires the sample to be controlled around the range of discontinuity and seeks the optimal bandwidth. Therefore, taking no consideration of these two regions has no much influence on the results.

<sup>2</sup> The statistic is compiled by State Department of Ministry of Finance. The official statistics are only updated until 2009. Taking the consideration of the impact of financial budget system reform on the statistical caliber after 2007, this paper uses the data from 2000 to 2007.

<sup>3</sup> The transfer payment = special subsidies + transfer payment subsidies + transfer payment in ethnic areas + taxation expenses allowance in rural + transfer payment subsidies in teachers of primary and secondary school + additional issuance of treasury bonds subsidiary + additional wage subsidies in arduous remote areas + settlement allowance + increase or reduce subsidies in the adjustment income assignment + other income + provincial grants to municipalities + other funds + other benefits.

Table 1  
Statistical feature of the main variables

| Variable name                                                 | Index          | Sample number | Mean      | Standard deviation | Minimum   | Maximum  |
|---------------------------------------------------------------|----------------|---------------|-----------|--------------------|-----------|----------|
| Income gap between urban and rural areas                      | Gap            | 6520          | 5.679404  | 2.810724           | 1.332908  | 23.24396 |
| Transfer payment                                              | Transfer       | 8053          | 4.772247  | 7.482760           | 0.047015  | 94.20853 |
| Western region or not                                         | West           | 8432          | 0.598672  | 0.490196           | 0         | 1        |
| Distance                                                      | Distance       | 8432          | -1.234651 | 4.656160           | -16.25232 | 8.757799 |
| Per capital basic construction investment (10000yuan/ person) | Infrastructure | 8224          | 0.177283  | 0.317755           | 0.001079  | 5.454545 |
| Tax burden level                                              | Tax            | 8051          | 0.041999  | 0.016694           | 0.017679  | 0.078604 |
| Per capital GDP (10000yuan/ person)                           | Gdpper         | 8340          | 0.577577  | 0.487237           | 0.050675  | 7.516575 |
| Proportion of the first industry                              | Pindustry      | 8238          | 0.320898  | 0.146475           | 0.005649  | 0.987018 |
| Proportion of the second industry                             | Sindustry      | 8234          | 0.355314  | 0.167509           | 0.005645  | 0.986210 |
| Per capita fiscal revenue (10000yuan/person)                  | Grper          | 7981          | 0.024567  | 0.033896           | 0.001671  | 1.112006 |
| Urbanization rate                                             | Urban          | 8101          | 0.142832  | 0.094575           | 0         | 1        |
| Population density                                            | Densitypop     | 8253          | 0.026757  | 0.023495           | 0.000014  | 0.151786 |
| Balance of financial institutions loan at the end of the year | LnLoan         | 8233          | 11.26259  | 1.038916           | 5.743003  | 13.99783 |
| Percentage of students in school                              | Students       | 8254          | 0.059936  | 0.018160           | 0.000418  | 0.252336 |

Note: With the central and western provinces boundary line as the discontinuity, the relative distance from the left of boundary line is negative and the relative distance from the right of the boundary line is positive. The level of tax burden is measured by the macro tax burden standard, which is represented by the ratio of local fiscal revenue and GDP. The urbanization rate is the ratio of non-agriculture population and total population. The balance of financial institutions loan at the end of the year is the natural logarithm of the ratio of balance of financial institutions loan at the end of the year and GDP. The proportion of students in the school is the ratio of elementary school students' number and the total population number.

#### 4. The regression results and analysis

##### 4.1. The regression results of OLS

Table 2 shows the regression results of the formula 12. The first column is the results of pooled OLS regression for the full sample. The variation of transfer payment expands the income gap between urban and rural areas for 10.8% with the significant level at 1%. The second column represents the regression of two-way fixed effects with the coefficient  $\varphi$  of 10.3%, which indicates the effect of transfer payment on urban-rural income gap is positive in the conditions at county level clustering. In addition, from the perspective of local sample, which is shown from the third column to seventh column, we can see from the regression of local sample that is around the western

boundary line in the scope of 200km to 75km that the coefficient of transfer payment on urban-rural income gap is between 11% and 13%, which has the pulling effect on income gap between urban and rural.

