Realizing the Transformation and Development of Chinese Recourse-based City by Breaking Resource Curse

—The Empirical Analysis on Panel Data of Prefecture Resource-based Cities

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Abstract: Resource curse is an important factor limiting the sustainable development of resource-based city. There is a certain dispute on whether "resource curse" exists in Chinese resource-based city. This paper analyzes the relationship between REI and urban per capita GDP based on the empirical analysis on panel data of prefecture resource-based city, and further proves that there is significant "resource curse" in these cities. At the same time, the empirical results show the necessity of problems in development and ecology occurring in resource-based city due to the transmission mechanism of "resource curse". The transformation and development of resource-based city can only be realized by breaking "resource curse".

1. Literature Review and Questions Proposed

In specific range of time and space, natural resources are scarce and limited, so abundant natural resources are considered as the signal of wealth. However, in "recourse curse", the abundance of natural resource is believed to be negatively correlated with economic growth. In traditional theory of economic growth, production factors include labor, capital, land (natural recourse) and entrepreneur, thus, the production function expression $Q = f(L, K, N, E)$ is built. According to this production function, the more abundant the natural resources, the more the output, the higher the production possibility frontier and the more rapid the economic growth. In reality, the rapid industrialization and economic take-off of such developed countries as America, British and France are dependent of abundant mineral resources in their nations. Whereas, in the middle and later period of 20th century, nations with poor natural resources ranked in the forefront of the world, such as Japan and Singapore. In contrast, nations with abundant natural resource in South America, Africa and Middle East developed so slowly. Thus, the view that natural resources can promote the economic growth is doubted. Auty (1990) earlier found that the abundant natural resources in some nations and regions cannot constantly promote the economic growth. Later, Auty (1993) proposes for the first time the concept of "recourse curse", holding that abundant natural resource limits the economic and social development for a country or region, but not promotes. Sachs & Warner (1995, 1997, 2001) taking developing countries as a case, prove the existence of "recourse curse", that is the negative correlation between the abundance of natural resource and economic growth. Then, there are more and more theoretical explanation and empirical studies on "recourse curse". In China, some scholars further verified the existence and causes of "recourse curse" from multiple perspectives and dimensions, such as Xu Kangning and Han Jian (2005), Hu Yuancheng and Xiao Deyong (2007), Shao Shuaihe and Qi Zhongying (2009), Sun Yongping and Ye Chusheng (2011, 2012) and so on.

In recent years, Chinese recourse-based cities are generally in recession, so "resource curse" raises again the wide attention and focus from the academic filed. Zhao Lingdi et al (2016) believe that there is "resource curse" in Chinese recourse-based cities and human capital cannot significantly restrain the "recourse curse", but "recourse curse" can extrude the investment of human capital. Han Xinyi and Huang Zhaojun (2016) hold that "recourse curse" has an "extrusion effect" on the investment in manufacturing, material capital and human capital, based on verifying

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the existence of “resource curse” in Chinese recourse-based cities. Xue Yawei et al (2016) analyze the formation mechanism of “recourse curse” in Chinese recourse-based cities and further verify the “recourse curse” effect. Yang Tongbin and Guo Cunzhi (2017) adopt the exponent correction model of “recourse curse” to examine 34 recourse-based cities in three provinces in the northeast of China. The results show that there is “recourse curse” effect in more than 70% of recourse-based cities, and its negative effect seriously restrains the sustainable development of these cities. Wang Jiayi and Cui Nana (2018) taking 36 prefecture resource-based cities in central regional of China as research object, on the basis of proving “recourse curse”, point out that the main transmission mechanism of “recourse curse” is the extrusion of manufacturing.

From the current development of Chinese recourse-based cities, abundant natural resource has positive and negative effect on urban economic and social development. Positively, the exploitation of natural resource brings direct economic benefits to cities and promotes the urban development to a certain extent. From the perspective of negative effect, long-term resource dependence causes the “extrusion effect” in manufacturing, innovation and human capital, and irrational exploitation and rent-seeking behavior of government due to the imperfect property tights system of natural recourse. Overall, the coexistence of abundant natural resource and sluggish economic growth is common, which shows that the obvious “recourse curse” problem possibly occurs in recourse-based cities.

