REINVESTIGATION OF THE RELATIONSHIP BETWEEN INEQUALITY AND BANK-BASED FINANCIAL SYSTEM

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ABSTRACT

This paper assesses the theoretical underpinnings and associated empirical findings of the non-linearity relationship between financial development and inequality by re-examining the results reported in one of the prominent studies in the literature. In contrast to the joint determinations of financial development and inequality, we implement a novel partially linear model to assess the impact of financial development on inequality. We further conduct our own analyses of 1,913 observations of pooled 64 countries over the period 1970-2011. An empirical application suggests that there is dramatic evidence of nonlinearity and there exists a U relation between inequality and bank-based financial system. The U-shaped model suggests that countries choosing to financial development experience a decrease in inequality up to a point, but then can take disadvantage of net benefits after that. Thus, it allows us to unravel the possible directions of non-linearity between the financial development and inequality and to help us shape future policy-oriented research, and to influence the priority that policy makers attach to reforming financial sector policies.

Keywords: Inequality, Bank-based Financial System, U curve, Inverted-U shaped, Partially linear regression

JEL Classification : F21, F31, F36

INTRODUCTION AND LITERATURE REVIEW

Due to its implications for several disciplines, including macro-, micro-economics, and finance, the interrelationships among economic growth, financial development, and income distribution (inequality) have generated separate strands in the existing growth literature. One broad strand assesses the effect of growth on inequality has been extensively examined through a variety of theoretical lenses. Among which, the most influential is the postulation of an inverted-U linkage between income inequality and economic development by Simon Kuznets (1955). Specifically, Kuznets argues that the distribution of income first worsens and then improves as a country develops. More theorization suggested a U- or inverted U relationship that quickly gained popularity and established itself as general theory in the literature. Consistent with this trends, a great deal of empirical research has been undertaken to investigate the relationship between inequality and growth. (Alesina and Rodrik, 1994; Persson and Tabellini, 1994; Li and Zou, 1998; Forbes, 2000; Dollar and Kraay, 2002; Lopez, 2006; Chambers, 2007; Beck et al., 2007; Baumol, 2007; Agnello and Sousa, 2012; Jalil and Feridun, 2011; Hoi and Hoi, 2013; Nikoloski, 2013; Shahbaz et al., 2017)

Another branch of theoretic literature that find the inter-relationship between financial development and growth, the central argument was that more developed financial systems reduce information frictions and transaction costs and as such facilitate growth. In support of this hypothesis, King and Levine (1993a, 1993b), Levine and Zervos (1998), Beck et al. (2000a, 2000b), Levine et al. (2000), Deidda and Fattouh (2002), Rousseau and Wachtel

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(2000), Levine (2004, 2005), based on a discussion of the available empirical evidence, concludes that the overall effect of more finance on growth is positive. Moreover, Beck et al. (2007, 2009) find that an oversized financial sector may result in a misallocation of resources, imperfect competition, instability, rent extraction and negative externalities from financial services. Manova (2008, 2013) also find that financially more developed economies experience disproportionately more exports in financially vulnerable sectors. Given these welfare improvement effects, it is critical to identify the key determinants of the development of financial intermediaries and markets.

According to the Kuznets' hypothesis, Greenwood and Jovanovic (1990) further demonstrate that the effect of financial development on inequality changes as countries progress through two sequential stages of financial expansion. In the first stage characterized by low financial depth, a country suffers from insufficient scale economies and liability of newness, thereby incurring inequality consequences. With increased financial depth, the country gradually progresses in exploiting economies of scale and smoothing the income inequality. However, a few studies report a non-linear relationship due to threshold effects find that the disadvantage of financial development on income distribution occur when the country has reached a threshold level of financial development tends to increase income inequality. Banerjee and Newman (1993), Galor and Zeira (1993), and Clark et al. (2013) have shown a negative relationship between the financial development and income inequality. de Haan and Sturn (2017) suggests that the level of financial development conditions the impact of financial liberalization on inequality. Inekwe et al. (2018) show that independent access to financing has no relationship with income inequality.