Table 2  
Results of OLS regression

| Gap                    | (1)                   | (2)                  | (3)                  | (4)                  | (5)                  | (6)                  | (7)                  |
|------------------------|-----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| Model and sample range | Mixed regression      | Fixed effect         | Less than 200km      | Less than 150km      | Less than 125km      | Less than 100km      | Less than 75km       |
| Transfer               | 0.108***<br>(0.00944) | 0.103***<br>(0.0113) | 0.128***<br>(0.0211) | 0.118***<br>(0.0220) | 0.119***<br>(0.0231) | 0.127***<br>(0.0237) | 0.130***<br>(0.0253) |
| R-squared              | 0.461                 | 0.611                | 0.546                | 0.536                | 0.526                | 0.546                | 0.557                |
| Controls               | YES                   | YES                  | YES                  | YES                  | YES                  | YES                  | YES                  |
| Province FE            | NO                    | YES                  | YES                  | YES                  | YES                  | YES                  | YES                  |
| Year FE                | NO                    | YES                  | YES                  | YES                  | YES                  | YES                  | YES                  |
| Observations           | 5825                  | 5825                 | 1894                 | 1480                 | 1273                 | 1048                 | 850                  |

Note: \*\*\*, \*\* and \* represent the significant level at 1%, 5% and 10% respectively. The value in the brackets represents the standard deviation of cluster robust. The third and seventh columns are estimated by the two-way fixed effect with the local samples.

#### 4.2. Discontinuity regression

This paper uses the function form of distance as the discontinuity regression results. For RD estimation, the graphic method is an important step to illustrate problem and also an effective method to test whether the conditions can be met or not (Lee and Lemieux, 2010). Samples are limited within the western boundary line of 150 km, and draw the scatterplot of execution variables about the income gap between transfer payment and urban-rural income gap with the three items of distance as the RD function form, which is shown in table 2. The left above figure shows there is the discontinuity point at the western boundary line of critical value, which indicates the transfer payment obtained in the western region is higher than in the middle. The right above figure shows the imbalance phenomenon that income gap in western region is higher than in middle region. In addition, there is no obvious difference in the infrastructure construction funds investment and tax burden around the central and western boundary line and the critical value of boundary line is continuous.

The figure 2 initially shows the increasing transfer payment contributes the improvement of income gap between urban and rural areas. However, whether it has the negative effect or not depends the model estimation. From figure 2, the three items of distance can better fit the distribution of scattered points and the three item of distance is used in the regression as the RD function form. At the same time, taking into account the need of selecting multiple bandwidths around the breakpoint, the regression results would not change along with the change of bandwidth. According to the calculation of optimal bandwidth proposed by Imbens and Kalyanaraman (2012),

the optimal bandwidth is about 200 km and this paper selects the sample scope of 150 km, 125 km, 100km and 75 km for the local regression.

