

# Prediction method of regional economic trend based on rough set support vector machine

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**Abstract.** With economic development level and the level of financial development as the threshold variable and by using relevant data from 1997 to 2015 of eleven cities Provinces in eastern region, this paper studies the relationship between financial development and poverty alleviation by using the panel threshold regression model. The result shows that the effect of financial development on poverty alleviation in East China is “double threshold effect”. (1) the economic development in backward areas, the financial development of the poverty reduction effect is not significant; the economic development level of middle area, slow financial development have a significant positive impact on poverty; higher level of economic development in the region, financial development to further enhance the role of poverty alleviation. (2) when the scale of financial development is the threshold variable, the poverty reduction effect of the financial development in the eastern region has double threshold characteristics, and the value of the action index decreases first and then increases.

**Key words.** Financial development, Poverty reduction effect, Threshold characteristics.

## 1. Introduction

Chinese average personal income has increased continually with sustainable and fast development of national economy since opening and reform. It is indicated that Chinese GDP increased from 367.87 billion yuan in 1978 to 68.55058 trillion yuan in 2015 and annual growth rate is 15.19% and per capita disposable income of rural residents increased from 133.6 yuan to 11.4217 thousand yuan according to data issued by State Statistics Bureau. As areas of good development of Chinese economy, eastern areas including eleven provinces (cities) such as Beijing, Tianjin, Hebei, Liaoning, Shanghai, Jiangsu, Zhejiang, Fujian, Shandong, Guangdong and Hainan, etc obtained great achievements in the aspect of poverty reduction; it can be found that decreasing speed of rural poverty personnel in eastern areas is the

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fastest because there were 9.56 million of rural poverty population in eastern area in 2014 occupying 13.6% in the nation and 16.31 million people were relieved from poverty compared with 2010 according to *Monitoring Report of Rural Poverty in China in 2015* issued by household investigation office of national Statistical Bureau; poverty incidence in 2014 was 2.7% , reducing by 4.7% than 2010. However, eastern areas also face the problem of unbalanced regional development when great achievement is obtained in anti-poverty project. In perspective of inter-provincial development, partial provinces still have great anti-poverty pressure because Shandong and Liaoning are provinces with many people below poverty line determined by the government in eastern areas and poverty incidence of Hebei, Liaoning and Hainan is still over 5%; in perspective of inner provinces, unbalance of inner development of provinces such as Fujian and Guangdong, etc is significant; economic aggregate of Guangdong is the first in the nation, but development in northwestern Guangdong lags behind and problem that development gap expands also exists in northwestern area of Fujian.

## 2. Model setting, variable selection and data source

### 2.1. Model setting

Firstly, the following panel data model is constructed to testify relation between financial development and poverty mitigation:

$$POV_{it} = \mu_i + \beta_1 FD_{it} + \gamma X_{it} + \varepsilon_{it}. \quad (1)$$

POV is poverty level; FD is financial development level; X are other control variables affecting poverty mitigation; i and t respectively indicate area and time;  $\mu_i$  is area effect not observed;  $\varepsilon_{it} \sim iid(0, \sigma^2)$  is random disturbance item.

Exertion of financial poverty mitigation effect has complexity according to what is mentioned hereinbefore and there may be non-linear relation between financial development and poverty mitigation based on difference between action mechanism and poverty mitigation effect in different conditions; as key factors affecting financial development, economic development level and financial development scale will constitute threshold condition of financial poverty mitigation effect on certain conditions. Panel data model is respectively expanded as regression model of panel with multiple thresholds with economic development level and financial development scale as threshold variables according to construction thought of threshold regression model proposed by Hasen (1999):

$$POV_{it} = \beta_1 FD_{it} I(PGDP \leq \eta_1) + \beta_2 FD_{it} I(\eta_1 < PGDP \leq \eta_2) + \dots + \beta_{n+1} FD_{it} I(PGDP > \eta_n) + \gamma_j X_{itj} + \mu_i + \varepsilon_{it} \quad (2)$$

$$POV_{it} = \beta_1 FD_{it} I(FD \leq \eta_1) + \beta_2 FD_{it} I(\eta_1 < FD \leq \eta_2) + \dots + \beta_{n+1} FD_{it} I(FD > \eta_n) + \gamma_j X_{itj} + \mu_i + \varepsilon_{it} \quad (3)$$

