DOES TOO MUCH FINANCE HARM GROWTH?: PRE AND POST GLOBAL FINANCIAL CRISIS ANALYSIS

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ABSTRACT

The existing studies found that the relationship between financial development and economic growth was nonlinear with an inverse U-shape, where financial development will harm the economic growth after surpassed the threshold point. The objective of this study is to investigate the nonlinear relationship between financial development and economic growth for 65 developing countries from 1980-2015 by using Generalized Method of Moment (GMM). We split the sample into two regimes, 1980-2008 and 2009-2015, which is before and after global economic crisis. Three financial indicators namely domestic credit, liquid liabilities, and private credit are used in this study. The results from our study, however found that the findings were contrasted from the past literature for 2009-2015 subsample. Based on the results from second regime, interestingly, the relationship of financial development and economic growth is nonlinear but U-shape for all indicators. It means that the financial development will accelerate economic growth after reach the turning point. The results of the Sasabuchi-LindMehlum test also confirmed the nonlinear mixture of inverse U-shape for first subsample but U-shape for second subsample. It shows that the higher financial development will improve better performance on economic growth for the recent economy. Thus, our results provide new insight in recent literature and policy review.

Keywords: financial development, economic growth, nonlinear, U-shape

1. Introduction

There is a huge amount of the studies on investigated the relationship between financial development and economic growth, for example, King and Levine (1993a, 1993b), Demetriades and Hussein (1996), Levine (1997, 2003), Rajan and Zingales (1998), Levine et al. (2000), Al-Yousif (2002), Beck and Levine (2004), Bertocco (20080), Hassan et al. (2009), Jalil et al.(2010), Rahaman (2011), and Kendal (2012). The studies were found that the financial development had a positive effect on economic growth, according to the pioneer work

by Schumpeter (1911), followed by King and Levine (1993a) who supported the 'more finance, more growth' hypothesis. The study by Levine (1997), financial indicators enhance the economic growth, by assisting allocate capital to be more benefited.

However, a number of studies show that the effect of financial development on economic growth is conditional on many factors rather than itself. The performance of financial development on economic growth is depends on threshold of other variables such as inflation, government size, trade openness and income per capita (Yilmazkuday, 2011). The other mediating variables such as financial sector policies (Abiad and Mody, 2005; Ang, 2008), legal systems (La Porta et al., 1997, 1998), government ownership of bank (La Porta et al., 2002; Andrianova et al., 2008), political institutions (Girma and Shortland, 2008; Roe and Siegel, 2011; Huang, 2010), culture (Stulz and Williamson, 2003), trade and financial openness (Rajan and Zingales, 2003; Baltagi et al., 2009; Law, 2009), remittances (Aggarwal et al., 2011; Demirguc-Kunt et al., 2011), institutions (Law and Azman-Saini, 2012; Law et al., 2013; Law et al., 2017).

A number of studies show that the relationship between financial development and growth depends on many qualifications. Beck and Levine (2004) and Ndikumana (2005) investigated whether bank-based or market-based systems are more efficient in promoting economic activity, concluding that both types of financial intermediation play a significant role. In addition, Rousseau and Wachtel (2000) show that the increasing influence of stock markets on economic activity holds for both developed and developing economies. Rousseau and Wachtel (2002) also consider the role of inflation and find that there is an upper threshold above which financial development ceases to have a positive effect on growth. While Aghion et al. (2009) pointed out the importance of the level of financial development in understanding the relationship between growth and exchange rate volatility.

In nonlinear properties, Deidda and Fattouh (2002) and Rioja and Valev (2004a) found that the relationship between financial development and growth is not significant in low-income countries, but it has positive and significant impact in high-income countries. Furthermore, Rioja and Valev (2004b) highlighted the impact of financial development on economic growth is positive only when it has achieved a certain level or threshold point. The studies from Shen and Lee (2006), Ergungor (2008) and Hung (2009) also discovered patterns on nonlinearity in the relationship between financial development and growth. Based on the findings, all these papers suggested that a well-developed financial development to be increase and supported the 'more finance, more growth' proposition.

However, the global financial crisis in 2007-2008 that hit the global economy has led both academics and policymakers to reconsider their prior conclusions. The crisis has illustrated the possibilities that malfunctioning financial systems can directly and indirectly waste resources, discourage saving and encourage speculation, resulting in underinvestment and a misallocation of scarce resources. Consequently, it may led to the economy stagnant, increasing the unemployment and poverty is impaired. The drastic falls in real sector activity during the crisis, due to adverse implications of financial turbulence, highlight the need for economists and policy makers to question the optimal size of financial systems for sustainable economic growth. In addition, the sub-prime mortgage crisis where the people who are disqualified to borrow the money for buying house has been lending for second chances. The second chances because of the moral hazard from the bankers to get the commission and also to cover the house construction industry. When the borrowers unable to repay the money, the non-performing loan increases. The global financial crisis is not only effect to Asian countries, but the whole world economics which also reflect the developing countries. These conditions implies the question: does finance is found to boost the economic growth regardless of the size and growth of the financial sector? In the other words, does the size and growth of financial sector should be limited?

Thus, the proposition of 'more finance, more growth' has been challenged with the above questions. Moreover, the studies Arcand et al. (2012) Cechetti and Kharroubi (2012), Law and Singh (2014), and Samargandi et al. (2015) highlighted the positive effect of financial development is limited up to the certain point, but then the financial development will dampen the economic growth after surpassed the threshold value. This implies that the relationship between finance and growth is a non-linear with inverted U-shape or exist the economic Kuznets curve. These studies suggested the 'too much finance harm growth' hypothesis. The other example such as Huang and Lin (2009) pointed out that the positive effect between financial development and growth is larger in low-income countries than in high–income countries, that contrary with the findings from the study by Rioja and Valev (2004b). The conflict between 'too much finance' hypotheses or 'vanishing effect' (Arcand et al., 2012; Cechetti and Kharroubi, 2012, Law and Singh, 2014; Sarmargandi et al., 2015) contradict with the hypothesis of 'more finance, more growth' by Levine (1993) and Schumpeter (1911). This conflict implies a discussion on revealing the ambiguity of these mixed findings. Hence, the nonlinearity relationship between financial development and economic growth is still in debate.