2. The Verification on the Existence of “Recourse Curse”

Although some scholars have verified the existence of “recourse curse” effect in Chinese recourse-based cities through empirical study, some scholars think that it is not obvious or it does not exist. Specifically, Ding Juhong et al (2007) find out that “recourse curse” is not obvious or it does not exist according to the model built by urban panel data and interprovincial panel data. Zhang Gongsheng and Li Bode (2010), starting from basic concepts of natural resource, hold that the backward development of regions with abundant resources is jointly caused by multiple factors, and there is not “recourse curse” effect in China. Tian Zhihua (2014) verifies the relationship between the abundance of resource and urban economic development, and believes that the former promotes positively the later. Natural recourse has certain “extrusion effect” on manufacturing, innovation and domestic capital investment, however, this indirect effect hindering economic effect is less than the direct effect of natural resource on promoting economic development. At present, “recourse curse” does not exist in Chinese cities. There are multiple causes for these different conclusions. First of all, there is difference in the selection of abundance indicator of natural resource and measurement. Some scholars apply the relative ratio of mineral reserve (Xu Kangning et al, 2005, 2006), and some scholars also adopt the proportion of fixed investment in mining industry in gross investment, the proportion of output value of mining industry in GDP of this region, and the indirect indicator of orking population in mining industry in gross orking population (Hu Yuancheng and Xiao Deying, 2007; Duan Limin and Du Yueping, 2009; Huang Yue et al, 2015; Zhang Zaixu et al, 2015). Secondly, research object samples are different. Some scholars take provincial region as research object, whereas, some choose city as the research object. Even they all take resource-based cities as the object, there are large differences in the selection of recourse-based cities and time period. Problems like the small sample of recourse-based city and short time period are common, resulting in the deviations in conclusions.

Thus, it is necessary to select scientific and reasonable indicator and method, to verify the existence of “recourse curse” in resource-based cities in a larger area and longer period. It examines the negative correlation between the abundance of natural resource and economic growth in a country or region. In order to more accurately verify the “recourse curse”, the reasonable indicator of “resource abundance” shall be firstly scientifically chosen. Resources will not bring direct economic benefits before being exploited and circulated in the market, thus, resource reserve cannot be taken as the indicator of resource abundance in economics. Besides, the resources involved in a certain region are diversified, so it is difficult to perform the unified conversion on various types of resources. In this paper, resource is believed to have an influence on economic development after being exploited and circulated in the market, so Resource Exploitation Intensity (hereinafter

referred to as REI) shall be the more scientific and reasonable indicator of "resource abundance". In theory, resource exploitation shall be multiplied by corresponding resource price as the quantitative index of REI, whereas, the annual resource exploitation in each city lacks corresponding statistical data. Taking the study of Huang Yue et al (2015) as a reference, the higher proportion of personnel in mining industry, the higher the REI. Xu Kangning and Wang Jian (2006) also prove that resource abundance is positively correlated with the proportion of personnel in mining industry on the significance level of 1%. This paper further considers the working time and working intensity of mining personnel, takes the proportion of mining personnel salary in the gross personnel salary as the quantitative index of REI, and builds the calculation equation of REI in Equation (1).

$$REI_{it} = \frac{Mining\_salary_{it}}{Gross\_salary_{it}} \tag{1}$$

In Equation (1), i is recourse-based city, t is a particular year, REI is the resource exploitation intensity, $Gross\_salary$ is the gross personnel salary in this recourse-based city, and $Mining\_salary$ is the mining personnel salary in resource-based city.

Based on the availability of data, this paper eliminates 6 logging resource-based cities, including Jilin, Baishan, Heihe, Yichun, Mudanjiang and Lijiang, and calculates the REI of 102 prefecture resource-based cities from 2006 to 2016. The average value is shown in Figure 1. The data comes from wind database, EPS database, *China Population & Employment Statistics Yearbook*, *China City Statistical Yearbook*, *China Industry Statistical Yearbook* and statistical yearbooks of various cities. The results show that, the salary proportion of mining personnel in 102 resource-based cities from 2006 to 2016 is obviously higher than national average level, in a trend of fluctuate rise, whereas, the proportion in the whole country declines. This fully reflects the basic characteristics of resource-based city that the serious dependence on resource exploitation.

