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Is There a Reverse U-Shaped Relation between Financial Development and Income Distribution? Comparison between Developed Countries and Transforming Countries

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Abstract

Researching relation between financial development and income distribution is always a hotspot issue of theory. In 1990s, Greenwood and Jovanovic proposed the reverse U-shaped relation model between financial development and income distribution. Related scholars conducted empirical analysis accordingly but there was always no consistent conclusion. In this paper, whether there is a reverse U-shaped relation between financial development and income distribution is verified via different country types. USA, UK and Germany are taken as representatives of developed country; China, Russia and Brazil are transforming countries to respectively carry out empirical analysis to relation between financial development and income distribution, and it is found that: there is no reverse U-shaped relation between financial development and income distribution in developed countries, nevertheless there is an apparent reverse U-shaped relation in transforming countries.

Keywords

Financial Development, Income Distribution, Reverse U-Shaped Relation, Developed Countries, Transforming Countries

1. Introduction

Since 1950s and 1960s, relation between financial development and income distribution has drawn high atten-

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tion of academic circles. In order to research on what the impact of financial development and resident income distribution is and how they impact each other, scholars domestic and abroad adopted various methods to conduct theory and empirical research; each scholar stuck to one's own viewpoint and there is till now no consistent conclusion. Among existing research results, the theory of reverse U-shaped theory has been always criticized by scholars domestic/abroad since its establishment. Nevertheless, it also becomes the issue firstly considered and discussed by each scholar researching income distribution. This paper is started from different country types (developed country and transforming country) to conduct empirical analysis on the relation between financial development and income distribution.

2. Literature Review

Reverse U-shaped theory was firstly used to describe relation between economic growth and income distribution gap. In 1955, in the works of "economic growth and uneven income distribution" of USA economist S. Kuznets, the theory of "S. Kuznets hypothesis" (*i.e.*, reverse U-shaped hypothesis) was proposed. In this works S. Kuznets deemed that "in the long term income structure, there is a long term fluctuation characterized by unevenness. If economic development process is divided into different stages as per economic growth level, early stage economic growth shall expand the income gap; at middle stage the economic growth is gradually stabilized, income gap is maintained stable; the later stage economic growth enters into a mature stage, economic growth level is slowed down, and income gap shall be gradually reduced. Therefore there is a reverse U curve relation between income gap and economic growth" [1]. Furthermore, S. Kuznets in details explained the establishment of the theory: at early stage of economic development, great concentration of deposit and investment is in favor of pushing forward industrialization and urbanization, and this shall inevitably bring about expansion of gap for income between rural and urban area; with sustainable growth of economy, the offsprings of rural migrants shall gradually adapt to and be fused into modern economic life of city, their political position shall be gradually enhanced, furthermore the government shall also maintain interests and rights of low income crowd via lawmaking, finance and tax, and various welfare policies, to counteract the accumulated effect from unequal deposit. Proposing this hypothesis shall not only conduct linkage investigation to economic growth factor and income distribution gap, but also provide theoretical evidence of capital expansion routine of each industrialization country.

In 1990, in the paper of "economic development, growth and income distribution" [2] of Greenwood and Jovanovic, establishment of reverse U curve theory was a symbol of formally starting research on financial development and income distribution relation. In this paper hypothesis of S. Kuznets was based to establish a dynamic model to discuss the relation among economic growth, financial development and income distribution. In this model, economic growth can provide the capital required for developing financial medium, while development of financial medium shall also promote the growth of economy. The model shall also assume that individual has two optional investment modes: 1) investment to no risk asset with fairly low return rate, such as deposit in the bank; 2) investment to establish enterprise, the earnings shall be fairly high but risk fairly great. On the basis of this hypothesis, the financial medium can collect a large number of individual resources in the society via more abundant investment information to acquire fairly high expected return. At early stage of economic development, since financial medium is not developed, economic growth is slow, and financing via financial market needs to pay considerable fixed cost (*i.e.*, the threshold effect), only the rich can pay this cost, to get financing from financial market to operate investment project with high return and high risk, the poor with fairly low initial fortune level cannot get financing from financial market thus the investment return is very low, at early stage of economic growth, the gap of income distribution is fairly great. Nevertheless, with comprehensive development of economic growth and financial medium, final fortune level of poor via high deposit rate shall be enough to pay the cost of getting financing from financial market, to enter the financial market to share the financial service, and acquire high investment return, the income distribution pattern is finally stabilized up to equal level, and income gap is also decreasing. It comprehensively presents the reverse U-shaped relation between financial development and income distribution gap, therefore, the conclusion which is similar with hypothesis of S. Kuznets is also acquired via their model.