However, the aforementioned parametric and nonparametric approaches are mainly focusing on estimating the conditional mean function of inequality. While the mean effects obtained via the conditional mean regression offer intriguing summary statistics for measuring the impacts of covariates, they restricted to the linear function form impact. This paper is an extensive literature on the relationship between financial development and income inequality. In contrast to mean equation, we try to examine the validity of the U- or inverted-U hypothesis across countries, both parametric and nonparametric. As well known, semiparametric regression has become an increasingly important tool to describe the impact of variables not only on the fixed linear model but also on the pattern of the outcome.

The organization of this article is as follows. Section 1 briefly reviews the related studies in more detail. Section 2 proper describes methodology and data used, while section 3 present the main results and sensitivity analysis. The last section offers a concluding remark.

MODELING PROCEDURE AND DATA DESCRIPTION

Modelling Procedure

The mostly commonly-used empirical model can also be combined with the insights of Kuznets (1955) to suggest potential links between the financial development and income inequality. Eq(1) is the following parametric quadratic specification:

$$gini_i = \beta_0 + \beta_1 finance_i + \beta_2 finance_i^2 + W_i^{'}\gamma + \varepsilon_i \tag{1}$$

where 'gini' is the Gini coefficient (income inequality), 'finance' denotes the ration of Liquidity Liabilities to the GDP (level of financial development) and the vector 'w' contains other determinants of inequality. If there exists an inverted-U-shaped link between income inequality and financial development as conjectured by Kuznets (1955), we would expect that β_1 to be significantly positive and β_2 to be significantly negative. Ordinal Least squares (OLS) estimation provides a convenient method of estimating such conditional mean models.

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In order to avoid possible model misspecifications, there are increasing studies employing more flexible nonparametric techniques to estimate the functional form between 'gini' and 'finance' rather than to specify a parametric quadratic relationship ex ante. As a nonparametric counterpart to Eq. (2), we have:

$$gini_i = f(finance_i) + W_i^{'}\gamma + \varepsilon_i \tag{2}$$

where $f(finance_i) = E(gini|finance)$ is assumed to be an unknown but smooth function and $\varepsilon_i, i = 1,2,\cdots,n$, are random variables with mean 0 and variance σ_ε^2 In contrast to the parametric regressions, the $f(\cdot)$ function which describing the relationship between income inequality ('$gini$') and economic development ('$finance$') is now left un-specified However, popular nonparametric approaches such as series expansions (Gallant and Nychka (1987)), nearest neighbor (Yakowitz (1987)), smoothing splines (Eubank (1988), Wahba (1990)), kernels (Härdle (1990)), and wavelets (Donoho, Johnstone, Kerkyacarian and Picard (1995)) can be used to make inference of the unknown function under mild conditions.

In this paper, the unknown function f is estimated by the penalized spline with radial basis. Specifically, let the model be:

$$y = f(x) + \varepsilon \tag{3}$$

Where $y = gini$, $x = finance$, and the underlying model for $f(x)$ is the mixed model,

$$f(x) = \beta_0 + \beta_1 x_i + \cdots + \beta_{m-1}x^{m-1} + \sum_{k=1}^{K} u_k |x - \kappa_k|^{2m-1}$$

For $m = 1,2,3,\cdots$, and with

$$u = (u_1, u_2, \cdots u_k)^{'} \sim N(0, \sigma_u^2 \Omega^{-1/2}(\Omega^{1/2})^{'}),\ \Omega = \left\lfloor |\kappa_k - \kappa_{k'}|_{1\le k,k'\le K} \right\rfloor$$

The $\hat{f}(x)$ can be obtained via estimated best linear unbiased prediction, e.g., Robinson (1991), and the class of penalized spline smoothers may be expressed as,

$$\hat{f} = X(X^{'}X + \lambda^{2m-1}D)^{-1}X^{'}y$$

where $y = (y_1, y_2, \cdots y_n)^{'}, \lambda \equiv \sigma_u^2 / \sigma_\epsilon^2$ is a smoothing parameter which can be estimated via restricted maximum likelihood,

$$X = \begin{bmatrix} 1 & x_1 & \cdots & x_1^{m-1} & |x_1 - \kappa_1|^{2m-1} \cdots |x_1 - \kappa_K|^{2m-1} \\ 1 & x_2 & \cdots & x_2^{m-1} & |x_2 - \kappa_1|^{2m-1} \cdots |x_2 - \kappa_K|^{2m-1} \\ \vdots & \vdots & \ddots & \vdots & \vdots \quad \ddots \\ 1 & x_n & \cdots & x_n^{m-1} & |x_n - \kappa_1|^{2m-1} \cdots |x_n - \kappa_K|^{2m-1} \end{bmatrix}$$