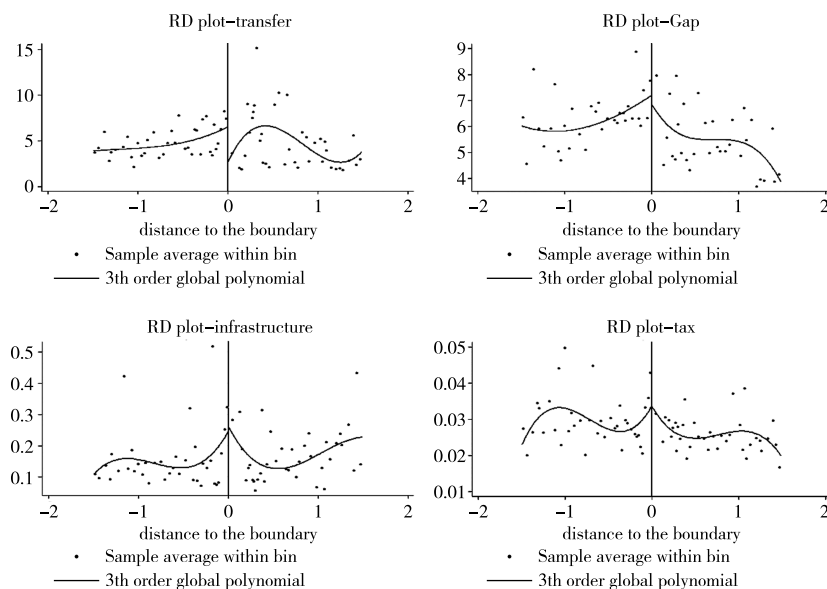


Figure 2. The discontinuity map in the first phase and the map of the gap between urban and rural

The result of the first stage regression is shown in table 3 and the discontinuity effect of these three major policies are summarized. Taking into account of the heteroskedasticity, this paper uses the county cluster robust standard errors and all the models are controlled at the provincial level with time effect. Overall, only the transfer payment has the significant differences in Midwest with the significant level of 5%. The infrastructure fund investment and tax incentives in the central and western regions have no obvious discontinuity. Among them, the explanatory variable in Panel 1 is transfer payment. The sample is the in the scope of 200km around the western border and the regression coefficient  $\beta$  is significant positive at 1%. Along with the shrinking bandwidth, even though the sample is limited to the range of 75km, the regression coefficient decreases but significantly positive. The regression results show the transfer payments counties around the Midwest boundary line obtain have differences. The local government that is incorporated into the strategic policy of western region can enjoy more financial capital injection. At the same time, from the regression results of Panel 2, whether the sample is with 200km or 75 km, the infrastructure construction funds invests in the counties around the Midwest boundary line have no significant differences, due to that the infrastructure invested by central government also contains the transport channel connecting between western region and surroundings. Similarly, due to the preferential tax treatment in the Midwest region is directly referred to the east region during the reform and opening up in a large extent, the middle regions also enjoy similar privilege. Therefore, the tax preferential policies in the Midwest region does not show the significant difference, Panel 3 reflects the inference.

Table 3

Regression results of the first phase

|                         | (1)                   | (2)                   | (3)                  | (4)                   | (5)                    |
|-------------------------|-----------------------|-----------------------|----------------------|-----------------------|------------------------|
| Sample range:           | Less than<br>200km    | Less than<br>150km    | Less than<br>125km   | Less than<br>100km    | Less than<br>75km      |
| Panel 1: Transfer       |                       |                       |                      |                       |                        |
| West                    | 9.402***<br>(2.456)   | 9.271***<br>(2.450)   | 8.884***<br>(2.453)  | 8.472***<br>(2.478)   | 6.575**<br>(2.838)     |
| F(distance)             | Cubic                 | Cubic                 | Cubic                | Cubic                 | Cubic                  |
| R-squared               | 0.369                 | 0.364                 | 0.366                | 0.372                 | 0.369                  |
| Observations            | 2668                  | 2113                  | 1806                 | 1482                  | 1189                   |
| Panel 2: Infrastructure |                       |                       |                      |                       |                        |
| West                    | 0.0372<br>(0.0425)    | 0.0546<br>(0.0450)    | 0.0222<br>(0.0478)   | 0.0145<br>(0.0527)    | 0.0662<br>(0.0661)     |
| F(distance)             | Cubic                 | Cubic                 | Cubic                | Cubic                 | Cubic                  |
| R-squared               | 0.264                 | 0.243                 | 0.232                | 0.211                 | 0.201                  |
| Observations            | 2675                  | 2118                  | 1813                 | 1495                  | 1208                   |
| Panel 3: Tax            |                       |                       |                      |                       |                        |
| West                    | 0.000752<br>(0.00398) | 0.000859<br>(0.00404) | 0.00113<br>(0.00456) | 0.000611<br>(0.00503) | -0.000468<br>(0.00708) |
| F(distance)             | Cubic                 | Cubic                 | Cubic                | Cubic                 | Cubic                  |
| R-squared               | 0.097                 | 0.097                 | 0.093                | 0.134                 | 0.145                  |
| Observations            | 2659                  | 2110                  | 1805                 | 1485                  | 1192                   |