Subsequently, Agihon, Bolton (1997) [3] and Matsuyama (2000) [4] adopted different clews to respectively establish models to analyze distribution of initial fortune and how development of credit market impacts distribution of long term fortune via Trickle-Down Effects. Their research result once more proved the reverse U relation between financial development and income distribution. In the model of Agihon and Bolton, action mechanism of trickle-down effects shall be: increase of fortune accumulation of rich → decrease of market interest

rate → financing of poor from financial market → gap of income distribution is gradually converged. In the model of Matsuyama, the poor cannot enter into financial market due to insufficiency of initial fortune accumulation, and shall only be capital provider at financial market. The rich has fairly high marginal propensity to invest, increasing of their fortune shall stimulate the rich to further get financing from financial market, incurring rise of interest rate, rising of interest rate shall increase earning of poor and speed up the progress of fortune accumulation.

3. Model and Empirical Study

3.1. Model

On the basis of this theory, this paper refers to research methods of George, Lixin and Hengfu (2003) [5] to establish two nonlinear models (see (1)) to demonstrate whether reverse U relation between financial development and social resident income distribution gap exists. In this model, if α_1 is a positive value, α_2 is a negative value, it means that reverse U curve theory between financial development and income distribution gap can be established, *i.e.*, the finance shall not have the effect of reducing income gap until it has been developed to some extent.

$$\ln(\text{Ineq}) = \alpha_0 + \alpha_1 \ln(\text{Finance}) + \alpha_2 \left(\ln(\text{Finance})\right)^2 + \alpha_4 \ln u_i \tag{1}$$

wherein, Ineq presents unequal extent of income distribution, Finance presents financial development index, u_i is residual term. Furthermore, all indexes are conducted by logarithmetics processing, it can eliminate heteroskedasticity, and also improve stability of data.

Furthermore, in order to deeply research the direction and size of the role of financial development to income distribution gap, in this paper USA, UK and Germany are selected as representatives of high income country subject to GNI Gross National Income data issued by World Bank for each country, China, Brazil and Russia are selected as representatives of low income country, the panel data of two country groups of 1999-2013 is adopted to simply conduct empirical research to relation between financial development and income distribution gap, and compare and analyze research results of two groups of data.

3.2. Empirical Analysis

3.2.1. Verification of Unit Root Test

In this paper, at first the test mode of unit root is determined as per sequence diagram of Ln(GNI), Ln(FDI) and $(\text{Ln(FDI)})^2$, then unit root test is conducted, detailed test result is shown in **Table 1**. Wherein, GNI presents Geni coefficient to measure income distribution gap; FDI presents financial development indicator, *i.e.*, M_2/GDP. The logarithmetics processing to each data can prevent heteroscedasticity, to improve accuracy of empirical result.

Sequence diagram of each sequence of developed country group (**Figure 1**) shows that, Ln(GNI), Ln(FDI) and $(\text{Ln(FDI)})^2$ all have the trend term and constant term. Sequence diagram of each variable of transforming country group (**Figure 2**) presents that, Ln(GNI) contains constant term, but general trend is not apparent; Ln(FDI) and $(\text{Ln(FDI)})^2$ have both trend term and constant term.

According to research result of **Table 1** following conclusion can be made in this paper: 1) Ln(GNI), Ln(FDI) and $(\text{Ln(FDI)})^2$ of developed country group is all non-stationary sequence, each variable all abides by first order integration, thus co-integration test can be done; 2) Ln(GNI), Ln(FDI) and $(\text{Ln(FDI)})^2$ of transforming country group is all instable, nevertheless, after first order difference, they are all changed to stationary sequence.