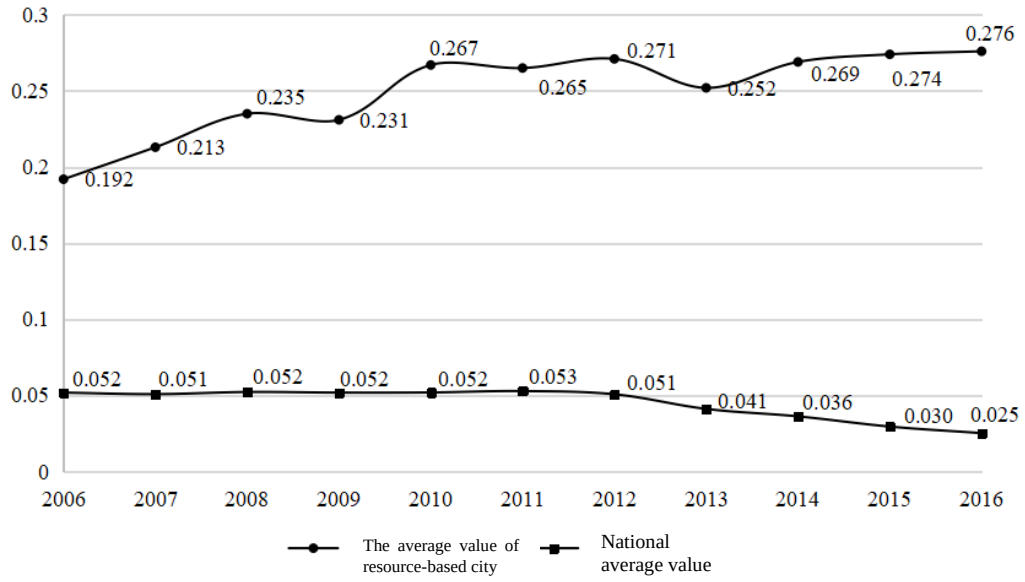

Figure 1 The salary proportion of mining personnel in resource-based cities and the whole country from 2006 to 2016

Secondly, it is required to scientifically and reasonably select the index to measure the economic development of resource-based cities. Different scholars apply different methods in this index. Generally, regional DGP growth rate or regional per capita GDP growth rate is considered as the index to measure the economic development. This paper selects the latter to better reflect the actual condition and efficiency of economic growth in resource-based cities. In order to explore the relationship between REI and economic development, and verify the existence of "recourse curse" in these cities, this paper builds the panel regression mode, shown in Equation (2).

$$gdp_{it} = \alpha_0 + \beta_1 REI_{it} + \beta_2 Z_{it} + \varepsilon_{it} \quad (2)$$

In Equation (2), i is resource-based city, t is a particular year, is the per capita GDP growth rate in recourse-based cities, REI is the resource exploitation intensity, Z is the vector set consisting of other control variable to be added, β is variable coefficient, ε_{it} is the error term of equation, including unobservable factor, and α_0 is the constant term of equation. In addition to REI, the development of manufacturing, material capital investment, human capital investment and opening-up also directly affect the economic development of resource-based cities. This paper takes these influencing factors as the control variables of this model. The description of relevant variables involved are shown in Table 1. The data comes from wind database, EPS database, *China Population & Employment Statistics Yearbook*, *China City Statistical Yearbook*, *China Industry Statistical Yearbook* and statistical yearbooks of various cities. When calculating the index of opening-up, firstly, the actual investment volume from foreign merchants shall be converted into RMB in the same year according to USD/RMB exchange rate in that year, and it is divided by regional GDP of the same year.

Table 1 The description of relevant variables in model

Variable symbol	meaning	calculation
gdp	The growth rate of per capita GDP	(per capita GDP in this year/per capita GDP in the last year)-1
REI	Recourse exploitation intensity	The salary of mining personnel/the salary of all personnel in city
Manu	The development of manufacturing	The growth rate of value added in manufacturing
Inv	Material capital investment	The volume of fixed capital investment/regional GDP
HC	Human capital investment	Investment on education cause/the expenditure of local government
Open	Opening-up	Investment from foreign merchants/regional GDP

Before the panel data regression by stata14 software, the Hausman test is conducted to decide to apply random effect model or fixed effect model. The test result rejected the original hypothesis that the disturbance term of the individual difference is not related to the explanatory variable, so the fixed effect model is adopted to perform the regression analysis. Besides, in order to ensure the reliability of regression coefficient and explanatory ability of indexes, GMM method is applied for robustness test, shown in Table 2. The results show that the variable coefficient symbol of fixed effect model and GMM estimated results and its significance level remain consistent. It means that the model setting is reasonable and empirical results are robust. According to the regression results of fixed effect mode, the existence of “recourse curse” in resource-based cities is analyzed quantitatively.