And

$$D = \begin{bmatrix} 0_{2\times 2} & 0_{2\times K} \\ 0_{K\times 2} & (\Omega^{1/2})'\Omega^{1/2} \end{bmatrix}$$

As is in the parametric cases, we might want to include some controlling variables in the nonparametric regression as in equation (3). For example,

$$gini_i = f(finance_i, w_i) + \epsilon_i \tag{4}$$

where, again, w_i represents a $k \times 1$ vector of explanatory variables so that there are $k+1$ variables enters nonparametrically. However, as is well unknown in the literature, the high-dimensional nonparametric regression models, unless they rely on additional structure (such as additive separability), suffer from the "curse of dimensionality" which severely limits our ability to estimate the regression relationship with any degree of precision.

One simple way to get around of this difficulty, at some cost of flexibility, is to follow Robinson (1988) by specifying a partially linear regression model as,

$$gini_i = f(finance_i) + w_i^{'}\gamma + \in_i \tag{5}$$

where only one component, i.e., finance, enters the regression nonparametrically whereas the other controlling variables w are specified parametrically. A particularly appealing feature of this model is that it permits the inclusion of many explanatory variables without succumbing to the "curse of dimensionality".

Data Sources

To empirically test the impact of financial development on inequality across countries, we collect data on liquidity liabilities as well as comparable data on income inequality is a pooled dataset consisting of 1,913 observations on 64 countries observed from 1970 to 2011. The "gini" and "financial development" data used in this paper is taken from World Income Inequality Database and Čihák et al. (2012), respectively. In case of a completely egalitarian income distribution in which the whole population has the same income, the Lorenz curve would be the dashed 45-degree line. From this it is clear that the Gini coefficient will be equal to 0 when the distribution is equal. The Gini coefficient, 'gini', is used to measure the degree of income inequality. Table 1 and Table 2 provide descriptive statistics and correlations of the variables for the sample countries, respectively. The correlation matrix indicates that inequality measures are negatively linearly correlated with the level of financial development.

Table 1. Summary Statistics

Variable	Mean	Std. Dev.	Min	Max	Obs.
gini	38.3790	9.9268	19.7000	67.4000	1,913
lly	3.8548	0.7208	1.2556	5.9892	1,894
llysq	15.3785	5.4435	1.5766	35.8710	1,894
pcgdp	8.7386	1.4255	5.5761	11.3636	1,907
pop	15.4857	1.8143	7.1050	20.5489	1,901
sch	3.7401	0.8837	0.1098	4.9390	1,913
gov	1.1695	0.9994	-4.0981	6.3378	1,612
inv	3.0803	0.2435	1.6837	3.8278	1,909
trade	4.1086	0.5726	2.0199	6.0097	1,909
pi	1.8056	1.4201	-28.9404	8.9202	1,873

Note: 1. The dataset is taken from the World Development Indicator online at http://data.worldbank.org. 2. Except "gini" variable, all variables are in their logarithmic form.

As for financial development, we follow Levine et al. (2000) in using Liquidity Liabilities (lly) as our preferred indicator of financial development. This is the sum of currency and demand and interest-bearing liabilities of banks and non-bank financial intermediaries, divided by GDP. This is also a commonly-used measure of financial depth, although it might

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involve double counting and it includes liabilities backed by credits to the public sector. In addition to the financial variables, we include several variables to control for other factors that might affect inequality. Specifically, we include linear terms of the logarithm of real per capita GDP (pcgdp) that is independent of any effect of financial development.

To strengthen our empirical results, we also experiment with alternative conditioning information sets in the determination of financial development on inequality. We seek to reduce the chance of omitted important variables. The conditioning information set includes the average years of schooling in the population (sch), which is used to serve as an indicator of the human capital stock in the economy. The sum of import and export as a share in GDP (trade), the ratio of government expenditure to GDP (gov), the ratio of investment to GDP (inv) and the inflation rate (pi) are used to measure macroeconomic stability.