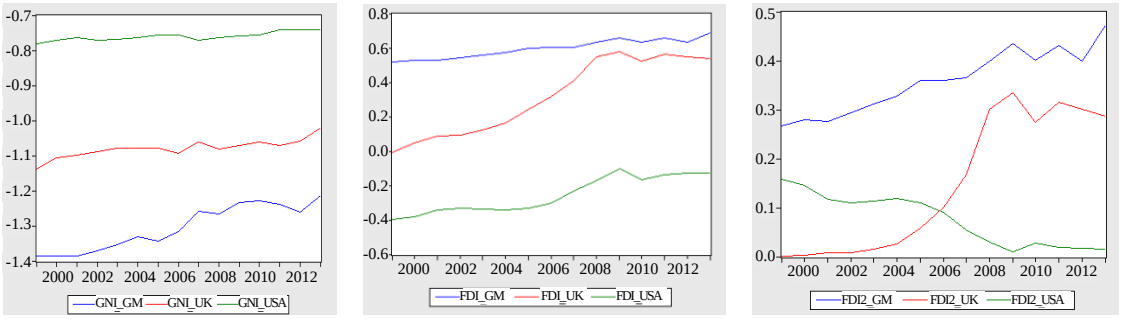

Figure 1. Sequence diagram of Ln(GNI), Ln(FDI) and $(\text{Ln(FDI)})^2$ of developed country group.

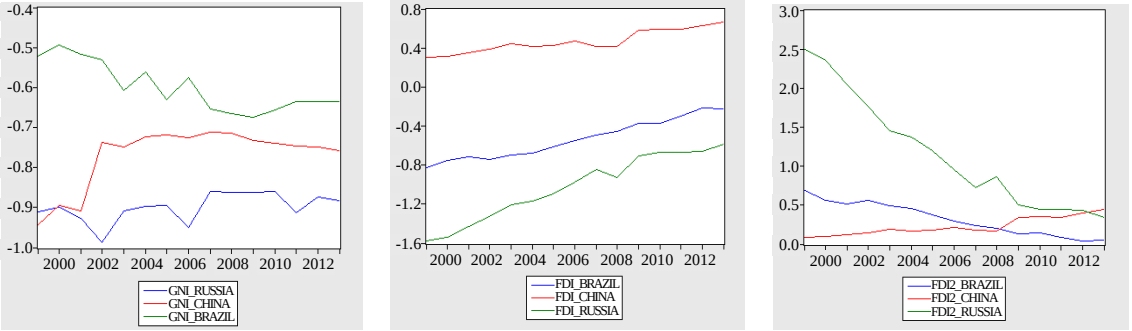

Figure 2. Sequence diagram of Ln(GNI), Ln(FDI) and $(Ln(FDI))^2$ of transforming country group.

Table 1. Unit root test result.

Group type	Variable	Test type (c, t) test	ADF test		Stability (α = 5%)	Conclusion
			Test method	P value		
Developed country	Ln(GNI)	(c, t)	LLC	0.0178**	[1]Instable	Ln(GNI) ~ I(1)
			Breitung	0.1130		
			IPS	0.1020		
			ADF	0.1253		
			PP	0.1108		
	D(Ln(GNI))	(c, 0)	LLC	0.0000	Stable	
			Breitung	-		
			IPS	0.0000		
			ADF	0.0001		
			PP	0.0000		
	Ln(FDI)	(c, t)	LLC	0.4053	Instable	Ln(FDI) ~ I(1)
			Breitung	0.6198		
			IPS	0.2194		
			ADF	0.2123		
			PP	0.3880		
	D(Ln(FDI))	(c, 0)	LLC	0.0006	Stable	
			Breitung	-		
			IPS	0.0001		
			ADF	0.0005		
			PP	0.0001		
	$(Ln(FDI))^2$	(c, t)	LLC	0.1663	Instable	$(Ln(FDI))^2$ ~ I(1)
			Breitung	0.4188		
			IPS	0.0522***		
			ADF	0.0572***		
			PP	0.2689		
	$D[(Ln(FDI))^2]$	(c, 0)	LLC	0.0036	Stable	
			Breitung	-		
			IPS	0.0001		
			ADF	0.0007		
			PP	0.0001		