Understanding the relationship between financial development and economic growth is important to the policy makers who are concerning the facts that surrounding around to the particular issue to make a decision on regulation, controlling and monitoring the financial intermediaries' activities. Ang (2008) emphasized that an appropriate specification of the functional form is critical in understanding the relationship between financial development and growth since several studies have shown that the finance-growth nexus may be nonlinear, thus, more research in this area is necessary.

Since these hypotheses are contradict, we create some doubt from the previous findings by pointed out the question as highlighted by Law and Singh (2014) that, does the too much finance harm growth permanently or temporarily? Thus, in this study, we extend the existing literature to scrutinize the consistency of the 'too much finance' hypothesis by splitting the sample of 65 developing countries into two regimes, with and without global financial crisis. First regime is the period starting from 1980 through 2008 by considering the period global financial crisis in 2007-2008 in our sample. While, second regime is the period after the global financial crisis that covered from 2009 until the recent data of year 2015. The global financial crisis in 2007-2008 has been chosen as defining moment in this study for two reasons, mainly because of the recent economic crisis on our sample and the global financial crisis is more affect the developing countries in our sample as compared to Asian financial crisis.

The purposed of this study are focused on two main objectives. First, the objective of the study is attempted to examine the consistency of nonlinearity between financial development and economic growth relationship of inverted U-shaped as found from the previous study (Arcand et al., 2012; Cechetti and Kharroubi, 2012; Law and Singh, 2014; Samargandi et al., 2015) by splitting our sample into the period until the global financial crisis in 2008 that reflects the countries in our sample and after this Great Depression. Second, we investigate whether there is the different of the threshold points of these two regimes which entails to the discussion on the policy review, that extent to which the financial activities during the soft-landing activities period.

This study is organized as follows. In the next section, the previous empirical studies on the relationship between finance and growth are highlighted. Section 3 presents the data, empirical model and the econometric methods applied in this study. The empirical results and discussions are enclosed in Section 4. The last section provides a summary and conclusions.

2. Past Empirical Studies

Despite the recognition of financial intermediation's crucial role in economic activity, policymakers had not been proactive in promoting financial development prior to the 1970s. In the early 1970s McKinnon (1973) and Shaw (1973) developed theoretical arguments challenging the policies leading to financial repression. According to their study, financial liberalisation would reduce the financial repression and would bring up the financial development and spur the economic growth. Moreover, the liberalizing financial markets would allow emerging economies to access international capital markets, allowing consumption smoothing, risk sharing, and producing a virtuous circle between financial development and efficient capital allocation.

The development of endogenous growth theory during the 1980s and 1990s (Greenwood and Jovanovic, 1990; Bencivenga and Smith, 1991; King and Levine, 1993b; Blackburn and Hung, 1998) led to the construction of several models that incorporated financial institutions and described the mechanisms through which financial development could affect growth. Capital accumulation channel and total factor productivity channel has been identified as to how well-functioning financial systems would affect savings and allocation decisions. The capital accumulation is channelled to the local and foreign entrepreneurs who need funds in order to invest that led to widen the financial liberalisation. Notwithstanding, in the early 2010s Broner and Ventura (2010) argue that the financial liberalisation is not prolonged boost the economic growth due to the pro-cyclicality of the financial system emerges as one of the main factors to the global financial crisis in 2008.

There is exist comovement between financial development and economic growth as founded in the studies by Demetriades and Husein (1996), Arestis and Demetriades (1997), Christopoulos and Tsionas (2004) and Apergis et al. (2007). The cointegration between these two variables shows the long run relationship between financial development and economic growth. Odedokun (1996), Beck et al. (2000), Benhabib and Spiegel (2000) and Henry (2000) found that several measures of financial development are positively correlated with real per capita GDP, TFP and the investment rate.

Finance-growth nexus has been proven in the causality analysis. Luintel and Khan (1999), Shan et al. (2001), and Calderon and Liu (2003) found bi-directional causality between financial development and economic growth. On the other hand, Ang and McKibbin (2007) with focusing on the case of Malaysia, find that growth leads financial development. In contrast, Neusser and Kugler (1998), Rousseau and Wachtel (1998), and Choe and Moosa (1999) provide evidence that financial development leads economic growth. Graff (2005) underlined the possibility of a causal relationship between financial development and economic growth postulates three distinguish perspectives. First, the provision of an inexpensive and reliable means of payment such as coins and later banking money, which historically came as a by-product of fractional reserve banking (Kindleberger, 1993). Second, a volume effect, where financial activity increases savings where the resources can be channelled into investment and thirdly, an allocation effect which improves the allocation of resources devoted to investment (Gurley and Shaw, 1960).

Cross-sectional studies tend to provide evidence supportive of the positive role of financial sector development. For instance, using data from 90 countries King and Levine (1993a) document strong and positive correlation between measures of financial development and per capita output growth. This finding is further substantiated by King and Levine (1993b), Levine and Zervos (1998), and Rajan and Zingales (1998). Xu (2000) further notes that "there is strong evidence that financial development is important to economic growth both in the short-term and in the long-term (p. 333) in his analysis of 41 developing countries. Moreover,

by examining five industrialized countries over the period 1870-1929, Rosseaul and Watchel (1998) provide strong evidence for a unidirectional causality from finance to economic growth.

However, there is fragility of the relationship between financial development and economic growth (Ibrahim, M., 2007). Financial development can reduce the real supply of domestic firms as consumers may substitute loans from informal curd markets to formal markets (Van Wijbergen 1983). This can lead to credit crunch and retard economic growth. Further, some even argue that financial development may have adverse repercussion on economic growth. The presence of financial instability decreases favourable macroeconomic conditions for a strong economic growth. There are easy mobilization of productive savings, efficient resource allocation, reduction of information asymmetry, and improvement of risk management (Schumpeter, 1991).

