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AGRICULTURAL LAND RESOURCE CURSE AS THE DRIVING-FORCE FOR WUHAN METROPOLITAN AREA

In this article applying the land resource curse coefficients, we measure the degree of the curse by district and classified 4 of them. Furthermore, we use the principle of component-stepwise regression model (PCR-SRA) to analyze the driving forces behind agricultural land resource curse in Wuhan Metropolitan Area. The results indicate that: 1) the phenomenon of land resource curse is different in different districts, and we classify Wuhan Metropolitan Areas into 4 districts – none, slight, ordinary, and severe curse districts; 2) in the slight curse district food security and urbanization are the main driving forces; in ordinary curse districts land resource curse is forced by man-land relationship; cultivated land protection policy can lead to agricultural land resource curse to some extent in severe districts.

Keywords: *resource curse; metropolitan areas; PCR-SRA; driving force; Wuhan.*

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ПРОКЛЯТТЯ ЗЕМЕЛЬНИХ РЕСУРСІВ ЯК РУШІЙНА СИЛА РОЗВИТКУ: НА ПРИКЛАДІ МЕГАПОЛІСУ УХАНЬ (КНР)

У статті за допомогою коефіцієнтів прокляття земельних ресурсів здійснено спробу виміряти ступінь ресурсного прокляття та виділити 4 округи з різною мірою його впливу на економіку. Регресійна модель на основі методу головних компонент використана для аналізу рушійних сил прокляття земельних ресурсів у різних округах Уханя. Результати аналізу показали, що: 1) за ступенем прояву ресурсного прокляття вся досліджена територія може бути поділена на 4 округи – без ознак ресурсного прокляття, з незначним його проявом, середнім проявом та суттєвим ресурсним прокляттям; 2) в окрузі з незначним проявом прокляття головних рушійних сил в його дві – продуктова безпека та урбанізація, в окрузі із середнім прокляттям – співвідношення Люди – Земля, а на території зі значним ресурсним прокляттям його головною причиною багато в чому є сама політика захисту агропромислових земель.

Ключові слова: *ресурсне прокляття; територія мегаполісу; регресійна модель на основі методу головних компонент; рушійна сила; Ухань.*

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ПРОКЛЯТИЕ ЗЕМЕЛЬНЫХ РЕСУРСОВ КАК ДВИЖУЩАЯ СИЛА РАЗВИТИЯ: НА ПРИМЕРЕ МЕГАПОЛИСА УХАНЬ (КНР)

В статье при помощи коэффициентов проклятия земельных ресурсов сделана попытка измерить степень ресурсного проклятия и выделены 4 округа с различной мерой его влияния на экономику. Регрессионная модель на основе метода главных компонент использована для анализа движущих сил проклятия земельных ресурсов в различных округах Уханя. Результаты анализа показали, что: 1) по мере проявления ресурсного проклятия вся исследуемая территория может быть поделена на 4 округа – без признаков ресурсного проклятия, с незначительным проявлением, средним проявлением и серьёзным ресурсным проклятием; 2) в округе с незначительными проявлениями проклятия его главные движущие силы – продуктовая безопасность и урбанизация, в округе со средним проявлением проклятия – соотношение Люди-Земля, а на территории со значительным ресурсным проклятием главной его причиной во многом является сама политика по защите агропромышленных земель.

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Ключевые слова: *ресурсное проклятие; территория мегаполиса; регрессионная модель на основе метода главных компонент; движущая сила; Ухань.*