$\eta_1, \eta_2 \dots \eta_n$  are respectively the first, the second and the  $n$ th threshold value;  $I(\text{PGDP} \leq \eta_1)$ ,  $I(\text{FD} \leq \eta_1)$ , etc are corresponding piecewise functions to indicate intervals of different income and financial development scale; function value of this index is one if threshold variable satisfies conditions, or it is zero; POV indicates poverty level; FD represents financial development scale; PGDP indicates threshold variable of economic development level; X represent other control variables affecting poverty mitigation;  $i$  and  $t$  respectively indicate province (city) and a particular year;  $\mu_i$  is area effect not observed;  $\varepsilon_{it} \sim \text{iid}(0, \sigma^2)$  is random disturbance item.

## 2.2. Selection of variable

1. Explained variable. It can be found from related research and literature that indexes commonly used to measure poverty level is often measured based on poverty line, such as poverty incidence, FGT index and SEN index, etc, so its applicability to eleven provinces and cities in eastern area is weak. The reason is that eastern area is area of good economic development in china and poverty incidence of all provinces and cities is low; meanwhile, poverty line in different periods is of great gap because there is no uniform standard for delimitation of poverty line and major changes of above index value will take place due to selection difference of poverty line. POV index value to measure poverty level is obtained by using the following equation in reference to practice of Guo Xibao and Luo Zhi (2008), Yang Xia and Liu Xiaoying (2013) in this research.

POV=rural per capita net income \* ratio of rural population + total incomes per head in city \* ratio of urban population.

2. Core explanatory variable. Financial development scale (FD) is adopted as proxy variable to measure financial development. Common measurement indexes of financial development scale are Maxwell index and Goldsmiths index; Goldsmiths index is selected in this thesis and ratio of balance sum of loans and deposits in financial institutions in all provinces and cities to GDP is adopted to represent financial development scale.

3. Threshold variable. It has been uncovered in related researches that development of financial industry is affected and restricted by many factors and the influence of economic development level is the most outstanding. Economic development level is an important influence factor of financial development, but its mode of action on the relation between financial development and poverty mitigation is to be further judged and researched. So, empirical test is conducted on non-linear relation between financial development and poverty mitigation in eleven provinces and cities in eastern area with economic development level and financial development scale as threshold variables in this thesis. Per capita GDP is used as proxy variable of economic development level.

4. Control variable. The following factors are regarded as control variables in this thesis because poverty mitigation can be affected by factors such as urbanization level, industry structure, trade openness, education level and financial support strength, etc.

### 2.3. Data source and processing

Data in eleven provinces and cities in eastern area between 1997 and 2015 is selected as the sample of this research. The explanation is as follows: (1) total volume of foreign trade is converted according to exchange rate of the very year; (2) absolute index value (poverty level, per capita GDP, fixed investment) is converted with CPI index (regard 1997 as base period) to eliminate the influence of price factor in statistical data; (3) related statistical data in this thesis is from *China Statistical Yearbook* between 1998 and 2016, statistical yearbook of eleven provinces and cities in eastern area, national economy and social statistical bulletin; (4) natural logarithm process is conducted on absolute index value to avoid influence of dimension and heteroscedasticity about acquisition and treatment of data. Measurement and descriptive statistics of variables can be seen in Table 1.

Table 1. Descriptive statistics of variable

Variable	Measurement	Mean value	Standard deviation	Minimum	Maximum	Sample capacity
POV	Ln (per capita net income in country * ratio of country population + urban per capita disposable income * ratio of urban population)	9.267697	0.7249551	7.8368	10.7893	209
FD	Balance of loans and deposits/GDP	2.825965	1.438614	0.5592	7.999985	209
CITY	Urban population/total population	0.5618804	0.1936162	0.1828	0.8960	209
EDU	Number of college students on campus in ten thousand people	157.7157	87.11257	19.9682	357.8621	209
INS	Added value of tertiary industry	0.4468163	0.1062223	0.3172	0.7981	209
GOV	expenditure/GDP	0.1318665	0.0523655	0.0512	0.3347	209
TRA	Total volume of foreign trade/GDP	0.664266	0.4473326	0.0823	1.7222	209
INVEST	Ln (fixed investments/total population)	9.306045	0.8495045	7.5898	10.9660	209
PGDP	Ln (per capita GDP)	10.1305	0.6801575	8.6246	11.3107	209