This statement have been proven by looking the situation in the global financial crisis. The global financial crisis in 2008 was marked clearly in the study by Calomiris (2009) with the following events: the increase in subprime delinquency rates in the spring of 2007, the ensuing liquidity crunch in late 2007, the liquidation of Bear Stearns in March 2008, and the failure of Lehman Brothers in September 2008. The resulting decline in economic activity came to full view in 2008, as the US economy officially slipped into a recession following the peak in December 2007. The study from Claessens et al. (2010) found that there is not all countries were affected at the same time or to the same extent. Some were impacted mainly through rapid financial spillovers and others through the subsequent collapse in international trade. The advanced countries such as Ireland and Iceland were affected first. Next were countries with strong financial links with the United States, following several Western European countries such as Estonia, Latvia and United. Most emerging markets were only affected later, when the collapse in global demand led to a contraction in global trade. Thus, the developing countries impacted by the subsequent collapse in open economies from the crisis. For example, Thailand and Turkey affected in second quarter in 2008, following by Bolivia, Brazil, China Colombia, Costa Rica, Malaysia, Peru, Philippines, Romania, Russia, and South Africa in third quarter of year 2008.

The precipitating factor was a high default rate in the United States subprime home mortgage sector. The expansion of this sector was encouraged by the Community Reinvestment Act (CRA) a US federal law designed to help low- and moderate-income Americans get mortgage loans. Many of these subprime (high risk) loans were then bundled and sold, finally accruing to quasi-government agencies. The implicit guarantee by the US federal government created a moral hazard and contributed to a glut of risky lending. Many of these loans were also bundled together and formed into new financial instruments called mortgage-backed securities, which could be sold as low-risk securities partly because they were often backed by credit default swaps insurance. Because mortgage lenders could pass these mortgages on in this way, they could and did adopt loose underwriting criteria, and some developed aggressive lending practices. The accumulation and subsequent high default rate of these mortgages led to the financial crisis and the consequent damage to the world economy. Low-quality mortgage-backed securities backed by subprime mortgages in the United States caused a crisis that played a major role in the end of 2007 global financial crisis.

Hence, the government respond to crises with bailouts that allow new expansions to begin. As a result, financial markets have become ever larger and financial crises have become more threatening to society, which forces governments to enact ever larger bailouts. This process culminated in the current global financial crisis, which is so deeply rooted that even unprecedented interventions by affected government. Therefore, the response to the subprime crisis should not be to roll back the clock, and punish the technologies and markets that have the future potential to reduce risk, improve economic equity and provide the foundation for a sounder, fairer financial system. This crises are closely linked in the aftermath of financial

liberalization. The solution to the market failure lies in better and more liquid markets. Henceforth, year 2008 has been chosen as defining moment in our study. By looking at the performance of financial development after the global financial crisis, do the countries learnt something from the crisis? Should we worry about the hypothesis of too much finance?

Therefore, the present study is interesting to investigate the nonlinearity of the relationship between financial development and economic growth that attracted the academicians and policy maker to identify the optimum level of financial development to spur economic growth (see Table 1). The study by Deidda and Fattouh (2002) found the evidence of a nonlinear relationship between financial development and economic growth. Financial development has a positively significant impact on economic growth holds after a specific threshold with high initial per capita income, whereas in countries with low initial per capita income there seems to be no statistical significance. On the other hand, Ketteni et al. (2007) found that the linearity of financial development and growth holds only when nonlinearities between growth, initial income and human capital are taken into account. Based on the past literature in nonlinearity between financial development and economic growth as shown in Table 1, there is no study which covered the period of study from 1980 to 2015. In addition, the studies did not covered the sample after the global financial crisis in 2007-2008. The studies also combining the developed and developing countries, but not focus or splitting into developed and developing countries.

Thus, our contribution focus on five main things. First, we split the sample of the period from 1980 to 2015 into two regimes. The first regime is started from 1980 through 2008 with considering the duration on global financial crisis, the second regime covers the period after global financial crisis started from 2009 until 2015. By homogenizing the data for the case of after the global financial crisis in the second regime, we can further investigate the recent economic condition and also the efficiency of financial regulation had been taken after the crisis. Second, we investigate whether there is exist nonlinear mixture between these two regimes. Third, we examine the difference of threshold value between these two regimes, which indicates the transition period of the economy. Thus, it implies further discussion on soft landing policy during the transition period. Forth, we use the long time period until the recent data covers from year 1980 to 2015. Fifth, we focus only for developing countries since the financial development is more relevant in developing countries who depends on the financial intermediaries to spur the economic growth as compared to developed countries.

By splitting the sample into two different regime, we would be to identify state the level of financial development at which any further improvement would exert the economic impact once again. This is important to policy makers because some of the policy makers may reduce to extend the financial development after knowing that is harmful to growth. By identifying two threshold level in our this study, we suggest to provide insight to policy makers how much more the financial development should be improve after the financial crisis in order for it to regain its strength in boosting economic growth once again.

Table 1: Summary of past studies in nonlinear relationship between financial development and economic growth

Authors	Sample of study	Type of data and sample period	Method	Variables	Findings
Deidda and Fattouh (2002)	119 Developed and developing countries	Cross-sections (1960-1989)	Hansen (2000) threshold regression (two groups: high and low income countries)	Liquid liabilities (% of GDP)	Nonlinear relationship between finance and growth. Finance is significant determinant of growth in high-income countries but insignificant in low-income countries
Rioja and Valev (2004a)	74 Developed and developing countries	Panel data (1961-1995) averaged over 5-year interval	Dynamic panel GMM (three regions: low, intermediate and high level of financial development)	Private credit, commercial central bank, liquid liabilities	Financial has large positive effect on growth in intermediate financial development region. It is positive but the effect is smaller in high region, but insignificant in low region.
Graff (2005)	90 countries	Panel data (1950-2000)	Pooled OLS	The share of the labour force employed in the financial system, the share of financial system in GDP, M2/GDP	Thresholds are delimiting regimes of higher and lower marginal contribution of financial activity to economic growth.
Shen and Lee (2006)	48 Developed and developing countries	Panel data (1976-2001)	Pooled OLS	Private sector credit, liquid liabilities, interest rate spread, ratio of total stock traded value, stock turnover ratio	Nonlinear inverted U-shaped relationship between finance (stock market variables) and economic growth, however bank development is better described as a weak inverted U-shaped
Huang and Lin (2009)	71 Countries of high and low income countries	Cross-sections (average from 1960 to 1995)	Caner and Hansen (2004) IV threshold regression (two regimes: high and low income countries)	Private credit, commercial-central bank, bank assets, liquid liabilities.	Nonlinear positive relationship between finance and growth. The positive effect is more pronounced in the low-income countries than in the high-income countries
Yilmazkuday (2011)	84 countries	Panel data (average over 5-year periods from 1965 to 2004)	2 stage least square	Liquid liabilities (% of GDP), the ratio of M3 less M1 to GDP	High inflation crowds out positive effects of financial depth on long-run growth; small government sizes hurt finance-growth nexus in low-income countries, while large government sizes hurt the finance-growth nexus in high-income countries; low levels of trade openness are sufficient for finance-