Introduction. Generally, classical economists believe that abundant natural resources contribute to economic development (Ma et al., 2012). However, since the mid-20th century an interesting economic phenomenon has been discovered that economic growth is stagnated or negative in many resource-rich countries, like Canada and Australia, while some countries with relatively scarce resources achieve rapid development (South Korea, Singapore). In 1993, R. Auty (1993, 1999) proposed the concept of "resource curse" to describe this phenomenon. In his opinion, under a certain condition, especially during economy's transition, abundant natural resources may be a curse rather than a blessing for economic development. Since then, an increasing number of scholars through empirical analysis confirmed the hypothesis of resource curse (Gylfason et al., 1999; Hamilton et al., 2003; Auty, 2007). China, after the reform and opening up, had experienced a rapid economic development. But interestingly, its Eastern coastal regions have achieved long-term economic growth albeit resources are relatively poor. In contrast, mid-West, where resources are relatively richer, grows much slowlier. Many Chinese scholars have carried out a large number of empirical studies, confirming the existence of the resource curse phenomenon (Cheng, 2007; Li and Wang, 2010; Liu et al., 2009; Wang, 2010; Xu and Wang, 2006). "Resource curse", in its essence, is an unsustainable state of development in regions where natural resource is rather plentiful (Lu, 2009). In recent years, economic development of regions became more unbalanced, uncoordinated and unsustainable (Xie, 2011), China is experiencing an unprecedented urbanizing process with the urbanization rate being 47.54% in 2010 and it is estimated to reach 75% in the middle of this century (Poel et al., 2012). This is likely to be accompanied by a dramatic increase in consumption of natural resources, such as water, land and energy (Liu, 2014). On the one hand, after 1993, with the establishment of land market in China, a great deal of farmland was transfered to construction land to meet the demand of economic development, especially in urban-rural fringe (Zhang, 1999). On the other hand, farmland surrounding city needs to be protected to ensure food security and its high quality. Hubei province is the pivot and center of the implementation of "central rise" strategy, and it is also the important grain production base in China, with agricultural lands accounting for 85%, where the primary farmland represents 82.77% of all arable lands according to state statistics of 2012. So we wonder whether abundant and high-quality agricultural land resource will be a "curse" or "blessing" to these regions? What is the relationship between agricultural land resource and regional economy? What caused the curse if it really exists?

Research objective. Agricultural resource is not the only one of the most important strategic resources, but it is also a public good with strong positive externalities, playing a significant role in national economic growth and stable development (Tian et al., 2013). Land resource, especially agricultural land, is undoubtedly one of the most important agricultural resources. Unfortunately, what researchers usually focus on mostly is the point resource, for example coal. Recently, they gradually come to dividing natural resources into mineral and agricultural ones (Pu, 2010). A. Wood and K. Berger (1997) used the per capital of arable land resource as the abundance indi-

cator to prove the existence of this hypothesis. But on the whole, there is only a limited number of literature on this topic, and the analysis of its driving force is even rarer. Therefore, under the background of urbanization process, grasping the heterogeneity of regional resources and economic development, and finding out the cause of the resource curse in different areas, are of important practical significance in promoting regional coordination and sustainable development.

The existing studies on "resource curse" mostly analyze it using the provincial macroeconomic data, but "the role of resource abundance to economic growth can be hided easily in large scale" (Zhang, 2011). In recent years (Shao and Qi, 2008; Shao and Yang, 2010, 2011; Shao et al., 2013), have attempted to narrow the scope of the research area gradually, from the domestic to provincial level and municipal level to collect data, and they gained a series of achievements. It has been proved that the scale of study area transformed from the international scale to provincial and municipal one, turning out to be a smaller one (Stella, 2013; Wen and Zhang, 2013). Therefore, the study area we choose is the Wuhan metropolitan areas which are crucial to the development of Hubei province in China, composed of 9 cities, namely Wuhan, Huangshi, Ezhou, Xiaogan, Huanggang, Xianning, Xiantao, Qianjiang, Tianmen (Figure 1).