Note: \*\*\*, \*\* and \* represent the significant level at 1%, 5% and 10% respectively. The value in the brackets represents the standard deviation of cluster robust, and the province effect and time effect are controlled.

The regression results of the second stage are shown in table 4. The first column limits the sample within the boundary line of 200km/h. The coefficient is 23.4% with the significant level at 1% when the function of RD form is regressed. The coefficient decreases slightly when the quadratic distance is regressed with the value of 21.1% while the coefficient remains unchanged when the three terms of distance is regressed with the value of 21.1% at the significant level of 1%. Along with the continued shrinking bandwidth, the coefficient is significant at the level of 1% when the sample is limited in the range of 75km around the distance boundary line and is regressed with the low order term. When regressed with the higher item, the significance of coefficient is declining but still significant at the level of 5%. On the one hand, due to the sample is limited in a small scope as much as possible and fewer observation points lead to the results not significant. On the other hand, when the distance is smaller and the fitting form is more close to the linear function form, the significance of the regression results with the three or four terms of distance is declining. If the regression of optimal bandwidth with 200km calculated with the method of IK is regarded as the benchmark, it can be considered that one percent change in the transfer payment will lead to the

widening gap between urban and rural income for 20% to 30%, which indicates that the blindly increase of local government transfer payment cannot attain the intention of balance in urban and rural income. From the table 4, the sample is still large enough when the bandwidth is adjusted from 200km to 75km. The conclusion of this paper about the effect of transfer payment in the Midwest counties on the income gap between urban and rural areas is representative.

Table 4  
Regression results with the F (distance)

| Gap           | (1)                  | (2)                  | (3)                  | (4)                  | (5)                  |
|---------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| Sample range: | Less than 200km      | Less than 150km      | Less than 125km      | Less than 100km      | Less than 75km       |
| Transfer      | 0.234***<br>(0.0491) | 0.224***<br>(0.0489) | 0.219***<br>(0.0497) | 0.195***<br>(0.0477) | 0.198***<br>(0.0536) |
| F(distance)   | Linear               | Linear               | Linear               | Linear               | Linear               |
| R-squared     | 0.413                | 0.401                | 0.395                | 0.444                | 0.430                |
| Transfer      | 0.211***<br>(0.0479) | 0.208***<br>(0.0481) | 0.207***<br>(0.0489) | 0.192***<br>(0.0464) | 0.196***<br>(0.0510) |
| F(distance)   | Quadratic            | Quadratic            | Quadratic            | Quadratic            | Quadratic            |
| R-squared     | 0.442                | 0.420                | 0.410                | 0.449                | 0.436                |
| Transfer      | 0.211***<br>(0.0482) | 0.201***<br>(0.0501) | 0.216***<br>(0.0566) | 0.217***<br>(0.0627) | 0.253**<br>(0.0991)  |
| F(distance)   | Cubic                | Cubic                | Cubic                | Cubic                | Cubic                |
| R-squared     | 0.442                | 0.425                | 0.404                | 0.434                | 0.373                |
| Transfer      | 0.206***<br>(0.0484) | 0.201***<br>(0.0495) | 0.216***<br>(0.0562) | 0.231***<br>(0.0665) | 0.287**<br>(0.116)   |
| F(distance)   | Quartic              | Quartic              | Quartic              | Quartic              | Quartic              |
| R-squared     | 0.446                | 0.426                | 0.405                | 0.425                | 0.322                |
| Observations  | 2043                 | 1599                 | 1371                 | 1122                 | 904                  |