Continued

Transforming country	Ln(GNI)	(c, 0)	LLC	0.0000*	Instable	Ln(GNI) ~ I(1)
			Breitung	0.7782		
			IPS	0.3860		
			ADF	0.2107		
			PP	0.1882		
	D(Ln(GNI))	(c, 0)	LLC	0.0000	Stable	
			Breitung	-		
			IPS	0.0000		
			ADF	0.0000		
			PP	0.0000		
	Ln(FDI)	(c, t)	LLC	0.0035*	Instable	Ln(FDI) ~ I(1)
			Breitung	0.0328**		
			IPS	0.3782		
			ADF	0.4615		
			PP	0.5388		
	D(Ln(FDI))	(c, 0)	LLC	0.0000	Stable	
			Breitung	-		
			IPS	0.0000		
			ADF	0.0000		
			PP	0.0000		
	$(Ln(FDI))^2$	(c, t)	LLC	0.2361	Instable	$(Ln(FDI))^2$ ~ I(1)
			Breitung	0.0098*		
			IPS	0.8004		
			ADF	0.7743		
			PP	0.7639		
	$D[(Ln(FDI))^2]$	(c, 0)	LLC	0.0000	Stable	
			Breitung	-		
			IPS	0.0000		
			ADF	0.0002		
			PP	0.0000		

Note: 1) *, ** and *** respectively presents the significance at 1%, 5% and 10% significance level; 2) c and t of test type respectively present constant term and trend term. [1]Only LCC method rejects original hypothesis (*i.e.*, Ln(GNI) is deemed as stationary sequence), the other methods all present that Ln(GNI) sequence has unit root, therefore in this paper, Ln(GNI) is deemed as instable sequence.

3.2.2. Co-Integration Test

At present the methods for co-integration test to panel data in the world can be divided into two types: 1) establish panel co-integration test on the basis of Engle and Granger two step method test, the detailed methods include Pedroni and Kao test; 2) panel co-integration test established on the basis of Johansen co-integration test.

I) Developed countries

Tables 2-4 are respectively the result of Pedroni, Kao and Johansen co-integration test acquired via Eviews 6.0 software. In Table 1, statistics of panel V and statistics of panel PP show that, at 10% significance level, there is a co-integration relation among each sequence of developed country group; statistics of group PP shows that, there is a co-integration relation among these three sequences at 5% significance level; the other statistics cannot reject the original hypothesis, *i.e.*, there is no co-integration relation among three sequences. Data of Table 3 shows that, P value (0.3624) of test result is apparently higher than any significance level (1%, 5%, and 10%), therefore there is no co-integration relation among three sequences. In Table 4 the statistics show that, at 10%

Table 2. Pedroni co-integration test result.

Alternative hypothesis: common AR coefs. (within-dimension)				
			Weighted	
	Statistic	Prob.	Statistic	Prob.
Panel v-Statistic	1.382484	0.0834***	1.586353	0.0563
Panel rho-Statistic	0.306899	0.6205	0.128059	0.5509
Panel PP-Statistic	−1.632623	0.0513***	−2.118482	0.0171
Panel ADF-Statistic	−0.955258	0.1697	−1.392742	0.0818
Alternative hypothesis: individual AR coefs. (between-dimension)				
	Statistic	Prob.		
Group rho-Statistic	0.770779	0.7796		
Group PP-Statistic	−1.955619	0.0253**		
Group ADF-Statistic	−1.066013	0.1432		

Note: *, ** and *** respectively present the rejection to original hypothesis at 1%, 5% and 10% significance level, *i.e.*, there is a co-integration relation among variables.

Table 3. KAO co-integration test result.

	t-Statistic	Prob.
ADF	0.351969	0.3624
Residual variance	0.000350	
HAC variance	0.000316	

Table 4. Johansen co-integration test result.

Hypothesized No. of CE(s)	Fisher Stat.* (from trace test)	Prob.	Fisher Stat.* (from max-eigen test)	Prob.
None	18.54	0.0050*	11.61	0.0712***
At most 1	12.17	0.0583***	8.279	0.2184
At most 2	15.36	0.0176	15.36	0.0176

Note: 1) "Deterministic trend specification" optional sequence has deterministic trend while co-integration equation only has the situation of intercept; 2) *, ** and *** respectively present the rejection to original hypothesis at 1%, 5% and 10% significance level, and the accepting to alternative hypothesis.

significance level, original hypothesis of "existence of at most one co-integration relation" among each sequence can be rejected, but the hypothesis of "existence of at most two co-integration relations" among each sequence cannot be rejected; maximum characteristic statistics show that, at 10% significance level, hypothesis of "no co-integration relation" among sequence can be rejected, but original hypothesis of "existence of at most one co-integration relation" among sequences cannot be rejected. Therefore, irrespective of trace statistics measurement or maximum characteristic statistics, result of Johansen co-integration test presents the co-integration relation among each sequence. In combination with test results of **Tables 2-4**, different conclusions are made for three testing methods of Pedroni, Kao and Johansen co-integration test. Therefore in the developed country group, therefore is no long term stable co-integration relation among three variables of Ln(GNI), Ln(FDI) and $(\text{Ln(FDI)})^2$, this further presents that panel data of three countries of UK, USA and Germany cannot verify the establishment of reverse U relation between financial development and income distribution gap.