From the results in Table 2, on the significance level of 1%, the influence of REI on the growth rate of regional per capita GDP in resource-based cities is -0.0130, which shows that there is significant “resource curse” in resource-based cities. In terms of other factors, the influence from the development of manufacturing (*Manu*) and material capital investment (*INV*) are positively significant, promoting the economic growth of recourse-based cities. Whereas, the promotion of human capital investment (*HC*) and opening-up (*Open*) is not significant. Theoretically, the improvement of human capital and widening opening-up positively promote the regional economic growth. However, it is not significant in resource-based cities, which is related to the characteristics and development stage of resource-based cities.

Table 2 The model regression results

variable	Fixed effect model	GMM estimation
REI	-0.0130*** (-7.5291)	-0.0090** (-2.3542)
Manu	0.1431*** (11.0318)	0.2541*** (15.2160)
Inv	0.0367** (2.6423)	0.0164*** (3.5689)
Hum	0.0739 (1.4683)	0.1870* (1.8475)
Open	0.1152 (1.0004)	0.2472 (0.5820)
α_0	-0.3430*** (-34.0435)	-0.2184*** (-21.1539)
Observation data	1122	1122
R^2	0.482	——
F for θ_i =0	rejected	——
Sargan	——	37.15
AR(1)	——	0.00
AR(2)	——	0.128

Notes: Values in brackets are statistical values of t-test, *, ** and*** is the significance level of 10%, 5% and 1%, two-tailed test.

3. The Empirical Verification on Transmission Mechanism of "Resource Curse"

On the basis on verifying the common existence of "resource curse" in Chinese resource-based cities, it is necessary to further perform empirical verification on the transmission mechanism of "resource curse" in resource-based cities, and clearly break the main contradictory of "resource curse" to lay a solid foundation for the transformation and development of resource-based cities.

3.1 Research hypothesis and model construction

Referring to main methods of domestic and foreign scholars, this paper constructs the measurement model shown in Equation (3), and accurately analyzes the function intensify of each transmission mechanism to identify the main transmission mechanism of "resource curse" in Chinese resource-based cities.

$$W_{it} = \alpha_0 + \beta_1 gdp_{i(t-1)} + \beta_2 REI_{it} + \varepsilon_{it} \tag{3}$$

In Equation (3), i is resource-based city, t is a particular year, W is the vector set that probably becomes the transmission mechanism of "resource curse", including five variables, $gdp_{(t-1)}$ is the growth rate of per capita GDP in lag phase, *REI* is the resource exploitation intensity of resource-based city, β is variable coefficient, ε_{it} is the error term of equation, including unobservable factors, and α_0 is the constant term of equation. It is required to pay attention to β_2 coefficient value. If it is positively significant, REI is positively correlated with this economic variable; if it is negative, REI is negatively correlated with this economic variable. It is notable that the introduction of $gdp_{(t-1)}$ in Equation (3) is mainly due to the different initial conditions of variables. This variable can reduce the negative effect of this difference on regression results to a certain extent.

3.2 Variable selection and data processing

The description of relevant variables involved in Equation (3) is shown in Table 3.

Table 3 The description of relevant variables in verification model of transmission mechanism of "resource curse"

Variable type	Variable symbol	Meaning	Calculation
Dependent variable *W* vector set	*Manu*	The development of manufacturing	The growth rate of value added in manufacturing
	RUR	Resource utilization rate	Energy consumption (ten thousand tons of standard coal)/ regional GDP
	HC	Human capital investment	Investment on education cause/the expenditure of local government
	TRP	The growth rate of production of general industrial solid waste	(the production of general industrial solid waste in that year/the production of general industrial solid waste in last year)-1
	Inst	The quality of system	The number of cities privately operated jobholders and individual jobholders/the entire workforce in cities
Independent variable	$gdp_{(t-1)}$	Per capita GDP in lag phase	(per capita GDP in last year/per capita GDP in the year before last year)-1
	REI	Resource exploitation intensity	The salary of mining personnel/the salary of personnel in cities