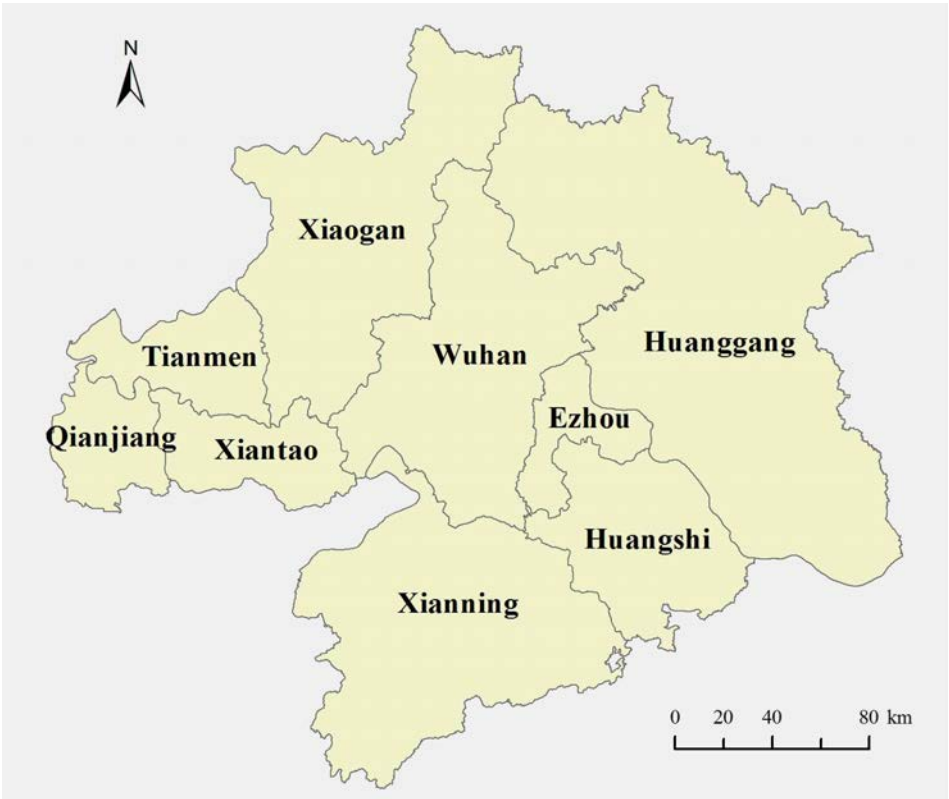

Figure 1. **Wuhan metropolitan areas**

The contribution of this paper is twofold. Firstly, we built a value system to measure the abundance of agricultural land resource and classified the districts to present

their spatial differences. Secondly, we use the principle component-stepwise regression model (PCR-SRA) to analyze the driving forces behind agricultural land resource curse in Wuhan metropolitan areas, where we can seek the homogeneity of land resource curse from spatial heterogeneity. All the data came from "Hubei Statistical Yearbook from 1995 to 2011", "Hubei Rural Statistical Yearbook from 1995 to 2011" and other related sources.

Key results.

1. The test fOR agricultural land resource curse.

1.1. Defining the degree of agricultural land resource curse. In order to describe the relationship between resources and economic development, X. Su (2007) proposed the poverty index of mineral resources, namely the ratio of the share which is the value of output value of mining industry in each district divided by that in the whole region to a district's GDP accounted for the proportion of the GDP in the whole region. Based on that, Z. Yao et al. (2011) introduced the concept of curse coefficients to measure the degree of districts cursed, and tested the resource curse as well, by the method of location entropy. From their perspective, resource curse coefficient is the index measuring the deviation degree of economic development and its superiority of resource endowment in a region, reflecting the extent to which the region suffering from the resources curse – the greater is the index value, the higher is the degree of resource curse suffered. Combining both two ideas and the theory of comparative advantage, we develop a method to test the hypothesis of agricultural land curse. Specifically, it's a value of dividing the ratio of one district's agricultural land value to that of the whole region by the district's GDP accounted for the proportion of GDP in the whole region, expressed as ESi (see (1)). What is the biggest difference between this formula and the two mentioned above is that we build a value system of agricultural land, including both market and non-market value. As far as we concern, agricultural land, which is the largest part of land use in Wuhan metropolitan areas (76.21%), plays a significant role in its production and economic development. What is more, with the expansion of urbanization, a large number of agricultural land has been forced to transfer to construction land because in the huge gap of economic profit between urban and farm land (Zhang,1999), which, apparently, will lead us ignore the positive externality of agricultural land if accounting just its market value.

$$ES_i = \frac{E_i \Big/ \sum_{i=1}^{n} E_i}{SI_i \Big/ \sum_{i=1}^{n} SI_i}, \qquad (1)$$

where ES_i represents the coefficient of land resource curse in each district; E_i refers to agricultural land resource value in each district; SI_i is GDP of each district. According to (1), if ES_i is over 1 – land resources in an area do not turn into economic advantages, then this region will suffer the resource curse; if the coefficient is less than 1, the curse phenomenon does not exist in the area.

1.2. Estimating the degree of agriculture land resource. Agricultural land resources, in this paper, mainly include arable farmland, orchard, woodland and waters, all of

them having both market and non-market value (except woodlands). The market value of agricultural land can be estimated by agricultural production, while the non-market value usually includes the option value, existence value and the bequest value, which represents the opportunity cost of agricultural land transformation to some extent, because it is the price that consumers are willing to pay in advance to ensure it will be used in the future (Bishop, 1982). Since non-market value can not be gained through market transactions, the approaches to is estimation have been a concern. However, Y. Cai et al. (2007) based their valuation method (CVM) for non-market value of the land in Hubei province (Table 1), which is a mature land value assessment system in this field. Without the consideration of the currency discount, we use the value of agricultural land in Hubei research results (Cai et al., 2007) to measure the abundance of land resources in Wuhan metropolitan areas.