Table 2. Correlation Matrix

	gini	lly	llysq	pcgdp	trade	gov	inv	pi	sch
lly	-0.4144	1							
	(0.0000)								
llysq	-0.4028	0.9876	1						
	(0.0000)	(0.0000)							
pcgdp	-0.5688	0.4993	0.5114	1					
	(0.0000)	(0.0000)	(0.0000)						
trade	-0.1376	0.2013	0.2281	0.1319	1				
	(0.0000)	(0.0000)	(0.0000)	(0.0000)					
gov	0.2165	-0.1390	-0.1472	-0.3378	-0.0480	1			
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0543)				
inv	-0.2786	0.3636	0.3486	0.2098	0.0714	0.0906	1		
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0018)	(0.0003)			
pi	0.2625	-0.4589	-0.4682	-0.3051	-0.2248	0.1525	-0.1203	1	
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)		
sch	-0.3034	0.3562	0.3681	0.6293	0.3266	-0.3218	0.1059	-0.2760	1
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	

Note: The values in parentheses are p-value.

EMPIRICAL RESULTS AND DISCUSSION

The results of the parametric regression analyses are provided in Table 3. In the Model A of Table 3, we first summarize the results from the parametric conditional mean as in Eq(1) without considering any control variables, i.e. w is an empty set. In this simple form, the conditional mean results in column (1) shows that the estimates of 'lly' and 'llysq' are -0.246 and 0.0127, respectively. Both are significant at 1% level, and have the different expected signs, thus, providing a preliminary U-shaped relationship between income inequality and financial development. The magnitude of -0.246 implies that a 1% increase in financial development decreases income inequality by around 0.246%.

In order to assess the robustness of our results, we use the pooled ordinary least square estimators. Model B to Model D of Table 3, we report conditional mean estimates with additional explanatory factors such as 'pcgdp', 'trade', 'gov', 'inv', 'pi' and 'sch' included. From column (2) to column (4), we can see that the main finding of the conditional results does not change, namely, a significantly negative coefficient on 'lly' and a significantly positive estimate on 'llysq'. Judged by the corresponding significance level, we are inclined to conclude that the evidence of the U curve is even stronger. This result suggests that a well-functioning financial sector system is essential for promoting economic and reducing income inequality by increasing the availability of financial services to the poor for financing their capital investments. For example, in Model D, finance development appears to have a negative and statistically significant impact on income inequality, while the coefficient of its square term has positive and significant impact on income inequality at 1% level. The magnitude of -0.243 indicates that a 1% increase in finance development growth decreases income inequality by 0.243%, suggesting that when financial development growth continues to increase, income inequality starts to increase.

Table 3. Results of Parametric Regression

Variables	Model A	Model B	Model C	Model D
Constant	4.366***	5.556***	5.495***	5.635***
	(52.95)	(47.27)	(44.20)	(39.47)
lly	-0.246***	-0.280***	-0.268***	-0.243***
	(5.574)	(7.540)	(7.151)	(7.026)
llysq	0.0127**	0.0329***	0.0323***	0.0283***
	(2.201)	(6.608)	(6.192)	(6.102)
pcgdp		-0.0890***	-0.0879***	-0.109***
		(17.87)	(17.29)	(17.75)
trade		-0.0283**	-0.0267**	-0.0666***
		(2.401)	(2.136)	(5.003)
gov		0.0150***	0.0137**	0.0194***
		(2.591)	(2.347)	(3.242)
inv		-0.160***	-0.166***	-0.157***
		(6.176)	(6.329)	(5.882)
pi			0.0154***	0.0141***
			(2.963)	(2.750)
sch				0.0551***
				(6.314)
Observations	1,894	1,595	1,560	1,552
F-statistics	254.79***	153.20***	141.18***	125.11***
R-squared	0.173	0.382	0.391	0.421

Note: ***, ** and * denote significance at 1%, 5% and 10% level, respectively. The values in parentheses are t-statistics.

As expected, both 'pcgdp' and 'trade' exert negative and highly significant impacts on income inequality, ie, an increase in the per capita GDP, 'pcgdp', country openness, 'trade', and domestic investment, 'inv' are found to improve income inequality in a given country. In addition, the estimates of the government expenditure for fiscal policy and inflation for economics stability are each positive, statistically significant. All models are statistically significant (p< 0.001) and, therefore, fit the data well.