II) Transforming country group

Tables 5-7 respectively disclose result of Pedroni, KAO and Johansen co-integration test. Wherein, sequence diagram of each variable shows that it contains both constant term and trend term, during Pedroni co-integration test, "deterministic trend specification" shall be "contain both trend term and constant term". **Table 5** shows that, at 10% significance level group rho statistics rejects original hypothesis, at 5% significance level panel rho statistics and panel ADF statistics reject original hypothesis, at 1% significance level group PP statistics, panel V statistics and panel PP statistics reject original hypothesis, only group ADF statistics cannot reject original hypothesis at any significance level. During Pedroni co-integration test, original hypothesis H_0 is "there is no co-integration relation among each variable", therefore when most statistics reject original hypothesis, existence of co-integration relation among each variable can be determined. In **Table 7**, trace statistics measurement and maximum characteristic statistics both reject the original hypothesis of None (*i.e.*, no co-integration relation among sequences), nevertheless they cannot reject original hypothesis At most 1 (*i.e.*, at most one co-integration relation among each sequence), and this can prove the co-integration relation among each sequence. Therefore combination of data result of **Tables 5-7** shows that, there is a stable long term balance relation among three variables of Ln(GNI), Ln(FDI) and $(\text{Ln(FDI)})^2$ of transforming country group.

Table 5. Pedroni co-integration test result.

Alternative hypothesis: common AR coefs. (within-dimension)				
			Weighted	
	Statistic	Prob.	Statistic	Prob.
Panel v-Statistic	−0.549849	0.0088*	−1.938698	0.0737
Panel rho-Statistic	−0.442100	0.0292**	0.581714	0.0196
Panel PP-Statistic	−4.907997	0.0000*	−4.866084	0.0000
Panel ADF-Statistic	−1.156631	0.0237**	−2.206950	0.0137
Alternative hypothesis: individual AR coefs. (between-dimension)				
	Statistic	Prob.		
Group rho-Statistic	0.208955	0.0828***		
Group PP-Statistic	−5.646846	0.0000*		
Group ADF-Statistic	−0.634466	0.2629		

Note: *, ** and *** respectively present the rejection to original hypothesis at 1%, 5% and 10% significance level, *i.e.*, there is a co-integration relation among variables.

Table 6. KAO co-integration test result.

	t-Statistic	Prob.
ADF	−0.942076	0.0331**
Residual variance	0.002028	
HAC variance	0.001360	

3.2.3. Regression Model of Transforming Country Group

On the basis of data of transforming country group, this paper shall further discuss the detailed form of co-integration relation of transforming country group, *i.e.*, to adopt regression method to analyze and verify whether there is a reverse U-shaped relation between financial development and income distribution gap in the transforming countries.

I) Determine impact form

Which one shall be used, fixed effect model or random effect model? The ordinary method of academic circle is to at first establish random impact model, and then verify whether the model satisfies the hypothesis, if yes, random effect model shall be adopted, otherwise the model shall be determined as the form of fixed impact. Hausman test is just the statistics test method on the basis of this method, the original hypothesis is "individual of random impact model is unconcerned with explaining variable" (*i.e.*, random effect model shall be established). **Table 8** is the result of Hausman test method. Since P value (0.0000) is lower than any significance level, original hypothesis is rejected, *i.e.*, fixed effect model shall be established.

II) Regression analysis

Through F test (see **Table 9**), the form of regression model determined in this paper is variable coefficient model. **Table 10** is the detailed result of regression via fixed impact variable coefficient model. The data of the table shows that, in the transforming country group, coefficient before FDI of each country is all positive value, coefficient before FDI^2 is all negative value, and each coefficient all pass the significance test. Therefore, the conclusion of "there is a reverse U-shaped relation between financial development and income distribution gap" in transforming countries can be made.

Table 7. Johansen co-integration test result.