Table 1. **The estimated value of the overall agricultural land resources in Hubei province** (Cai et al., 2007)

Type of agricultural land	market value (RMB/hm^2)	non-market value (RMB/hm^2)	total value (RMB/hm^2)
arable farmland	221681	19979	241598
orchard	753641	119062	872703
woodland	-	6407	6407
waters	523496	30377	553873

Note: arable lands includes paddy field, dry land, vegetable, with different values for different land markets, but they have the same non-market value; and the total value of farmland is the weighted result of various types of arable farmlands.

2. The degrees of agriculture land resources curse in Wuhan metropolitan areas. According to the value of agricultural land shown in Table 1, GDP and the unit agricultural land of Wuhan Metropolitan Areas from1996 to 2010, coefficients of land resource curse in each district from 1996 to 2010 have been calculated by equation (1) – see Table 2.

To further describe the degree of spatial difference in land resource curse, we use the threshold to divide 9 districts into four different zones. According to the results, combined with economic and social heterogeneity in the city circle, we clasify 4 districts: 1) non-curse district: the land resource curse coefficient is less than 1.0, the degree of land intensive use is high enough making economic develop quite faster than what their own land resource endowments can determine; 2) slight curse district: the curse factor is greater than 1 but less than 1.5, there exists a slight curse phenomenon, and economic development begins to produce a slight threat to sustainable land use; 3) general curse district: curse coefficients are greater than 1.5 but less than 2.0, an obvious curse phenomenon; 4) serious curse district: the curse coefficients are greater than 2.0, indicating that agricultural land and resource advantages of these areas didn't change into economic advantages completely, the resource curse is the most serious among all districts.

Land resource curse coefficients of Wuhan metropolitan area from 1996 to 2010 have been averaged to measure their curse extent (Table 3, Figure 2).

3. Analysis of the driving forces behind resource curses of various degrees. Usually, there is a correlation relationship between different levels of economic indicators. Economic indicators can explain a variety of economic connotation, but can also

Table 2. **Land resource curse coefficients in Wuhan metropolitan area, 1996 to 2010**, *authors'*

	Wuhan	Huangshi	Ezhou	Xiaogan	Huanggang	Xianning	Xiantao	Qianjiang	Tianmen
1996	0.3915	1.0080	0.7053	1.2779	2.0536	2.8070	1.0285	0.7035	0.7628
1997	0.3985	2.2686	0.9235	1.4641	1.8725	2.8055	0.9020	0.7914	0.8216
1998	0.3997	0.9927	0.9410	1.4414	1.8973	2.9763	0.8902	0.7830	0.8483
1999	0.4706	1.7654	1.0176	1.6153	1.9606	2.5225	1.4111	1.2291	1.4900
2000	0.4856	0.7959	1.1406	1.6023	2.0533	2.6394	1.4146	1.1967	1.5737
2001	0.3511	1.7327	1.1147	1.6044	2.1066	2.3738	1.7293	1.2214	1.8190
2002	0.3533	1.2914	0.6585	1.0243	1.5263	2.5167	3.9008	2.0032	1.9126
2003	0.3544	1.8293	1.1668	1.5600	2.3926	2.4590	1.2957	1.1198	1.3065
2004	0.3441	0.9391	1.2207	1.5953	2.5124	2.4012	1.3467	1.1379	1.3144
2005	0.3105	1.9228	1.2226	1.7031	3.2395	2.5391	1.3370	1.1719	1.5821
2006	0.3393	0.8733	1.2161	1.7381	3.3063	2.5813	1.3784	1.1456	1.6086
2007	0.2862	1.6463	1.0012	2.6124	2.7996	2.5191	1.2022	1.3415	1.3263
2008	0.3359	0.9718	1.0456	1.8659	3.1403	2.6266	1.5215	1.0552	1.6211
2009	0.3314	2.0536	0.9684	2.0301	2.9747	2.1069	2.0023	1.4435	2.1554
2010	0.2501	1.0281	2.4820	1.6376	2.6962	2.5713	1.1482	1.2582	3.3953

cause multicollinearity and cannot guarantee the result is accurate enough (Yu and Xiao, 2007). Mostly, methods used to deal with this problem are stepwise regression, principal component regression, ridge regression etc. However, since stepwise regression ones independent variables only based on the principle of minimum partial regression sum of squares, and furthermore, the variables selection progress is not only influenced by their order, but also by the sample number, it is difficult to get the best equation (Wang and Wang, 2008). While the principal component analysis is not critical about the size of sample and also has high compression efficiency on variables, it always causes information loss and has low accuracy (Wu and Xie, 2005). Combining the respective strengths and weaknesses of these methods, the principle component-stepwise regression model is put forward to analyze the driving force behind the agricultural land resource curse in this paper.