#### 4.3. The robustness test

First, in order to accurately reflect the geographical factors in different counties to control the differences in Midwest, this paper regressed with the multi-discontinuity from the perspective of dual dimensions (the longitude and latitude difference with the Midwest boundary line), namely the F (distance) in formula (13) and (16) is replaced by F (longitude, latitude). Table 5 shows that the transfer payment has no effect on narrowing the income gap between urban and rural. The extent of expanding effect is same with the regression results with the distance as the executive variable. Even if the observation point is reduced to the boundary line with 75km, the coefficient is significant at 1% level, which is higher than that of the sample high away from the boundary line. This indicates that the expanding effect transfer payment on income gap between urban and rural has limited significance in the Midwest boundary line.

Table 5  
Regression results with F (longitude, latitude)

| Gap                   | (1)                  | (2)                  | (3)                  | (4)                  | (5)                  |
|-----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| Sample range:         | Less than 200km      | Less than 150km      | Less than 125km      | Less than 100km      | Less than 75km       |
| Transfer              | 0.195***<br>(0.0474) | 0.187***<br>(0.0479) | 0.194***<br>(0.0512) | 0.189***<br>(0.0513) | 0.239***<br>(0.0623) |
| F(longitude,latitude) | Cubic                | Cubic                | Cubic                | Cubic                | Cubic                |
| R-squared             | 0.464                | 0.440                | 0.542                | 0.466                | 0.401                |
| Observations          | 2,043                | 1,599                | 1,371                | 1,122                | 904                  |

Second, in accordance with the design requirements of discontinuity regression model, the unobservable factors in the processing and control group are similar in principal. Therefore, joining the control variable or not has no effect on the final results. But in order to improve the efficiency of estimation, we add the control variable in table 6 and compare the sensitivity of one-time addition method with the gradually adding method that refers to Altonji (2005) and Dahlberg (2008), the result has no difference with that of no adding variable, which indicates the effectiveness of instrumental variables.<sup>1</sup> When the observation distance is limited to the boundary line with 75km, the regression results is significant at the level of 1%. Therefore, the regression results with the control variable verify the robustness of results. In addition, the regression result is consistent when changing the sample.<sup>2</sup>

Table 6  
Regression results when adding the controlled variable

| Gap           | (1)                  | (2)                  | (3)                  | (4)                  | (5)                  |
|---------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| sample range: | Less than 200km      | Less than 150km      | Less than 125km      | Less than 100km      | Less than 75km       |
| Transfer      | 0.159***<br>(0.0448) | 0.145***<br>(0.0458) | 0.155***<br>(0.0489) | 0.173***<br>(0.0510) | 0.189***<br>(0.0617) |
| F(distance)   | Cubic                | Cubic                | Cubic                | Cubic                | Cubic                |
| R-squared     | 0.549                | 0.537                | 0.524                | 0.540                | 0.545                |
| Observations  | 1,894                | 1,480                | 1,273                | 1,048                | 850                  |
| Controls      | YES                  | YES                  | YES                  | YES                  | YES                  |

#### 4.4. Effectiveness test

According to the validity of standard in Imbens and Lemieus (2008), the feasibility

<sup>1</sup> Due to the space limitation, only the results of the regression that adds the controlled variable are listed in table 6. In the local sample, the regression results has no much more changes when adding the economic level (per capital GDP, proportion of first industry, proportion of second industry), financial level (per capital revenue, macro tax burden level, infrastructure investment level), population level (urbanization rate population density), proportion of balance of financial institutions loan and that of students in school.