Taking studies of Wang Zhongya (2011) and Huang Yue (2015) as a reference, this paper considers *Manu*, *RUR*, *HC*, *TRP* and *Inst* as five proxy variables of transmission mechanism. To be more specific, if *REI* is significantly negatively correlated with *Manu*, the "resource curse" effect will restrain economic growth of resource-based cities through the "Dutch disease" effect; if *REI* is significantly negatively correlated with *RUR*, the "resource curse" effect will restrain economic growth through low efficiency; if *REI* is significantly negatively correlated with *HC*, the "resource curse" effect will restrain economic growth through the "extrusion effect" of human capital; if *REI* is significantly positively correlated with *TRP*, the "resource curse" will restrain economic growth through ecological environment deterioration; if *REI* is significantly negatively correlated with *Inst*, the "resource curse" effect will restrain economic growth through rent-seeking effect lacked in system; otherwise, it is contrary. This paper studies the period from 2006 to 2016. The data comes from wind database, EPS database, *China Population & Employment Statistics Yearbook*, *China City Statistical Yearbook*, *China Industry Statistical Yearbook* and statistical yearbooks of various cities.

3.3 The analysis of empirical results

This paper firstly conducts the Hausman test to decide random effect model or fixed effect model. The test results rejected the original hypothesis that disturbance term of individual difference is not correlated with explanatory variable. Fixed effect model can be adopted to perform regression analysis on the transmission mechanism of "resource curse" effect in resource-based cities. The specific results are shown in Table 4.

Table 4 The regression results of verification model of transmission mechanism

variable	Model 1	Model 2	Model 3	Model 4	Model 5
Explained variable	*Manu*	*RUR*	*HC*	*TRP*	*Inst*
REI	-0.3852*** (-10.3290)	-0.0869* (-1.7580)	-0.1454*** (-23.8931)	0.0127** (2.3367)	-0.0042* (-1.8475)
$gdp_{(t-1)}$	0.0568*** (12.9402)	0.1572 (1.2189)	0.2105*** (8.7450)	-0.3220 (-0.9400)	0.1815*** (5.2718)
α_0	48.7833*** (3.8243)	-3.4926 (-1.4220)	-15.8800*** (-6.8843)	-29.0001*** (-4.6670)	-1.3290 (-0.7304)
Observation data	1122	1122	1122	1122	1122
R^2	0.301	0.004	0.479	0.150	0.192
F for θ_i=0	rejected	rejected	rejected	rejected	rejected

Notes: Values in brackets are statistical values of t-test, *, ** and*** is the significance level of 10%, 5% and 1%, two-tailed test.

From the regression results in Table 4, the transmission mechanism of "resource curse" will have negative influences in at least five aspects. First of all, the coefficient value of the impact of *REI* on Manu on 1% of significance level is -0.3852, that is, when *REI* increases 1 unit, *Manu* will drop by about 0.38 unit, which shows the more obvious "extrusion" of *REI* to *Manu*. The single industry is the most important transmission mechanism for causing "resource curse" effect in Chinese resource-based cities. Secondly, the coefficient value of the impact of *REI* on *RUR* on 10% of significance level is -0.0869, that is, when *REI* increases 1 unit, *RUR* decreases by about 0.08 unit, which shows that low *RUR* is also the transmission mechanism of "resource curse" effect in resource-based cities. However, the function of this transmission mechanism is weaker, R^2 value is low, and goodness of fit is not good enough. Thirdly, the coefficient value of the impact of *REI* on *HC* on 1% of significance level is -0.1454, that is, when *REI* increases 1 unit, *HC* decreases about 0.15 unit, which shows that resource exploitation in resource-based cities forms a certain "extrusion" effect to *HC*, and this effect is relatively obvious. Fourthly, the coefficient value of the impact of *REI* on *TRP* on 5% of significance level is 0.0127, that is, when *REI* increases 1 unit, *TRP* rises about 0.01 unit, which shows that the rise of *TRP* caused by the larger *REI* is also the transmission mechanism. Fifthly, the coefficient value of the impact of *REI* on *Inst* on 10% of significance level is -0.0042, that is, resource exploitation obviously hinders the development of private industry and individual industry. In general, the prosperity of private and individual economy can represent the economic vitality of a region, whereas, it development is impacted by the system and government's interference. In the development of resource-based cities, there are a large quantity of economic rents in resource exploitation, which will indulge the subjective willingness of government's interference under the imperfect resource property rights system and supervision, and hinder the development of private and individual economy, becoming an important transmission mechanism of "resource curse" in resource-based cities.

4. Paths to Break "Resource Curse" Effect

The "resource curse" is the fundamental and critical factor restraining the transformation and development of Chinese resource-based cities, causing unreasonably resource exploitation and utilization, and problems in industrial development and ecological environment. In view of the transmission mechanism of "resource curse" effect in resource-based cities, this paper puts forward four paths to break the "resource curse" effect, including promoting the industrial diversification, intensify the investment of human capital, comprehensively advancing cleaner production and improving property rights system of mineral resources.