### 3. Empirical result and analysis

#### 3.1. Test of threshold effect

Threshold model mainly solves two problems, including estimation of threshold value and corresponding coefficient and related test on threshold effect. Firstly, threshold effect of model is tested to determine specific form of threshold model. Economic development level and financial development scale are regarded as threshold variables and financial development is estimated pertinent to original hypothesis of multiple thresholds with model (2)-(3) to obtain F statistics; then bootstrap method is adopted to obtain p value, which can be seen in Fig. 2. The result indicates that single threshold effect of financial development on poverty mitigation is not significant and double threshold effect is significant under 1% significance level when economic development level is regarded as threshold variable; single threshold effect and double threshold effect of financial development on poverty mitigation are significant respectively under 5% and 1% significance level when financial development level is regarded as threshold variable. So, analysis will be conducted based on threshold feature of double threshold model on financial poverty mitigation effect hereinafter for the two threshold variables of economic development level and financial development scale.

Table 2. Test result of threshold effect

Model	threshold variable	
	Economic development level (PGDP)	Financial development scale (FD)
Single threshold	13.281(0.107)	18.039**(0.020)
Multiple thresholds	20.098***(0.007)	11.802***(0.000)

Note: values in the table are corresponding F statistics of threshold test and p value is in the bracket; \*\* and \*\*\* respectively indicate that they are significant under 5% and 1% significance level.

Table 3. Threshold estimation value and its confidence interval

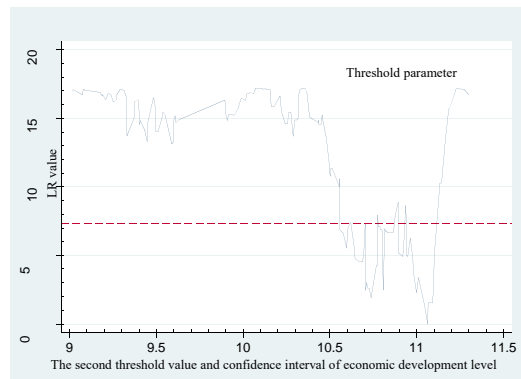
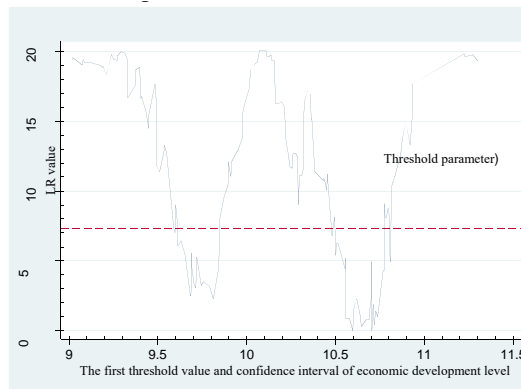
Index	Economic development level (PGDP)		Financial development level (FD)	
	Threshold estimation value	95% confidence interval	Threshold estimation value	95% confidence interval
The first threshold	10.598	[9.589,10.808]	1.424	[1.319,7.024]
The second threshold	11.064	[10.557, 11.101]	4.938	[1.424,5.168]

Then, threshold values of double threshold model are respectively estimated with economic development level and financial development scale as threshold variables. Estimation value of threshold and corresponding 95% confidence interval are recorded in Table 3 and likelihood of Fig. 1 explains estimation of threshold value and construction process of confidence interval more clearly than function figure; critical value of LR value under 10% significance level is imaginary line in the figure,

while area below the line constitutes 90% confidence interval of threshold value. As shown in Fig. 1, LR statistics is close to zero in 90% progressive effective confidence intervals [9.589, 10.808] and [10.557, 11.101] when economic development level is threshold variable and test result cannot refuse the original hypothesis that threshold estimation value is consistent estimator of its true value, thus it can be inferred that there is double threshold effect for model estimation and the two threshold estimation values are respectively 10.598 and 11.064. Similarly, it can be judged that there is double threshold effect in model estimation as well and threshold estimation values are respectively 1.424 and 4.938 when financial development scale is threshold variable.