Table 3. **Land resource curse districts and the corresponding threshold in Wuhan metropolitan areas**, *authors'*

District	Threshold	Cities with their curse coefficients
non-curse district	$ES_i < 1$	Wuhan (0.3601)
slight curse district	$1 < ES_i < 1.5$	Ezhou (1.1216),Qianjiang (1.1735), Huangshi (1.4079)
general curse district	$1.5 < ES_i < 2$	Xiantao (1.5006), Tianmen (1.5692), Xiaogan (1.6515)
serious curse district	$ES_i > 2$	Huanggang (2.4356), Xianning (2.5630)

3.1. The selection and description of variables. L.-J. Wen and A. Zhang (2013) pointed out there is a close relationship between land resource curse and regional economic development. Namely, a non-cursed district has a huge agglomeration effect on the neighbors, attracting capital, technology, labor around to this area, forming a centripetal force for others; and vice versa, the areas cursed by land resource due to their advantages in resources abundance cannot contribute fully to economic development and form a centrifugal force driving capital, technology and labor to the areas without curse. Based on this mechanism, the indicators are selected, reflecting regional socio-economic development (Figire 3). In (Wen and Zhang, 2013), spatial difference of land resource in each degree district is described vividly, but the causes forming this difference are not expressed clearly. So we seek the homogeneity of land resource curse from spatial heterogeneity to analyze the driving force of agricultural land resource curse in each degree district.

Since the second industrial occupy an important position, thus the secondary industry to GDP is elected, expressed as N_2_{it}. Per capita area of arable land is directly related to the amount of cultivated land, while the per capita food production directly reflects the benefits of the use of arable land, so we choose per capita food production to reflect the intensification degree of agricultural land expressed as RC. Per area GDP (RDit) is also selected because it is an important indicator of land-use efficiency. The rate of urbanization (CH_{it}) and population density (RM_{it}) directly reflect the contradiction between land supply and population demand. Per area fixed investment, expressed as GT_{it}, may be seen as the input intensity of land use. For local government the revenue mostly come from the premium of urban construction land this moment, it can roughly reflect the benefits of construction land, expressed as I_{it}. Policy implementation is quantified by farmland protection policies, which is a qua-

litative assignment in accordance with the actual strength. Since 1986, the establishment of the State Bureau of Land Management ended the decentralized management situation, and gradually strengthened and improved land management, thus this paper defines farmland protection by comparing with it back in 1986. Assuming the degree of farmland protection in 1986 is 1, then the period 1996–1997 is given as 5, then the period of 1998–1999 is 8, furthermore the period 2000–2003 is 6, and finally it is denoted as 9 since 2004.