<sup>2</sup> Due to the space limitation, author can provide if required.

of RD regression in this paper is reflects in the following: (1) in the density continuity of execution variable, the sample used in this paper has no disadvantage. Since the observations around the boundary line can be mapped with clear position, this verifies the assumption rationality of geographic discontinuity regression, which is the characteristic of this model (Keek and Titunik, 2014). (2) In addition to the policy discontinuity, other effects change along with the geographical location. If the jumping occurs, the estimation results in the model also capture effect of other variable on the income gap between rural and urban. Other factors that influence the resident income contain the related controlling factors, the sample within 100km around the Midwest boundary line, and the three items of boundary distance as the RD formula. From the regression results in table 7, the factors have no significant differences in the Midwest region, which verifies the effectiveness of conclusion in this paper,

Table 7  
Effectiveness test

|                      | (1)                 | (2)                 | (3)                | (4)                | (5)                   | (6)                  | (7)              | (8)                   |
|----------------------|---------------------|---------------------|--------------------|--------------------|-----------------------|----------------------|------------------|-----------------------|
| Explanatory variable | Gdpper              | Pindustry           | Sindustry          | Urban              | Students              | Grper                | LnLoan           | Densitypop            |
| West                 | -0.0212<br>(0.0966) | -0.0569<br>(0.0368) | 0.0633<br>(0.0497) | 0.0375<br>(0.0422) | -0.00258<br>(0.00248) | 0.00250<br>(0.00533) | 0.364<br>(0.279) | -0.00259<br>(0.00360) |
| F(distance)          | Cubic               | Cubic               | Cubic              | Cubic              | Cubic                 | Cubic                | Cubic            | Cubic                 |
| R-squared            | 0.291               | 0.398               | 0.212              | 0.122              | 0.382                 | 0.176                | 0.229            | 0.126                 |
| Observations         | 1505                | 1556                | 1501               | 1437               | 1498                  | 1472                 | 1496             | 1496                  |

Note: the same with table 3.

Above all, this paper draws the conclusion that transfer payment contributes the inequality of urban-rural income through the analysis of discontinuity regression of transfer payment on income gap between urban and rural. This paper acquires the consistent results of robustness check. In addition, the effective test results verify the feasibility of transfer payment on income gap between urban and rural.

#### 4.5. Analysis of mechanism

Since the index of income gap between urban and rural is measured by the ratio of urban residents wages and rural residents net income, the above results are that the increasing relative transfer payment amount leads to the expanding of income gap between rural and urban for 20%. Then how the urban and rural residents income change? In this regard, this paper takes the incremental income level of urban and rural residents income as the explanatory variables. Results in table 8 show that, the coefficient of transfer payment on the incremental income of urban residents income is significant positive at the level of 5%. Benefit of rural residents is small and it is significant at the level of 10% when the sample is within 75km around the boundary line. On the basis of previous studies, this paper put forward the inherent mechanism of the influence. On the one hand, it is the tendency of local fiscal expenditure. The local fiscal expenditure tends to be invested in the urban areas with more sensitive.

Compared with rural areas, urban areas benefit more in the transfer payment, which is the result of different systems in different regions. There are other scholars suggesting the conclusion of fiscal expenditure has the characteristic of urbanization bias such as Lei and Cai (2012). On the other hand, with the asymmetric information, the structure of local fiscal expenditure is biased. The rural areas that really need financial support do not enjoy the full benefits. The infrastructure is more backward and self-development is lower in the poorer areas. Only limited funds can be used to give priority to infrastructure and administration project and there is fewer fiscal funds being used in the construction of people's livelihood project (Fu and Shen, 2012). This explains the reason why the income level of rural residents has not been significantly improved to a certain extent.

Just as the theoretical model reflects, rural residents can benefit from the transfer payment, but its size has externality with government behavior. If the urban area is more sensitive to the transfer payment, local government may be weighted in the policy in order to expand the urban and rural income gap.