### 3.2. Analysis of threshold estimation result

Comprehensively, test results of poverty mitigation effect of financial development based on economic development level and financial development scale both refuse original hypothesis of linear relation and threshold effects of financial development under double threshold model all pass significance test. Thus it can be judged that poverty mitigation effect of financial development in eastern area has obvious non-linear feature under influence of two threshold variables of economic development



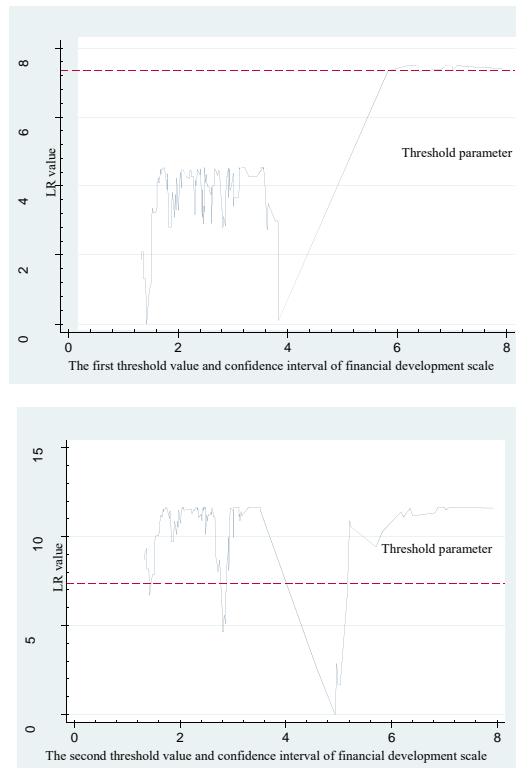


Fig. 1. Threshold estimation value and its confidence interval

level and financial development scale. Relations between financial development and poverty mitigation in different zone systems of economic development level and financial development scale are respectively investigated according to test result of threshold effect and threshold estimation value and the result is shown in Fig. 4. Besides, estimation result of fixed effect model of linear individual is recorded in Table 4 to compare the effect of financial development on poverty mitigation in two aspects of overall level and different zone systems. It can be found from estimation result that goodness-of-fit of threshold estimation model is better compared with fixed effect model. It can also be known for Table 4 that poverty mitigation effect of financial development in model (1) passes significance test and its effect estimation value is positive significantly, indicating that financial development in eastern area is beneficial to poverty mitigation. While, it can be found from threshold estimation models (2) and (3) that there is non-linear feature of financial development on poverty mitigation. So, there will be unpredictable deviation of measurement result if linear model (1) is regarded as measurement model. It is prone to establish relation of piecewise function for poverty mitigation effect with economic development level and financial development scale as thresholds.

Table 4. Estimated Result of Fixed Effect Model and Threshold Estimation Model

Variable	Fixed effect model		Threshold estimation model	
	(1)	(2)	(3)	(3)
EDU	-0.002111***(-8.48)	-0.00138***(-5.18)	-0.00250***(-8.68)	
CITY	0.8383161***(8.27)	-0.204*(1.90)	0.0819(0.81)	
FIN	1.361145***(5.48)	1.105***(3.87)	1.089***(3.20)	
INVEST	-0.0111223(-0.36)	0.180***(4.11)	0.0877*(1.82)	
TRA	-0.0029493(-0.09)	0.0324(-0.90)	-0.103***(-2.81)	
INS	0.916903***(3.68)	0.139(0.57)	-0.552*(-1.67)	
PGDP	1.041725***(20.36)	0.815***(10.89)	1.139***(16.29)	
FD	0.0782531***(6.27)			
FD_1(PGDP≤10.291)		0.0121(0.70)		
FD_2(10.291<PGDP≤11.064)		0.0403**(2.46)		
FD_3(PGDP>11.064)		0.0696***(4.44)		
FD_1(FD≤2.482)			0.129***(3.08)	
FD_2(2.482<FD≤4.938)			0.0598***(3.22)	
FD_3(FD>4.938)			0.0854***(5.20)	
Constant term	-2.128435***(-7.44)	-0.832**(-2.02)	-2.761***(-7.84)	
R2	0.9117	0.983	0.979	

Note: t value is in brackets, \*, \*\* and \*\*\* express significant under 10%, 5% and 1% significant level respectively.