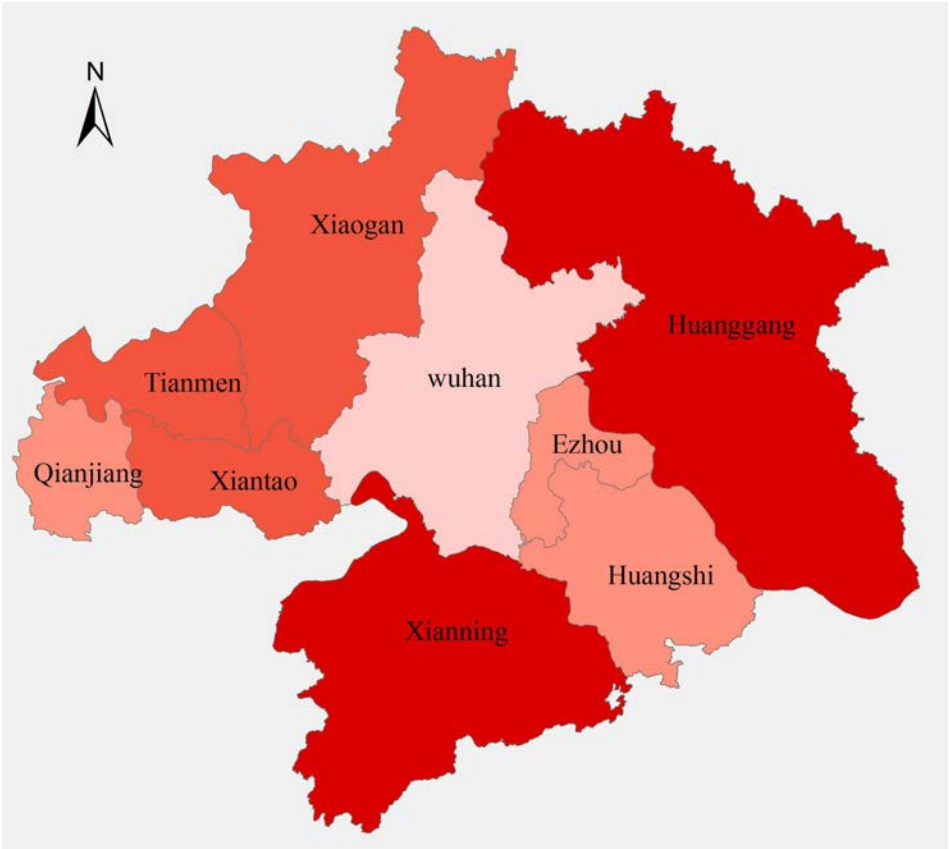

Figure 2. **Land resource curse districts in Wuhan metropolitan areas**

3.2. Results. Having eliminated the dimension, based on SAS procedures, the principal component regression is used to analyze 9 variables of Wuhan metropolitan area. By choosing the cumulative contribution rate over 85% to extract the principal components, we obtain the Eigen values of the principal components and their variance contribution rate (Table 4). According to Table 4, the two main components of the non-curse district has reached 92.15%, and the cumulative contribution rate of the 3 main components of slight curse district has been over 90%, while for the general curse districts the cumulative contribution rate of the 4 main components is 87.06%, and 3 principal components can cover 87.62% information about serious curse districts.

Furthermore, the components stepwise regression model is used to test the coefficients and all their principal components for non-curse district, slight curse, general curse and serious curse districts. The test results are shown in Table 5.

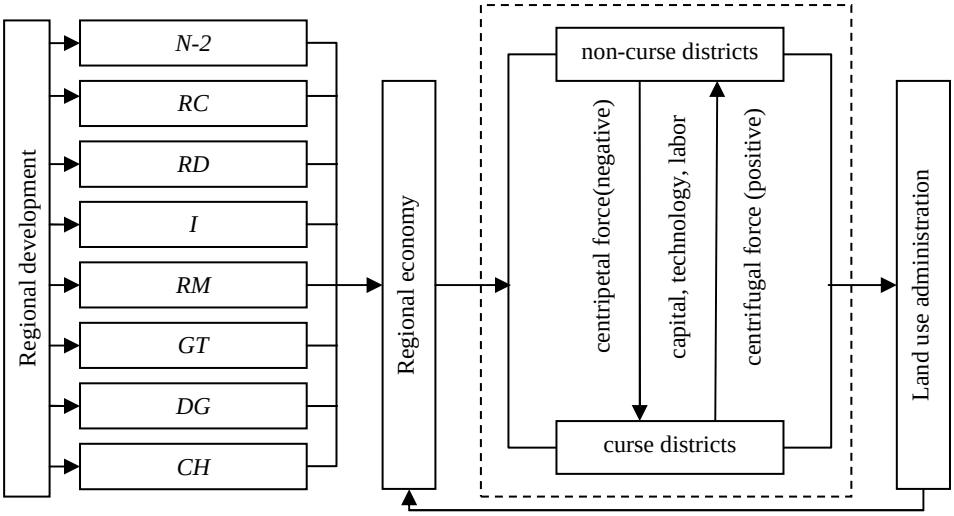

Figure 3. **Transmission between economic development and land curse**, *authors'*

The load coefficient of each index has to be calculated by the principal component test. Besides, referring to Table 4, we cut off the load coefficients with low level of significance and small variance contribution, and what we got is shown in Table 6. The first row of rotating load matrix in each group are load coefficients, and the second row represents their level of significance.