Table 8

Regression results of effect of transfer payment on income level of urban and rural residents

| Explanatory variable | The increment of income level of urban residents |                    |                    |                    |                    | The increment of income level of rural residents |                  |                  |                   |                   |
|----------------------|--------------------------------------------------|--------------------|--------------------|--------------------|--------------------|--------------------------------------------------|------------------|------------------|-------------------|-------------------|
|                      | (1)                                              | (2)                | (3)                | (4)                | (5)                | (6)                                              | (7)              | (8)              | (9)               | (10)              |
| Sample range         | Less than 200km                                  | Less than 150km    | Less than 125km    | Less than 100km    | Less than 75km     | Less than 200km                                  | Less than 150km  | Less than 125km  | Less than 100km   | Less than 75km    |
| Transfer             | 40.44**<br>(17.42)                               | 41.32**<br>(18.71) | 40.54**<br>(18.58) | 53.29**<br>(22.22) | 97.75**<br>(48.40) | 0.929<br>(2.021)                                 | 2.235<br>(2.230) | 3.710<br>(2.746) | 6.925*<br>(3.746) | 14.82*<br>(7.980) |
| F(distance)          | Cubic                                            | Cubic              | Cubic              | Cubic              | Cubic              | Cubic                                            | Cubic            | Cubic            | Cubic             | Cubic             |
| R-squared            | 0.232                                            | 0.210              | 0.320              | 0.312              | 0.237              | 0.076                                            | 0.069            | 0.068            | 0.068             | 0.053             |
| Observations         | 2025                                             | 1591               | 1352               | 1091               | 874                | 1848                                             | 1448             | 1247             | 1035              | 829               |

Note: the same with Table 3.

## 5. Conclusions and policy recommendations

The geographic information is used in the local polynomial RD model to analyze the impact of transfer payment on urban-rural income gap. Compared with other research, the executive variable of western geographic boundaries of distance, in a certain sense, captures the relative unobserved factors around the Midwest boundary line, effectively overcomes the endogeneity problem, greatly improves estimation accuracy of transfer payment effect on income gap and examine the robustness of results and validity of model. The results show that transfer payment will expand the rural-urban income gap when regulating the equilibrium of regional finance. If most of transfer payment continues to be used in urban area or infrastructure by local government to make achievements in short time with neglecting the special care in peoples' livelihood project, then even the amount of transfer payment funds is huge,

narrowing the income gap between urban and rural would be of no avail. Therefore, in the process of transfer payment system reform and improvement, in addition to strictly implementing the “notices on reforming and improving the central’s transfer payment to local government”, according to the analysis results, policy suggestions are as follows. Empirical results show that transfer payment has an significant expanding effect on rural-urban income gap. Central government should adjust the structure of transfer payment to gradually increase the general transfer payment, and to improve the degree freedom of local government in addressing fiscal expenditure. At the same time, integrate the special transfer payments with the principles of zero growth or little decreasing. The increasing capital should show the rural tendency and focus on improving the rural residents of people’s livelihood. The influence mechanism analysis shows that the expanding effect of transfer payment on rural-urban income gap is due to that benefit of rural resident is less than that of urban resident. Therefore, it is important to constraint the local government behavior that implements policies of transfer payment. First, government function should change into “public service” and correct bias problem of fiscal expenditure structure. Second, rural area should be paid attention in financial expenditure, especially in the construction of rural livelihood projects. It should be committed to promoting the equalization of public services in urban and rural areas and to effectively ease the problem of expanding income gap between rural and urban. From the point of view, using efficiency and coverage of transfer payment by local government are to be improved. It is necessary to perfect the transfer payment system in county and establish fiscal expenditure performance accountability.

## Reference

- Albouy, D.(2012). Evaluating the efficiency and equity of federal fiscal equalization. *Journal of Public Economics*, 96 (9-10), 824-839.
- Almond, D., Chen, Y., Greenstone, M., & Li, H. (2009) Winter heating or clean air? unintended impacts of China’s Huai river policy. *American Economic Review*, 99 (2), 184-190.
- Altonji, J., Elder, T., & Taber, C. (2005). Selection on observed and unobserved: Assessing the effectiveness of catholic schools. *Journal of Political Economy*, 113 (2), 151–184.
- Black, S. E.(1999). Do better schools matter? parental valuation of elementary education. *Quarterly Journal of Economics*, 114(2), 577-599.
- Boadway R. (1982). On the method of taxation and the provision of local public goods: Comment. *American Economic Review*, 72 (4), 846-851.
- Boadway, R. & Shah, A. (2007). *Intergovernmental fiscal transfers principles and practice*. US: World Bank Publications.
- Dahlberg, M., Mörk, E., Rattsø, J., & Ågren, H. (2008). Using a discontinuous grant rule to identify the effect of grants on local taxes and spending, *Journal of Public*