Hypothesized No. of CE(s)	Fisher Stat.* (from trace test)	Prob.	Fisher Stat.* (from max-eigen test)	Prob.
None	48.79	0.0000*	37.44	0.0000*
At most 1	20.59	0.1322	16.66	0.1206
At most 2	14.40	0.3254	14.40	0.2254

Note: 1) "Deterministic trend specification" optional sequence has deterministic trend while co-integration equation only has the situation of intercept; 2) *, ** and *** respectively present the rejection to original hypothesis at 1%, 5% and 10% significance level, and the accepting to alternative hypothesis.

Table 8. Hausman test result.

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	119.221967	2	0.0000*

Note: *, ** and *** respectively present the rejection to original hypothesis at 1%, 5% and 10% significance level.

Table 9. F test.

Original hypothesis	F statistics	Test result	Model type	Model form
$H_1: \beta_1 = \beta_2 = \cdots = \beta_N$	$F_2 > F_{a_2}(6,36)$ $F_1 > F_{a_1}(4,36)$	Reject H_2 Reject H_1	Variable coefficient model	$y_i = \alpha_i + X_i\beta_i + u_i$
$H_2: \begin{cases} \alpha_1 = \alpha_2 = \cdots = \alpha_N \\ \beta_1 = \beta_2 = \cdots = \beta_N \end{cases}$	$F_2 > F_{a_2}(6,36)$ $F_1 > F_{a_1}(4,36)$	Reject H_2 Accept H_1	Variable intercept model	$y_i = m + X_i\beta + a_i^* + u_i$
	$F_2 > F_{a_2}(6,36)$	Accept H_2	Invariable parameter model	$y_i = \alpha + X_i\beta + u_i$

Note: 1) $F_2 = \dfrac{(S_3 - S_1)/[(N-1)(k+1)]}{S_1/[NT - N(k+1)]} \sim F[(N-1)(k+1), N(T-k-1)]$; 2) $F_1 = \dfrac{(S_2 - S_1)/[(N-1)k]}{S_1/[NT - N(k+1)]} \sim F[(N-1)k, N(T-k-1)]$; 3) In this case, $N = 3$ (country quantity), $k = 2$ (quantity of independent variable), $T = 15$ (period quantity), S is residual sum of squares.

Table 10. Regression result of fixed impact variable coefficient model.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	−1.126811	0.073423	−15.34687	0.0000
_CHINA--FDI_CHINA	5.154017	0.778199	6.623003	0.0000*
_RUSSIA-- FDI _RUSSIA	0.172275	0.213399	0.807292	0.0248**
_BRAZIL--FDI _BRAZIL	0.522516	0.285505	1.830146	0.0755***
_CHINA--FDI2_CHINA	−4.949997	0.798281	−6.200816	0.0000*
_RUSSIA--FDI2_RUSSIA	−0.054511	0.099079	0.550180	0.0856***
_BRAZIL--FDI2_BRAZIL	−0.740766	0.275571	2.688115	0.0108**
Fixed Effects (Cross)				
_CHINA--C	−0.907642			
_RUSSIA--C	0.340994			
_BRAZIL--C	0.566648			
R-squared	0.9513			
Adjusted R-squared	0.9405			

Note: *, ** and *** respectively present the rejection to original hypothesis at 1%, 5% and 10% significance level.

4. Conclusions

This paper conducts empirical test to relation among Ln(GNI), Ln(FDI) and $(\text{Ln(FDI)})^2$ on the basis of 1999-2003 Geni coefficient and M_2/GDP data of developed country group (USA, UK, Germany) and transforming country group (China, Brazil and Russia). The research result shows that: 1) three variables of Ln(GNI), Ln(FDI) and Ln(FDI)^2 of developing country group and transforming country group are all non-stationary sequence and abide by first order integration; 2) there is no stable long-term relation among three variables of Ln(GNI), Ln(FDI) and Ln(FDI)^2 of developed country group, indirectly presenting that there is no long-term reverse U relation between financial development level and income distribution gap in developed countries; 3) in the regression model of transforming country group, coefficient before FDI of each country is all positive value, and coefficient before FDI^2 is all negative value. Therefore the conclusion of "there is a reverse U-shaped relation between financial development and income distribution gap" in transforming countries can be made.

Nevertheless this paper also has some shortcomings which may incur the consequences that: long-term stable co-integration relation between financial development and income distribution cannot be verified, e.g., fairly small group quantity and small country quantity in the group, as well as too short sample period.

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