					growth nexus in high-income countries, but low-income countries need higher levels of trade openness for finance-growth nexus; finance-growth nexus are higher for moderate per capita income levels.
Arcand et al. (2012)	>100 developed and developing countries	Cross-sections and panel data (1960-2010)	Semi-parametric estimations	Private sector credit to deposit money by banks and other financial institutions divided by GDP	Finance starts having a negative effect on output growth when credit to private sector surpassed 100% of GDP. The results are consistent with the 'vanishing effect' hypothesis
Cecchetti and Kharroubi (2012)	50 developed and emerging countries	Panel data (5-year non-overlapping from 1980 to 2009)	Pooled OLS with robust standard errors	Private sector credit (% of GDP)	Financial sector has an inverted U-shaped on productivity growth.
Law and Singh (2014)	87 from developed and developing countries	Panel data (1980-2010)	Dynamic panel threshold, GMM	Private sector credit (% of GDP), liquid liabilities (% of GDP), domestic credit to private sector (% of GDP)	Non-linear inverted U-shaped relationship between finance (private credit, liquid liabilities, domestic credit) and economic growth. Threshold value: private credit,
Samargandi et al. (2015)	52 middle income countries (MIC)	Panel data (1980-2008)	Pooled Mean Group (PMG), Mean group (MG), Dynamic Fixed Effect (DFE), U-test, dynamic panel threshold regression (three groups: all, upper and low middle income countries)	Liquid liabilities (% of GDP), ratio of commercial bank assets to the sum of commercial bank assets and central bank assets, ratio of bank credit to the private sector to GDP	Non-monotonic inverted U-shape between financial development index and economic growth Threshold value for MIC: PMG (), MG(), DFE ()Dynamic panel threshold regression (0.915)
Law et al. (2016)	85 cross-country	Cross-section (1980-2008)	Caner and Hansen (2004)	Private sector credit (% of GDP), commercial bank assets (% of GDP), liquid liabilities (% of GDP)	Threshold effect in the finance-growth relationship. The impact of finance on growth is positive and significant only after a certain threshold level of institutional development has been attained.

Sources: Law and Singh (2014) and author's compilation

3. Econometric Model and Data

An endogenous growth theory emphasized the capital concept in growth models. The importance of capital in the production function of Y such as AK model adopted in Aghion and Howitt (1998) is given by

$$Y_t = AK_t \tag{1}$$

where Y denotes the output, A is a constant that reflects the level of technology in the economy and is assumed to vary with time and K is capital. According to Hicks (1937) following AK model as applied by Jalil et al. (2010), a certain proportion of savings, the size of $(1 - \lambda)$ with $0 < \lambda < 1$, is the cost of financial intermediation per unit of savings. Therefore, the smaller the λ, the more efficient is the financial system. To indicate the changes of capital stock changes by $\dot{K}$ from dK/dt explain by $\dot{K} = \lambda sY - \delta K$. From Eq. (1), the growth rate of output per capita g_y can be expressed as:

$$g_y = g_A + g_k \tag{2}$$

where the growth rate of capital is

$$g_k = \frac{\dot{K}}{K} = \frac{\lambda S}{K} - \delta$$

by given $s = \frac{S}{Y} = \frac{S}{AK}$, therefore AK model can be written as:

$$\frac{\dot{K}}{K} = A\lambda s - \delta \tag{3}$$

Eq. (2)-(3) expresses that economic growth per capita depends on the total factor productivity (A), the efficiency of financial intermediation (λ), and the rate of savings (s). When depreciation rate δ is assumed to be constant, economic growth depends on financial development. The level of be λ is determined by the level of financial development while g_k can be articulated as financial intermediation.

Translating the endogenous growth theory into baseline model by referring to Beck and Levine (2004), the impact of financial development on economic growth can be expressed as follows:

$$\text{GROWTH} = f\,(\text{FINDEV, FDI, GFCF, CPI, HC}) \tag{4}$$

where, GROWTH indicates GDP per capita growth, FDI indicates foreign direct investment inflows as a percentage to GDP, GFCF indicates gross fixed capital formation, CPI indicates consumer price index, and HC indicates average years of schooling as a proxy for human capital. While, FINDEV indicates financial development by using three indicators separately, which include domestic credit to private sector, liquid liabilities and private credit to deposit money.

In addition, the dynamic effect of economic growth has to be considered where the economic growth in the current year depends on the economic growth in the previous year. Thus, the model can be written in a dynamic panel data form as:

$$GROWTH_{i,t} - GROWTH_{i,t-1} = (1-\alpha)GROWTH_{i,t-1} + \beta_1 FINDEV_{it} + \beta' X_{it} + \eta_i + \varepsilon_{it} \quad (5)$$

Equivalently, Eq. (4) can be written as follows:

$$GROWTH_{it} = \alpha GROWTH_{i,t-1} + \beta_1 \ln FINDEV_{it} + \beta' X_{it} + \eta_i + \varepsilon_{it} \quad (6)$$

where $GROWTH$ is GDP per capita growth, $FINDEV$ is financial development, X is a vector of control variables that are frequently used in the finance-growth literature comprising gross fixed capital formation (CF), consumer price index (CPI), and human capital (HC) that effect economic growth. The model using the semi log-linear specification in Eq. (6), cross-section is denoted by subscript i ($i = 1, 2, \ldots, N$) and time period by subscript t ($t = 1, 2, \ldots, T$), η is the country specific effect and ε is the stochastic random term. The impacts of β_1 is expected to have a positive sign on the economic growth. The group of financial development includes three proxies: domestic credit to private sector by banks as a percentage share of GDP (DCPS), liquid liabilities as a percentage share of GDP (LL) and private sector credit to deposit money by banks and other financial institutions as a percentage share of GDP (PCDM) are used as a proxy for financial development (*FINDEV*), following Law and Singh (2014). All proxies are tested by a separated model. The data are obtained from the World Databank Indicators, UNCTAD Database, Financial Structure Dataset, and Barro and Lee website.