According to Table 6, we can find the first principal component of non-curse district contains almost all of the variables and all of them pass the test with 5% significance level, while in the second principal component, only RC and RD passed the test. Since the first principal component (Z1) covers all social economic indicators, we call it the "social development factor", and the second principal component (Z2) named "agriculture production factor" for the two variables – per capita food production (RC) and per capita arable land area (RD), significantly positively correlated with it. In non-curse district, it presents a negative correlation relationship between curse coefficient and social development factor, which is consistent with the hypothesis, namely, the lower is the level of social economic development in a region, the more obvious is the farmland resource curse phenomenon. In terms with Z2, agricultural production factor is also negative with curse coefficient, so we can see RC and RD are negative with curse coefficient as well. As the capital city of Hubei Province, Wuhan City, is also the central city of Wuhan metropolitan area, with high developed economy and high intensive land use, therefore there is no agricultural land resource curse in Wuhan.

In slight curse district, the load factors of RC, RD, RM, and ZC in the third principal component are really large; therefore, they decided the name of the third principal component – "the food security factor". The fourth principal component's name is "urbanization factors", because only urbanization rate (CH) and farmland

Table 4. **The curse area main component characteristic value and the cumulative contribution of variance in each district**, *authors'*

Main component	Non-curse district		Slight curse district		General curse district		Serious curse district	
	Eigen value	Cumulative	Eigen value	Cumulative	Eigen value	Cumulative	Eigen value	Cumulative
Z1	7.08794	0.7875	4.81723	0.5352	4.51026	0.5011	4.44855	0.4943
Z2	1.206	0.9215	2.03403	0.7613	1.58026	0.6767	2.41213	0.7623
Z3	0.45489	0.9721	1.26295	0.9016	1.15832	0.8054	1.02522	0.8762
Z4	0.45489	0.9721	0.54415	0.962	0.58629	0.8706	0.48948	0.9306
Z5	0.18761	0.9929	0.13662	0.9772	0.47784	0.9237	0.4203	0.9773
Z6	0.04645	0.9981	0.10986	0.9894	0.35657	0.9633	0.11355	0.9899
Z7	0.01143	0.9994	0.0641	0.9965	0.20222	0.9858	0.05504	0.996
Z8	0.00443	0.9999	0.02107	0.9989	0.1078	0.9977	0.02154	0.9984
Z9	0.00119	1	0.00999	1	0.02045	1	0.0142	1

protection policy (ZC) pass the parameter verification. So in slight curse district, the main driving forces are food security and urbanization. Combining with Tables 5 and 6, after putting the expression of principal component into regression equation, we find the curse coefficient has a negative correlation with RC, RD, RM, while it has a positive correlation with CH. This indicates that the loss of rural labor, low level of agricultural production, and relatively low level of urbanization contribute to the curse phenomenon in this district.

Table 5. **The principal component regression model test**, *authors'*

	Parameter	Coefficient estimate	T statistics	Significance
Non-curse district (F = 12.21, P = 0.0007)	Constant	0.36014	45.92	<.0001
	Z1	-0.01666	-5.46	0.0003
	Z2	-0.01228	-1.66	0.1276
	Z4	0.06772	3.61	0.0047
	Z5	-0.06725	-1.79	0.1045
Slight curse district (F = 3.98, P = 0.0082)	Constant	1.23435	22.05	<.0001
	Z3	0.12483	2.48	0.0175
	Z4	0.13273	1.73	0.0915
	Z5	-0.2504	-1.63	0.11
	Z8	0.79125	2.03	0.0492
General curse district (F = 3.29, P = 0.0299)	Constant	1.57374	19.4	<.0001
	Z3	0.12509	1.64	0.1085
	Z7	0.37876	2.08	0.0442
	Z8	0.42385	1.7	0.0974
Serious curse district (F = 8.6, P = 0.0013)	Constant	2.49925	40.04	<.0001
	Z4	0.32488	3.58	0.0013
	Z8	-0.90664	-2.1	0.0456

In general curse district, due to the variance contribution of Z7 and Z8 and their variable load factors are too small to explain the dependent variable, we analyze mostly Z3. In Table 6 we can obviously see that the third principal component is determined by RC, RM, I, ZC, named "man-land relationship", indicating that the curse in this area is affected by the man-land relationship. According to Tables 5 and 6, the per capita food production (RC) has a negative correlation with coefficient curse, while population density (RM), fiscal revenue (I) and the farmland protection policy (ZC) have a positive correlation with the curse coefficient. It shows that if we increase food production, control population, keep a stable speed of land circulation, implement farmland protection policies effectively and improve the quality of agricultural lands in this district, the phenomenon of agricultural land resource curse will disappear one day.