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Table 4. Results of Semi-parametric PLR Model

VARIABLES	Model E	Model F	Model G	Model H
f(lly)	Figure 1	Figure 1	Figure 1	Figure 1
	(left first)	(left second)	(right second)	(right first)
pcgdp		-0.0794***	-0.0787***	-0.105***
		(18.22)	(17.87)	(17.07)
trade		-0.0158*	-0.0155	-0.0669***
		(1.672)	(1.575)	(5.066)
gov		0.0116**	0.0114**	0.0178***
		(2.160)	(2.110)	(3.375)
inv		-0.133***	-0.141***	-0.122***
		(5.559)	(5.806)	(5.090)
pi			0.0123**	0.0103**
			(2.368)	(2.025)
sch				0.0693***
				(8.760)
Observations	1,889	1,595	1,560	1,552
F-Statistics	191.7***	172.7***	149***	122.9***
R-squared	0.3851	0.4038	0.4048	0.4187

Note: ***, ** and * denote significance at the 1%, 5% and 10% level, respectively. The values in parentheses are t-statistics.

Moreover, in order to avoid the possible problem of model misspecification, we present the estimation results from the more flexible and robust semiparametric regressions, and the corresponding graphs depicting the effects of finance development on the inequality are show in Figures 1. First, as in the previous section, we consider the most basic (when w is a null set) form between 'gini' and 'finance' and display the graphical results in the left first of Fig. 1. It can be seen that the fitted nonparametric line (unknown function between 'gini' and 'finance') along with two standard error bands indicates that, after a slightly initial decrease in inequality, the income distribution keeps on improving as the financial system develops. The robust results of the extended different information sets are reported (Model F~G in Table 4). Various models are used for sensitivity checks. The results indicate that financial development is relevant in explaining market income inequality across countries. The results is similar in the dynamic specification but with smaller coefficient size.

Overall, the robustness analysis suggests that the coefficient estimates remained almost similar in magnitude and sign as both in parametric and semiparametric model. These empirical findings provide strong evidence that the initial results are robust. The resulting U-shaped curve is comparable to the result obtained from the parametric counterpart. we find that the inequality first decreases, then raises, and finally increases again in the course of financial development. In summary, financial sector development reduces inequality most in countries with relatively small scale, while increase with more developed financial markets. The conventional way to allow the linkage to have a U shape is to incorporate a quadratic term in an otherwise standard linear model.