To investigate the 'too much finance' hypothesis, we employed the quadratic polynomial model. The model specification which is broadly similar to the existing studies (e.g., Checetti and Kharraoubi, 2012; Arcand et al., 2012; Law and Singh, 2014; Law et al., 2017) by using financial development squared ($FINDEV^2$) to capture the non-linear effect of finance and economic growth and determine the U-shaped or inverted U-shaped relationship. By using semi-log model and quadratic polynomial model, the study further tailored Eq. (6) with respect to the hypothesis of 'too much finance' can be written in a panel data form as:

$$GROWTH_{it} = \alpha GROWTH_{i,t-1} + \beta_1 \ln FINDEV_{it} + \beta_2 \ln FINDEV_{it}^2 + \beta_3 X'_{it} + \eta_i + \varepsilon_{it} \quad (7)$$

If the conjecture of Kuznets (1955) is correct, that is an inverted-U-shaped association between financial development and economic growth, then the sign of the parameter β_1 and β_2 coefficients are positive and negative, respectively, and both are statistically significant, thus the 'too much finance' or 'finance curse' hypothesis is supported. On the other hand, if β_1 and β_2 coefficients are negative and positive, respectively, and both are statistically significant, this indicates a U-shaped relationship or anti-Kuznets, and the 'finance curse' hypothesis is not supported, but it support the 'more finance, more growth' hypothesis. If the true relationship between financial development and economic growth is non-monotone, models that do not allow for non-monotonicity will lead to a downward bias in the estimated relationship between financial development and economic growth.

To estimate the models, this study employs panel data of 65 developing (as listed in Table 2) that covers a 36-year period from 1980 until 2015. The starting period of this study is year 1980. This study follows the starting period from the study by Ergungor (2008), Checetti and Kharroubi (2012), Law and Singh (2014), and Samargandi et al. (2015). However, the end of period of this study until 2015 where the recent data is used. The choice of sample countries is based on availability of data especially for financial development for developing countries.

Table 2: The list of selected developing countries

No.	Country	No.	Country	No.	Country	No.	Country
1	Albania	18	Dominican Rep.	35	Mauritius	52	Senegal
2	Algeria	19	Ecuador	36	Mexico	53	Serbia
3	Armenia	20	Egypt	37	Moldova	54	Sierra Leone
4	Bangladesh	21	El Salvador	38	Mongolia	55	South Africa
5	Belize	22	Ghana	39	Morocco	56	Sri Lanka
6	Benin	23	Guatemala	40	Mozambique	57	Sudan
7	Bolivia	24	Guyana	41	Namibia	58	Tanzania
8	Botswana	25	Honduras	42	Nepal	59	Thailand
9	Brazil	26	India	43	Nicaragua	60	Togo
10	Burundi	27	Indonesia	44	Niger	61	Tunisia
11	Cambodia	28	Jordan	45	Pakistan	62	Turkey
12	Cameroon	29	Kazakhstan	46	Panama	63	Uganda
13	China	30	Kenya	47	Paraguay	64	Ukraine
14	Colombia	31	Lesotho	48	Peru	65	Vietnam
15	Congo, Dem. Rep.	32	Malawi	49	Philippines		
16	Costa Rica	33	Malaysia	50	Romania		
17	Cote d'Ivoire	34	Mali	51	Russia		

Full sample of our data is covered the period from 1980 to 2015. The time period for full sample is averaged into six-year intervals for a maximum of six observations per country. The six observations span 1980-1985, 1986-1991, 1992-1997, 1998-2003, 2004-2009, and 2010-2015. Then data is split into two regime, namely before global financial crisis in the duration of 1980 to 2008 and after global financial crisis in 2009 until 2015. The period of the regime before global financial crisis is 29 years longer than after the global financial crisis regime for 7 years. The time period is averaged into five-year intervals for a maximum of six observations per country. The six observations span 1980-1984, 1985-1989, 1990-1994, 1995-1999, 2000-2004, with the last observation covering a four-year span from 2005-2008. The longer period of the first regime dataset is averaged to validate use of the GMM estimator, which requires a large number of cross-section units (*N*) with a small number of time periods (*T*). If we shorten the period, we may lose the information. But if we use the panel dataset without averaging, the number of instruments tends to increase, which might proliferate the instruments (Roodman, 2009). If the instrument problems still exist, the collapse technique of lag length is used to control the instrument proliferation as proposed by Roodman (2009).

The selection of finance indicators is crucial to measure the financial development. Many proxies for finance indicators has been used depends on the objectives of the studies. Several papers including Beck, Levine, and Loayza (2000), Favara (2003) and Deidda and Fattouh (2002) suggest to employ liquid liabilities, which is a less liquid monetary aggregate, as a proxy for financial development. The liquid liabilities captures the amount of liquid liabilities of the financial system, including the liabilities of banks, central banks and other financial intermediaries, that reflects financial services (Demetriades & Hussein, 1996; Favara, 2003; King & Levine, 1993a, 1993b). The credit to private sector as a proportion of GDP also most widely used as alternative measure of financial development (see Arcand et al., 2012; Beck, Levine et al., 2000; Demetriades & Hussein, 1996; Favara, 2003; King & Levine, 1993a; Liang & Teng, 2006). This indicator indicates the ability of the financial system to channel funds from depositors to investors. This measure accounts for credit granted to the private sector that enables the utilization of funds and their allocation to more efficient and productive

activities. It excludes credit issued by the central bank and thus is a more accurate measure of the savings that financial intermediaries.