In serious curse district, due to both the variance and the variable load of Z8 are quite small, they are insufficient enough to explain the dependent variable. And therefore, we ignore the influence of Z8, and just use the fourth principal component (Z4) to analyze the general curse district. In the fourth principal component, only farmland protection policy (ZC) went through the test, which decide Z4 named "farmland protection policy". Combining Tables 5 and 6, Z4 positively correlates with curse coefficient, while ZC positively correlates with Z4, thus agricultural land

Table 6. **The principal component load matrix in each district**, *authors'*

		N_2	RC	RD	DG	CH	RM	I	GT	ZC
Non-curse district	Z1	0.95509 <.0001	-0.7408 0.0016	-0.84313 <.0001	0.95848 <.0001	0.93229 <.0001	0.89566 <.0001	0.94678 <.0001	0.91669 <.0001	0.76769 0.0008
	Z2	0.28486 0.3035	0.64220 0.0098	0.52261 0.0456	0.27271 0.3254	0.07164 0.7997	-0.35572 0.1932	0.31079 0.2595	0.36970 0.1750	0.00207 0.9942
Slight curse district	Z3	0.01293 0.9328	-0.31267 0.0365	-0.31267 0.0365	0.01113 0.9421	0.01113 0.9421	-0.38420 0.0092	0.07573 0.6210	0.02990 0.8454	0.48191 0.0008
	Z4	0.09059 0.5540	0.02206 0.8856	-0.09901 0.5176	0.01113 0.9421	0.30234 0.0435	-0.06540 0.6695	0.18052 0.2354	0.14702 0.3352	-0.60723 <0.0001
General curse district	Z3	0.07920 0.6051	-0.61341 <.0001	-0.16208 0.2875	0.13366 0.3814	-0.21498 0.1561	0.36387 0.0140	0.36387 0.0140	0.26696 0.0763	0.67114 <.0001
	Z7	-0.22474 0.1377	0.08115 0.5962	0.20289 0.1813	-0.1916 0.2075	-0.0801 0.6009	0.06494 0.6717	0.11491 0.4523	0.19207 0.2062	0.08087 0.5974
Serious curse district	Z4	-0.21567 0.2524	0.34897 0.0588	-0.01192 0.9502	-0.06339 0.7393	0.21545 0.2529	0.08244 0.665	-0.11050 0.561	0.00428 0.9821	0.50158 0.0047
	Z8	0.01331 0.9443	0.01685 0.9296	0.01499 0.9373	-0.04463 0.8149	-0.00015 0.994	0.00666 0.9721	0.10336 0.5868	-0.08948 0.6382	0.01123 0.953

resource curse is driven by farmland protection policy in this area, and the stronger is the farmland protection system, the worse is the resource curse. There are two causes with this result: firstly, this area has high-value agricultural land, such as Huanggang and Xianning, but its economic development is relatively backward, which make the value of agricultural land be not reflected; secondly, the lack of effective ecological compensation mechanism also make wipeouts in this district for farm land protection policy limit the transfer of agricultural land.

Conclusions. Through accounting the agricultural land resource curse, classifying the degree of curse and analyzing its driving forces, we can draw the following conclusions with relevant indicators, from 1996 to 2010:

1. Under the current state of economic development, there really exists agricultural land resources curse in Wuhan metropolitan area with visible spatial heterogeneity by districts. Depending on the extent of the curse in each city, we classify Wuhan metropolitan areas into 4 districts, namely no, slight, ordinary, and serious curse districts, where Wuhan belongs to the non curse district, Huangshi, Ezhou, Qianjiang belong to the slight curse district, Xiaogan and Xiantao belong to the general curse district, and Huanggang and Xianning belong to the serious curse district.

2. In different districts, the driving forces are also different. Food security and urbanization are the main forces in the slight curse district; the land resource curse in general curse district is forced by the man-land relationship; and the factor of cultivated land protection policy is influencing the agricultural land resource curse to some extent in serious district.

3. Since the driving force is different in different districts, it is necessary to develop different institutional arrangements. For non-curse district, although there is no curse phenomenon, it doesn't mean there is no such problem. On the contrary, we need to improve eco-efficiency of land use to reduce negative externalities, such as traffic congestion, environmental pollution, farmers' welfare etc.; for slight curse district, preventing labor outflow is the key to get rid of resource curse; for general curse district, agricultural land circulation should be strictly controlled, because extensive land use phenomenon is rather popular which is the main cause of agricultural curse in this district; for serious curse district, where the value of agricultural land is rather high, we should develop and improve the ecological compensation system and land protection institution, for institutional arrangements of land use can obviously impact the agricultural land resource curse.

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