Table 5. Year Distribution for Economic Development Level and Financial Development Condition of 11 Provinces and Cities in Eastern Region

Province and city	$pgdp \leq 10.598$	$10.598 < pgdp \leq 11.064$	$pgdp > 11.064$	$fd \leq 1.424$	$1.424 < fd \leq 4.938$	$fd > 4.938$
Beijing	1997-2003	2004-2010	2011-2015		1997-1999	2000-2015
Liaoning	1997-2010	2011-2015		1997-2004	2005-2015	
Hebei	1997-2015			1997-2003	2004-2015	
Tianjin	1997-2005	2006-2010	2011-2015		1997-2015	
Shandong	1997-2011	2012-2015			1997-2015	
Jiangsu	1997-2009	2010-2014	2015		1997-2015	
Shanghai	1997-2003	2004-2009	2010-2015		1997-2008	2009-2015
Zhejiang	1997-2009	2010-2015			1997-2015	
Fujian	1997-2011				1998-2015	
Guangdong	1997-2009	2012-2015		1997	1997-2015	
Hainan	1997-2015	2010-2015			1997-2015	

Model estimation result taking economic development level as threshold variable shows that role of financial development on poverty alleviation in eastern regions



presents double threshold characteristic. Specific expression is: when economic development level value of a region is 10.598 lower than threshold value, financial development produces certain positive influence on poverty alleviation, but it does not pass significance test; when economic development value enters into threshold value between 10.598 and 11.064, financial development has significant effect on poverty alleviation and coefficient value is 0.00403; when economic development level spans over threshold value for 11.064, the role of financial development on poverty alleviation increases further and influence coefficient is 0.0696. In conclusion, the higher economic development level is, more obvious the role of financial development on poverty alleviation will be. The reason lies in that financial industry is the result of market economy developing to a certain stage and has outstanding comprehensive driving effect. Development of financial industry can drive rapid development of related industries, while industry development also drives further development of financial industry, thus making the role of financial development on poverty alleviation increase constantly along with improvement of economic development level and present the characteristic of gradual gradient ascent. It can be seen from Table 5 that there are Beijing, Tianjin, Shanghai, Jiangsu these four provinces and cities entering into economic development level stage in eastern region. Hainan and Hebei province are in the first stage of economic development and other provinces and cities are in the second stage. It indicates that poverty alleviation effect of financial development is relatively significant in most provinces and cities in eastern region, but still has promotion space.

Model estimation result taking financial development scale as threshold variable shows that role of financial development on poverty alleviation in eastern regions presents double threshold characteristic. Specific expression of the characteristic is: when financial development scale is 1.896 lower than threshold value, financial development produces positive influence on poverty alleviation and effect coefficient value is 0.129; when financial development scale enters into threshold value between 1.424 and 4.938, financial development produces significantly positive effect on poverty alleviation and influence value is decreased to be 0.598; when financial development scale spans over threshold value for 4.938, the positive influence is improved and it passes significant test with lever of 1%. Thus it can be seen that financial development can alleviate poverty and the influence effect is significant in regions with small financial development scale; development of financial industry is beneficial to poverty alleviation, but the effect is decreased in regions with larger financial development scale; along with further expansion of financial development scale, positive influence of poverty alleviation effect of financial development tends to be increased. It may be because the government guides financial support for poverty consciously. Increase of agricultural loan makes poverty status of low-income groups improved obviously; as finance develops into middle stage, more financial resources are put into productive expenditure. Based on capital profitability, financial resources tend to be put into high-asset owner, and positive effect on income increase of low-income people is decreased; the ability of low-income people undertaking financial service is gradually increased in regions with high financial development, thus the effect of financial development on poverty alleviation is increased again. It can be known

from Table 5 that only Beijing city and Shanghai city enter into high financial development stage in eastern region at present, other provinces and cities are in the second stage. It indicates that poverty alleviation effect of financial development in most cities of eastern region is significant at present, but the effect is less.