Table 3: Summary statistics

	Minimum	10 % quantile	25% quantile	50% quantile	75% quantile	90% quantile	Maximum
Full sample (1980-2015)							
GROWTH	-12.1584	-1.95999	0.284293	2.054874	3.611244	5.099898	10.6468
DCPS	0.507391	7.255853	14.41938	24.42315	39.51458	65.25134	147.1132
LL	0.00007	15.36658	21.94535	31.67114	48.04944	77.08999	175.2327
PCDM	2.38E-05	7.178998	13.0196	23.71132	39.18753	66.65384	145.4332
FDI	-2.41406	0.098084	0.525568	1.556395	3.586591	5.86478	27.7441
FCAPITAL	5.287233	13.22195	16.7538	20.66417	25.31516	30.64452	67.94262
CPI	1.27E-11	5.68635	24.99292	57.67976	84.95159	113.6003	209.2374
HC	0.061667	0.415833	0.876667	1.556667	2.42	3.686667	6.758333
Regime 1: Period with the global financial crisis (1980-2008)							
GROWTH	-12.577	-2.25825	0	1.835465	3.700445	5.852173	12.40417
DCPS	0.624961	6.725534	12.82993	22.0526	35.90868	60.79381	148.9025
LL	0.00007	14.07986	20.45382	29.01117	45.17217	74.5094	140.1606
PCDM	2.38E-05	5.482951	11.7249	21.50451	33.65787	58.24547	145.3026
FDI	-3.43271	0.082384	0.364901	1.336748	3.078573	5.326728	16.87215
FCAPITAL	3.958172	12.74261	16.60739	20.01761	24.42503	29.98878	65.93127
CPI	1.02E-11	3.281525	15.48634	45.94872	69.93418	81.84431	96.37586
HC	0.06	0.36	0.81	1.42	2.29	3.38	6.87
Regime 2: Period after the global financial crisis (2009-2015)							
GROWTH	-22.2913	-0.88995	0.853345	2.599571	4.24655	6.016117	18.06457
DCPS	3.92231	14.06665	22.7601	35.715	51.6572	84.6743	151.48
LL	6.700744	21.02809	30.67901	41.23619	61.80407	97.36151	182.7313
PCDM	2.785867	13.48744	21.97756	34.16426	50.57098	89.03164	149.3656
FDI	-1.07525	0.873541	1.640418	3.057685	5.604434	9.022434	45.28993
FCAPITAL	8.95112	15.33145	19.11637	22.96524	27.33974	33.41376	50.77814
CPI	85.7374	96.56959	100	109.2717	120.2805	135.6614	348.9924
HC	0.19	0.59	1.46	2.27	3.34	4.58	6.87

Note: GROWTH = GDP per capita growth (%); DCPS = Domestic credit to private sector (% of GDP); LL = Liquid liabilities (% of GDP); PCDM = Private credit to deposit money (% of GDP); FDI = Foreign direct investment (% of GDP); FCAPITAL = Gross fixed capital formation (% of GDP); CPI = Consumer price index; HC = Average years of schooling.

In general, the finance indicators that widely used in the literature are private credit to deposit money as a percentage of GDP (Gregorio and Guidotti, 1995; Levine, 1999; Claessens and Laeven, 2002; Loayza and Ranciere, 2002; Liu and Hsu, 2006; Shen and Lee, 2006; Naceur and Ghazouani, 2007; Kemal et al., 2008; Barajas et al., 2010; Estrada et al., 2010; Goaied and Sassi, 2010; Huang et al., 2010; Hassan et al., 2010; Leitao, 2010; Law and Singh, 2014; Samargandi et al., 2015), liquid liabilities as a percentage of GDP (Levine, 1999; Favara, 2003; Christopoulos and Tsionas, 2004; Liu and Hsu, 2006; Shen and Lee, 2006; Naceur and Ghazouani, 2007; Kemal et al., 2008; Estrada et al., 2010; Goaied and Sassi, 2010; Huang et

al., 2010; Jalil et al., 2010; Hassan et al., 2011; Loayza and Ranciere, 2002; Lu and Yao, 2009, Law and Singh, 2014) and domestic credit to private sector as a percentage of GDP (Hassan et al., 2011; Law and Singh, 2014). Therefore, this study uses three financial indicators namely, domestic credit to private sector, liquid liabilities and private credit to deposit money by banks and other financial institutions. The source of these data is the 2017 version of World Bank's Dataset Indicators (WDI) and 2016 version of World Bank's Financial Structure Dataset.

The summary statistics of the variables are shown in Table 3. The highest median for financial indicators is liquid liabilities at 31.67 percent. The median for DCPS and PCDM is 24.42% and 23.71%, respectively. The summary statistics for second regime is higher than the first regime. This entails the high degree of financial activities and also the increment of the value due to increasing in inflation in the recent economy.

4. Methodology

4.1 Dynamic Panel Model: Generalized Method-of-Moment (GMM)

We estimate the quadratic polynomial model by using Generalized Method-of-Moments (GMM). GMM is used to estimate the dynamic panel data model also allows for the lagged level of economic growth. GMMs panel estimator was first proposed by Holtz-Eakin et al. (1988) and this was subsequently extended by Arellano and Bond (1991), Arellano and Bover (1995), and Blundell and Bond (1998). There are at least two reasons for choosing this estimator. Firstly, to control for the country-specific effects, which cannot use country-specific dummies due to the dynamic structure of the regression equation. Secondly, the estimator controls for a simultaneity bias are caused by the possibility that some of the explanatory variables may be endogenous. This method uses a set of instrumental variables to solve the endogeneity problem of the regressors.