- Economics*, 92(12), 2320–2335.
- Dell, M. (2010). The persistent effects of Peru's mining mita. *Econometrica*, 78(6), 1863–1903.
- Fu, W. I., & Shen, K. R. (2012). The equalization of transfer payment and local fiscal expenditure structure. *Economic Research Journal (jingji Yanjiu)*, 47 (5), 45–57.
- He, Q., & Dong, Z. Y. (2015). Transfer payment, local fiscal expenditure and residents' happiness. *Economic Perspectives (Jingjixue Dongtai)*, 2, 56–65.
- Imbens, G. W., & Kalyanaraman, K. (2012). Optimal bandwidth choice for the regression discontinuity estimator. *Review of Economic Studies*, 79(3), 933–959.
- Imbens, G. W., & Lemieux, T. (2008). Regression discontinuity designs: A guide to practice. *Journal of Econometrics*, 142(2), 615–635.
- Keele, L. J., & Titiunik, R. (2014). Geographic boundaries as regression discontinuities. *Political Analysis*, mpu014.
- Lee, D. S., & Lemieux, T. (2010). Regression discontinuity designs in economics. *Journal of Economic Literature*, 48(2), 281–355.
- Lei, G. Q., & Cai, X. (2012). Distortion of initial allocation, urban bias of fiscal expenditure and income gap between urban and rural—From the empirical evidence of provincial panel data in China. *The Journal of quantitative & technical economics (Shuliang Jingji Yu Jishu Jingji Yanjiu)*, 29 (3), 76–89.
- Liu, Q. Z. (2011). Income inequality and the decomposition of the redistribution function between central finance and local finance. *Finance and Trade Economics (Caimao Jingji)*, 5, 18–23.
- Lu, H. Y., & Chen, S. X. (2012). Who benefits from the added transfer payment—Based on the empirical analysis of China's county-level data. *Finance and Trade Economics (Caimao Jingji)*, 4, 24–32.
- Meng, L. S. (2013). Evaluating China's poverty alleviation program: A regression discontinuity approach. *Journal of Public Economics*, 101(1), pp.1–11.
- Oates, W. E. (2005). Towards a second generation theory of fiscal federalism. *International Tax and Public Finance*, 12 (4), 349–373.
- Park, A., & Wang, S. (2010). Community-based development and poverty alleviation: An evaluation of China's poor village investment program. *Journal of Public Economics*, 94(7856), 790–799.
- Wagener, A. (2000). Variable population size issues in models of decentralized income redistribution. *Regional Science and Urban Economics*, 30 (6), 609–625.
- Wang, C., & Caminada, K. (2011). Disentangling income inequality and the redistributive effect of social transfers and taxes in 36 LIS countries. *Department of Economics Research Memorandum*, 4, 1–53.
- Yao, H. X., & Wang, X. Y. (2009). Labor flow, education level, poverty alleviation policy and income gap in rural—Based on the micro empirical research of multinomial logit model. *Management World (Guanli Shijie)*, 9, 80–90.
- Yin, H., & Zhu, H. (2011). Expenditure bias research on county level production. *Social Sciences in China (Zhongguo Shehui Kexue)*, 1, 88–101.
- Zeng, G., & Hu, J. J. (2009). Financial system of China's urban bias and income gap between urban and rural residents. *Public Finance Research (Caizheng Yanjiu)*, 2, 36–39.