## 4. Research results and policy suggestions

### 4.1. *Research results*

Based on panel data of 11 provinces and cities in eastern region from 1997 to 2015, non-linear relationship between financial development and poverty alleviation is verified in the Thesis by using panel threshold regression model proposed by Hansen (1999) and taking economic development level and financial development scale as threshold variable. Researches show that financial poverty alleviation effect of eastern region has significant threshold characteristics under influence of two above threshold variables. Specific expression is: (1) financial poverty alleviation effect of eastern region presents significant double threshold characteristic when economic development level is taken to be threshold variable. Poverty alleviation effect of financial development is not significant in economically backward regions; financial development produces significantly positive influence on poverty alleviation in regions with middle economic development level; the role of financial development on poverty alleviation is strengthened further in regions with higher economic development level. (2) Poverty alleviation effect of financial development in eastern region has double threshold characteristic and presents the trend of decrease firstly and then increase when financial development scale is taken to be threshold variable. Financial development has significantly positive influence on poverty alleviation in backward regions of financial development; along with expansion of financial development scale, effect of financial development on poverty alleviation is decreased; the effect of financial development on poverty alleviation tends to be increased in financially developed regions.

### 4.2. *Policy suggestions*

1. Ideologically, objective understanding for relational complexity between financial development and poverty alleviation must be equipped, thus guiding development practice of financial poverty alleviation correctly. Along with economic development, relationship between financial development and poverty alleviation becomes complex under influence of multiple factors, and traditional linear model research frame has been unable to express relationship between financial development and poverty alleviation correctly. Thus obtaining development practice of financial poverty alleviation needs to refer to the concept of system and development to understand influence of financial development on poverty alleviation under different conditions and environment more comprehensively.

2. In the aspect of development path, regional financial decision-making power shall be broadened properly, especially financial decision-making power in poverty-

stricken regions. It is beneficial to give play to initiative and creativity for poverty-stricken regions, thus improving accuracy of financial poverty alleviation. According to poverty degree in different regions, different financial organizations are selected by reasonably selecting and differentiating action range of policy finance, development finance and commercial finance to participate in poverty alleviation and development process. Reform of financial system is promoted under orderly, effective and stable principle, thus promoting financial system in poverty-stricken regions to be improved gradually, reducing regional poverty conditions and improving effect of financial poverty alleviation.

3. In the aspect of development policy, transformation from unified mandatory policies to flexible coordination policies shall be realized. It can be known according to empirical analysis that financial poverty alleviation role can be exerted under certain conditions. Therefore, financial poverty alleviation policies cannot be made with the method of "one size fits all", but shall be made according to economic development level of all regions. In economically backward regions, preferential policies such as tax, financial discount and so on shall be considered to encourage industry development fitting local development, thus realizing poverty alleviation and prosperity achievement; in economically developed regions, flexible policies shall be made according to different regional environment and conditions to release policy bonus to maximum extent.

4. In the aspect of system and mechanism, financial system reform shall be promoted greatly to form coordinative development mechanism of finance and economy. Good economic development environment is important environment guarantee to promote anti-poverty. Trickle-down effect caused by capital accumulation shall be exerted positively, thus giving full play to poverty alleviation effect of financial development and improving income level of poor people by regional economic development.

5. In the aspect of livelihood employment, livelihood issue and employment issue of poverty-stricken regions is still one hotspot of social attention. These two issues is also one of factors causing slow step of poverty alleviation in poverty-stricken regions. Complying with development trend of industrialization and urbanization in China, rural labor force in poverty-stricken regions will inevitably be transferred orderly, thus making farmers increase income and overcome poverty. Different methods and measures shall be adopted for different income level, and government shall also perfect economic system, education mechanism, employment mechanism and social insurance system constantly at the same time, thus making poverty alleviation implemented better and faster.