There are two types of GMM estimators (difference and system) and they can both be alternatively considered in their one-step and two-step versions. However, the system-GMM as proposed by Arellano and Bover (1995) only used in this study. The system-GMM estimator (sys-GMM) includes not only the previous instruments but also the lagged values of the dependent variable (Blundell and Bond, 1998). It helps solve the endogeneity problem arising from the potential correlation between the independent variable and the error term in dynamic panel data models (Topcu, 2013). It also permits to dealing with omitted dynamics in static panel data models, owing to the ignorance of the impacts of lagged values of the dependent variable (Bonds, 2002). Following Arellano and Bover (1995), the moment conditions for the system-GMM are set as follows:

$$\mathrm{E}\left[\left(y_{i,t-s} - y_{i,t-s-1}\right).\left(\eta_i + \varepsilon_{i,t}\right)\right] = 0 \text{ for } s = 1 \tag{8}$$

$$\mathrm{E}\left[\left(FINDEV_{i,t-s} - FINDEV_{i,t-s-1}\right).\left(\eta_i + \varepsilon_{i,t}\right)\right] = 0 \text{ for } s = 1 \tag{9}$$

$$\mathrm{E}\left[\left(X'_{i,t-s} - X_{i,t-s-1}\right).\left(\eta_i + \varepsilon_{i,t}\right)\right] = 0 \text{ for } s = 1 \tag{10}$$

The consistency of the GMM estimator depends on two specification tests. The first is Hansen's (1982) *J*-test of over-identifying restrictions. Under the null of joint validity of all instruments, the empirical moments have zero expectation, so the *J* statistic is distributed and χ^2 with degrees of freedom equal to the degree of over-identification. The second test examines the hypothesis of no second-order serial correlation in the error term (Arellano and Bond, 1991). The failure to reject the null of both tests provides support to the estimated model.

The GMM estimators are typically applied in one-step and two-step variants (Arellano & Bond, 1991). The one-step estimators use weighting matrices that are independent of estimated parameters, whereas the two-step GMM estimator uses the so-called optimal weighting matrices in which the moment conditions are weighted by a consistent estimate of their covariance matrix. This makes the two-step estimator asymptotically more efficient than the one-step estimator. However, the use of the two-step estimator in small samples has several problems in terms of the estimation and diagnostics. These problems occur from the instruments' proliferation. If the number of instruments' proliferation is more than the number of groups, the estimation of parameter is inaccurate. To overcome this problem, we use the collapse of lag length technique proposed by Roodman (2009) to get better results and achieve the goodness of fit in the model.

4.1 Sasabuchi-Lind-Mehlum of U test

Even though most of the existing empirical studies claim that a U-shaped is identified if the nonlinear term in quadratic model is significant, Lind and Mehlum (2010) demonstrated that the true relationship is convex but monotone over relevant data values, it may spuriously identify an extreme value and U-shaped properties.

To test for the presence of a U-shaped profile in more appropriate way, this study is required to provide sufficiently strong evidence that the slope of the curve is positive at low values of $FinDev$ and negative at high values of $FinDev$ to examine the existing of Kuznets curve in 'finance curse' hypothesis. On the other hand, to investigate the existing of U-shape or anti-Kuznets curve, the slope of the curve is negative at low values of $FinDev$ and positive at high values of $FinDev$ to support the 'more finance, more growth' hypothesis. To confirm our finding of an inverted U-shaped or U-shaped relationship between financial development and economic growth, we conduct the U test of Sasabuchi (1980) which is extended by Lind and Mehlum (2010). In the quadratic case in Eq. (7), the composite null with the joint hypothesis is tested as follows:

$$H_0 : (\beta_1 + \beta_2 2FinDev_{min} \leqslant 0) \ \cup \ (\beta_1 + \beta_2 2FinDev_{max} \geqslant 0) \tag{11}$$

against the alternative hypothesis:

$$H_1 : (\beta_1 + \beta_2 2FindDev_{min} > 0) \ \cup \ (\beta_1 + \beta_2 2FinDev_{max} < 0) \tag{12}$$

where $FinDev_{min}$ and $FinDev_{max}$ represent the minimum and maximum values of financial development, respectively. If the null hypothesis is rejected, this confirms the existence of an inverted U-shape.

Particularly, the corresponding rejection is the convex cone:

$$R_\alpha = (\beta_1, \beta_2) \frac{\beta_1 + \beta_2 f'(FinDev_{min})}{\sqrt{s_{11} + 2f'(FinDev_{min})s_{12} + f'(FinDev_{min})^2 s_{22}}} < -t_\alpha$$

and

$$\frac{\beta_1 + \beta_2 (FinDev_{max})}{\sqrt{s_{11} + 2f'(FinDev_{max})s_{12} + f'(FinDev_{max})^2 s_{22}}} > t_\alpha \tag{13}$$

where s_{11}, $s_{22}$and s_{12} denote the estimated variances of β_1 and β_2 and the covariance between β_1 and β_2, respectively, and t_α is the critical value with the appropriate degrees of freedom and

significance level α. Following Fieller (1954), Lind and Mehlum (2010) also provided the (1-2α) confidence interval for the estimated extreme point, that is, $-\hat{\beta}_1/2\hat{\beta}_2$ in the quadratic case.

From the Eq. (7), the presence of a U-shape indicates that $\beta_1 + \beta_2 2FinDev_{min} < 0$ and $\beta_1 + \beta_2 2FinDev_{max} > 0$, whereas in the inverted U-shape means that $\beta_1 + \beta_2 2FinDev_{min} > 0$ and $\beta_1 + \beta_2 2FinDev_{max} < 0$. Therefore the existing of U-shape can be tested as follows:

$$H_0 : (\beta_1 + \beta_2 2FinDev_{min} \geqslant 0) \cup (\beta_1 + \beta_2 2FinDev_{max} \leqslant 0) \quad (14)$$

$$H_1 : (\beta_1 + \beta_2 2FinDev_{min} < 0) \cup (\beta_1 + \beta_2 2FinDev_{max} > 0) \quad (15)$$

From Eq. (14) and Eq. (15), and if the null hypothesis is rejected, this confirms the existence of U-shape in the nonlinearity relationship between financial development and economic growth. Thus, the hypothesis of U test is depends on the quadratic model estimation from system-GMM results in this study.

5. Empirical Findings and Discussions

Table 4 reports the results of system-GMM estimating Eq. (7) using three financial development indicators in the quadratic polynomial model from Eq. (7). Meanwhile, the results in Table 5 reports the existing of U-shape or inverted U-shape to confirm the nonlinearity either anti-Kuznets or Kuznets curve in the results in Table 4. Finance indicators measure is domestic credit to private sector (DCPS), liquid liabilities (LL) and private credit to deposit money (PCDM).