Firstly, it is necessary to realize the industrial diversification. On the one hand, traditional advantages of resource-based cities shall be combined to extend industrial chain and enhance industrial added value. On the other hand, it is necessary to get rid of resource dependence, focus on key planning industries, carry on industry transfer, and establish diversified industrial system through the improvement of hardware and software infrastructure.

Secondly, it is required to promote the talent introduction and incentive system, intensify the investment on introducing high-end talents, attract high-level and high-quality talents by high salary, establish talent attraction system and enrich talent types in regions. The more attractive working and life conditions shall be provided to avoid the brain drain. At the same time, it is important to actively carry out university-enterprise cooperation and university-region cooperation, build the bridge connecting talent cultivation by colleges and universities and talent demand by enterprises, and independently train more professional talents with professional technique to adapt to local development. Besides, it is necessary to emphasize the occupational and employment training, fully explore existing labor potential by job transfer and re-employment training, decrease involuntary unemployment rate, reduce talent drain and liberate the labor force locked in resource industry.

Thirdly, it is necessary to strengthen the control on the entire production process of resource-based enterprises to reach the maximum resource utilization and minimum pollution

emission and construct green and ecological production mode. A large number of ecological environment deteriorations show that it not only originates from problems in terminal products provided by enterprises, more from the production link and process. On the contrary, if the preparation process and product use of enterprises can be overall evaluated and controlled, problems of ecological environment can be probably prevented, in this way, the ecological environment deterioration caused by enterprises' inappropriate production can be greatly reduced.

Fourthly, the mining right of mineral products in many Chinese resource-based enterprises are not included in capitalized management, and there is no uniform standard for the pricing of mining right and asset evaluation, resulting the serious underestimation of mineral resource values. Thus, based on the category and level management system of mineral resources, resource-based cities shall focus on establish property rights system of exploration right and mining rights, appropriately allocate the ownership, mining rights and right of protection of resources, correspond the right, responsibility and profit, and form the property rights system of natural resources with clear responsibility and duty and effective supervision. It is necessary to formulate rational pricing standard and bidding procedure of mineral rights, monitor the transaction of resource exploitation rights with economic and legal means, prevent corruptive rent-seeking behavior such as bribery and further standardize the economic order of market in the field of resource.

References

[1] Zhang Chen, Jiang Xuan. Research on the Undertaking Industrial Transfer Problems of the Western Resource-based Cities [J]. Inner Mongolia Social Sciences, 2017(01):175-182.

[2] Fang Ying, Ji Yan, Zhao Yang. Is There "Resource Curse" in China? [J]. The Journal of World Economy, 2011(4):144-160.

[3] Shao Shuai, Qi Zhongying. Energy Development and Economic Growth in Western China: An Empirical Analysis Based on the Resource Curse Hypothesis [J]. Economic Research Journal, 2008(4):147-160.

[4] Zhang Juntao, Li Xiaofeng. Resource-based Industrial Dependence and Economic Growth in Urbanization –An Empirical Analysis based on Resource Curse Hypothesis [J]. Research on Financial and Economic Issues, 2017(9):32-38.

[5] Wang Baijie, Guo Xin. Local Government Behavior, "Resource Curse" and Imbalance of Industrial Structure——From the Survey Data of 43 Resource-based Cities [J]. Journal of Shanxi Finance and Economics University, 2017, 39(6):64-75.

[6] Ronald U. Mendoza, Harold J. Mac Arthur & Anne Beline Ong Lopez et al. Devil's Excrement or Manna from Heaven? A Survey of Strategies in Natural Resource Wealth Management [J]. Comparative Economic & Social Systems, 2017(2):39-51.

[7] Feng Zongxian, Wang Shi, Wang Hua. Are Natural Resources a "Blessing" or a "Curse"? -Based on Analyses of the Correlation between Resource Abundance and Income Level [J]. East China Economic Management, 2014(6):1-7.

[8] Yuan Xueying, Jie Maohua. Comprehensive Comparison and Evaluation of Circular Economy Efficiency of Resource-based Cities [J]. Macroeconomics, 2015(10):94-101.

[9] Zhang Shengling, Li Yue, Jiu Erke et al. Path Dependence, Market Entry and Transformation of Resources-based City [J]. Economic Theory and Business Management, 2016, V36(2):14-27.