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## References

- [1] R. W. GOLDSMITH: *Financial Structure and Development*[Z]. New Haven,CT: Yale University press. (1969).
- [2] A. KRAAY: *When is Growth Pro—Poor? Evidence from a Panel of Countries*[J]. *Journal of Development Economics*, 80 (2006), No.1, 198–227.
- [3] N. M. ODHIAMBO: *Is Financial Development a Spur to Poverty Reduction? Kenya's Experience*[J]. *Journal of Economic Studies*, 37 (2010), No. 4.
- [4] J. GREENWOOD, AND B. JOVANOVIĆ: *Financial Development, Growth, and the Distribution of Income*[J]. *Journal of Political Economy*, 98 (1990), No. 5 Part1:1076–1107
- [5] P. AGHION, AND P. BOLTON: *A Trickle- Down Theory of Growth and Development with Debt-overhang*[J]. *Review of Economic Studies*, 64 (1997).
- [6] H. L. ELLIS, D. BERNHARDT: *Enterprise, inequality and economic development*[J]. *The Review of Economic Studies*, 67 (2000), No. 230, 147–168.
- [7] T. POBERT AND K. UEDA: *Financial Deepning, Inequality, and Growth: A Model-Based Quantitative Evaluation*[Z]. IMF Working Paper ,2003, WP/03/193. (2003).
- [8] G. CLARKE, L. C. XU, H. ZOU : *arch working Paper*, (2003), No. 2984.
- [9] DALY K.J.: (2007) Akhters. *Finance and Poverty:Evidence from Panel Study*. Proceeding[Z].6TH Hawaii Intenational Conference on Social Science.
- [10] D. DOLLAR, A. KRAAY: *Crowth is good for the Poor* [J]. *Journal of Economic Growth*, 7 (2002), No. 3, 195–225.
- [11] H. JALILIAN, C. KIRKPATRICK: *Financia development and Poverty Reduction in Developing Countries*. *International Journal of Finance and Economics*, 7 (2002), No. 2, 97–108.
- [12] H. JALILIAN, C. KIRKPATRICK: *Does Financial Development Contribute to Poverty Reduction?* [J].*Journal of Development Studies*, 41 (2005), No. 4, 636–656.
- [13] S. G. JEANNENEY, K. KPODAR K.: *Financial development,Financial Instability and Poverty*[Z].Working paper, (2005), No.CSAE WPS/2005-2009.
- [14] A. G. JEANNENEY, AND K. KPODAR: *Financial Development and Poverty Reduction: Can there be a Benefit without a Cost?*[Z] IMF Working Paper, (2008), WP/08/62.
- [15] M. RAVALLION: *Can high-inequality developing countries escape absolute poverty?*[J]. *Economics Letters*, (1997), 561.
- [16] Y. J. CUI, G. SUN: *Is financial development the cause of poverty alleviation? - Evidence from China* [J]. *financial research*, 2012 (2012), No. 11, 116–127.
- [17] J. R. SU, J. Z. LIAO: *Empirical analysis of the relationship between financial development and income distribution and poverty in China – a study based on dynamic panel data* [J]. *Journal of Finance and economics*, (2009), No. 12.
- [18] Z. G. DING, X. TAN, J. ZHAO: *Study on the effect of Rural Finance on poverty reduction* [J]. *agricultural economy*, (2011), No. 11, 72–77.
- [19] DIVISION, R. RONG, Z. Y. XU, Y. J. ZHAO: *The threshold effect of financial poverty reduction and its empirical test based on panel data of Western China* [J]. *Chinese soft science*, (2013), No. 3.
- [20] Z. Q. ZHAO, Y. ZHENG, D. L. YANG: *Research on nonlinear relationship between financial development and economic growth. Empirical study based on threshold model* [J]. *quantitative economic, technical and economic research*, (2007), No. 7, 54–62.
- [21] Y. Q. SUN: *Research on financial development, urbanization and income gap between urban and rural residents* [J]. *financial research* (2012) No. 4, 98–109
- [22] F. HAN: *Threshold analysis and empirical test of the effect of financial poverty reduction* [J]. *financial development research*, (2014), No. 11, 22–26
- [23] L. F. GUO, R. Y. LI: *Threshold analysis and empirical test of the effect of tourism poverty reduction*[J]. *Business Economics and management*, (2016), No. 06, 81–91.
- [24] X. B. GUO, Z. LUO: *Trade liberalization, economic growth and poverty alleviation. Empirical study based on provincial data of China* [J]. *management world*, (2008), No. 02, 15–24.

- [25] X. YANG, X. Y. LIU: *Study on the relationship between technological progress and the improvement of people's livelihood in multi-ethnic areas* [J]. Xinjiang Social Science (Chinese Edition), (2013), No. 1, 13–19.

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