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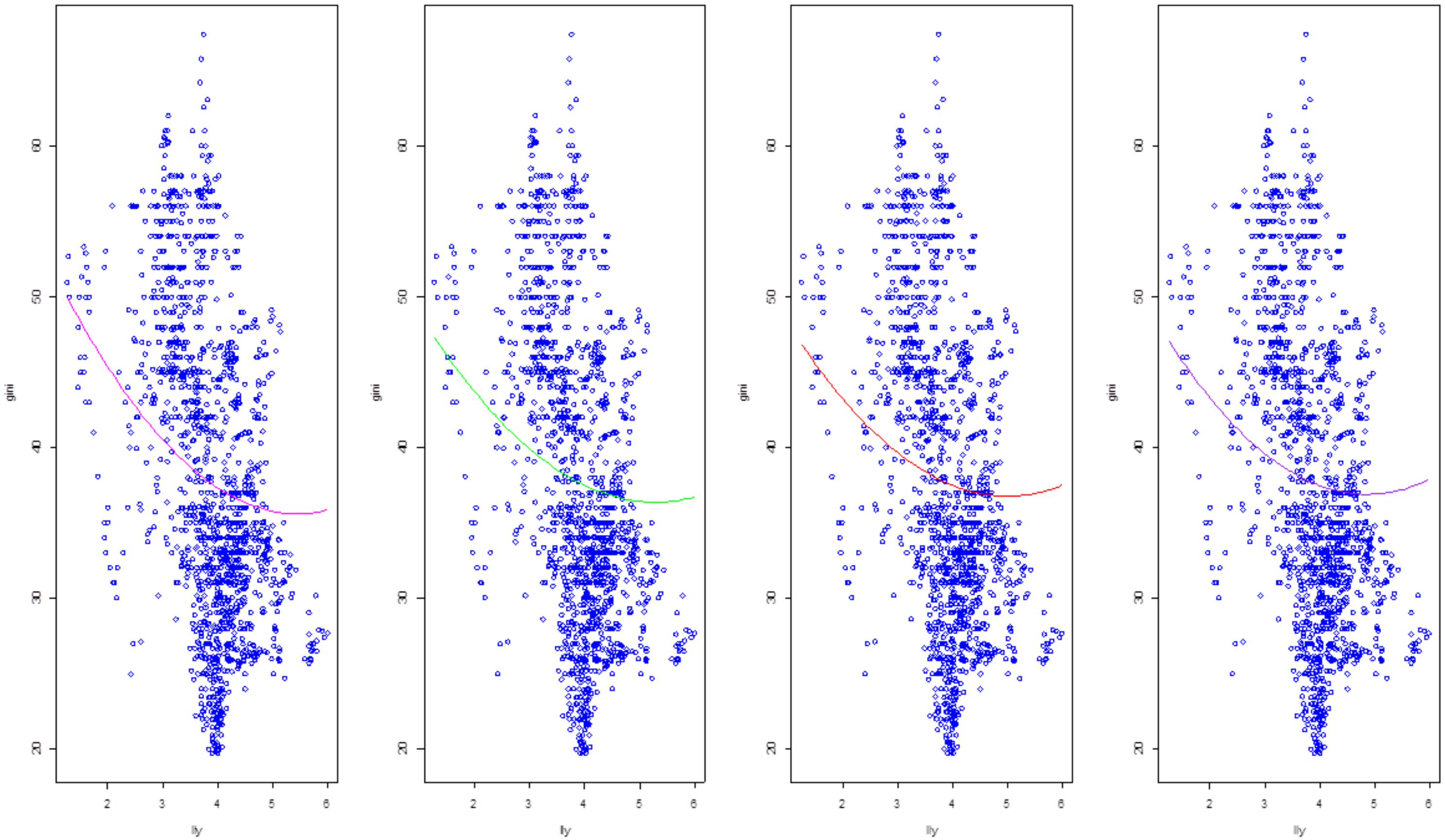

Figure 1: The fitted lines along with two standard error bands from the semiparametric partially linear regression in equation (5) with “gini” is the dependent variable and w is an empty set (left first panel), w=(pcgdp, trade, gov)’ (left second panel) and w=(pcgdp, trade, gov, inv, inf)’ (right second panel), and w=(pcgdp, trade, gov, inv, inf, sch)’ (right first panel), respectively.

CONCLUSION

This paper seeks to strengthen the existing literature by examining the relationship between financial development and income inequality for cross countries in favor of a U-shaped relationship, by using annual pooled data covering the period 1960-2011. Our results provide reasonably strong evidence that inequality decreases as economies develop their financial intermediaries, consistent with Galor and Zeira (1993), Banerjee and Newman (1993) and Clarke et al. (2013). However, there is no evidence of an inverted-U shaped relation between financial sector development and income inequality, as suggested by Greenwood and Jovanovic (1990). Based on indirect finance channel, financial institutional play the main financing role in the economics system. Initially, individuals or firms can borrow from the banks, improve the income inequality. Due to capital market imperfections, most agents can't borrow enough to run higher-return investment, these models suggest that countries with larger capital market imperfections should have higher income inequality. In other words, higher hurdles to borrow funds to finance investment when financial development excess the threshold. Finally, we observe a negative relationship between financial development and income inequality in linear hypothesis, then a positive effect of financial development on income inequality in its square term.

In contrast to the Kuznets (1955), Greenwood and Jovanovic (1990) to suggest potential links between the financial sector development and income inequality. Based on different industry structure, as people move from the low financial development to the high development, but more egalitarian in agricultural sector than in greenfield sector. As all we known, only a minority of people initially benefit from the higher income possibilities in the economics system, income inequality decreases at the initial stage of financial development. Financial development affect income inequality if agents require access to finance more to migrate to the greenfield sector. As suggested by Clarke et al. (2013) income inequality is likely to be higher in the greenfield sector, and if entry into this sector is made easier when it is easier to gain access to finance, inequality will be greater in financial develops.

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