DCPS in full sample shows that the point estimate of the threshold value is 3.092 or 22.02% of GDP based on the first order condition ($\partial GROWTH/\partial FINDEV$). The result also close with the threshold computed in Sasabuchi-Lind-Mehlum test (Table 5) of 3.091 or 22.00% of GDP with a corresponding 90% Fieller confidence interval [2.789, 3.267]. However, the threshold percentage from our study is higher than the threshold of 2.295 or 9.924% of GDP that calculated of the coefficient gain from GMM estimation studied by Law and Singh (2014). The differences of the threshold point because two main reasons. First, our sample focusing on developing countries, while the sample of study by Law and Singh (2014) covered the developed and developing countries. Second, our period of study extended until 2015 data. Nevertheless, we are not comparing the threshold point obtain from the dynamic panel threshold in their study or other different methods. While, the threshold point of LL is 3.646 or 38.321% with 90% Fieller confidence interval [3.585, 3.709], and PCDM's threshold point is 3.073 or 21.607% in the range of 90% Fieller confidence interval [2.914, 3.214]. The threshold point for LL is higher as compared to the rest financial indicators. By using the period until the recent data, these points also higher than the threshold points from the study by Law and Singh (2014) at 2.28 and 2.21 for liquid liabilities and private sector credit, respectively.

However, the main things in this study is to investigate the nonlinearity of the relationship between financial development and economic growth, whether there is exist U-shape or inverted U-shape. The results from system-GMM estimation in Table 4 in full sample (1980-2015 period) shows that the relationship between financial development and economic growth is inverted U-shape or economic Kuznets curve indicated by the coefficient of β_1 and β_2 from the Eq. (7) is significant in positively and negatively sign, respectively. These results are consistent with the findings by Arcand et al. (2012), Cecchetti and Kharroubi (2012), Law and Singh (2014), and Samargandi et al. (2012). The financial development has positive impact on economic growth until to the certain point, but after it reach the threshold point, financial sector may cause the detrimental of economic growth. These results supported the 'too much

finance harm growth' hypothesis and 'vanishing effect'. It is also supported by Sasabuchi-Lind-Mehlum of U-test in Table 5 of exist the inverted U-shape relationship between financial development and economic growth for all models. The slope of FINDEVmin is positive and statistically significant, while FINDEVmax is negatively significant for all models, thus, the results corresponding to the inverse U-shape in the relationship between financial development and economic growth. This result of U-shape is consistent with the study by Samargandi et al. (2015) that employed the same econometric technique.

Nonetheless, our interesting part is in splitting sample results. Our sample period in the first regime is similar with the sample period of Samargandi et al. (2015), but the sample of countries is different. The first regime prolonged with 29 years period consistent with the full sample results that confirming the inverted U-shape for all models as shown in Model 2a-2c. The U-test results in Model 5a-5c as shown in Table 5 also confirmed the economic Kuznets curve or inverted U-shape. Thus, the results in the sample period in crises (Asian financial in 1997-1998 and global financial crisis in 2007-2008) supported the 'too much finance harm growth' hypothesis. Similar with the full sample result, the financial development will dampen the economic growth after it surpassed the threshold point due to the 'vanishing effect' as highlighted by Arcand et al. (2012). Moreover, the threshold points in Model 2a-2c and also in Model 5a-5c are slightly lower than the threshold points in the full sample. This is because the financial development is increasing from year to year with including the recent data that slightly higher (see Table 3), that inherit the threshold point to become higher in full sample.

Interestingly, the results for the second regime is contrast with the first regime and also different with the full sample. The results from system-GMM estimation in Model 3a-3c (see Table 4) in the second regime shows that the coefficient of β_1 and β_2 from the Eq. (7) specification has negative and positive sign, respectively, and both are significant. These indicates the relationship between financial development and economic growth is U-shape or economic anti-Kuznets curve in all models for the Regime 2. These results are contrast with the findings by Arcand et al. (2012), Cecchetti and Kharroubi (2012), Law and Singh (2014), and Samargandi et al. (2012). For the case of second regime, the financial development can boost the economic growth after it surpassed the threshold point. As a result, our findings had challenging the hypothesis of 'too much finance', but supported the 'more finance, more growth' as highlighted by Levine (1993). These results also supported by Sasabuchi-Lind-Mehlum of U-test in Table 5 of U-shape relationship between financial development and economic growth for all models. The slope of FINDEVmin is negative and statistically significant, while FINDEVmax is positively significant for all models, thus, the results conforming the U-shape in the relationship between financial development and economic growth. The nonlinear mixture in the different regimes for all financial indicators also illustrated in Figure 1. It seems like this group of country has been learnt from the global financial crisis where these countries gone through the learning process. There is lesson to be learnt from the global financial crisis. Consequently, there will focus more on tighten the financial regulation with monitoring the liquid activities in the economy.

Rely on our results, it also supported Schumpeter (1911) where the important role of financial development is still relevant in the recent economy. Our result denying the argument from Asongu (2011) in his meta-analysis study, who claimed that the Schumpeter might be wrong in the recent economy. The nonlinear mixture in our findings did not supported the meta analysis study by Asongu (2011) who concern on endogeneity to be take into account that leads the negative effect of finance and growth. He criticized the finance spillover has positive impact on economic growth in Schumpeter hypothesis. Although the endogeneity problem has been resolved in GMM technique, the impact of finance positively and negatively and both are significant on growth was depends on the economic condition.

In further details, the threshold point of the second regime is higher than the threshold point in the first regime. This is related to the statistical properties as shown in the Table 3 that indicates the higher of financial development is necessary in the recent economy. Based on the result in the Table 4, the threshold value for DCPS in first regime is 19.75% of GDP and the size is increase in the second regime carry the threshold value up to 56.77%. This implies the transition of threshold value in at least 25 percentile to Similarly to liquid liabilities and private credit to deposit money where the threshold value increase 115.98% (from 30.08% of GDP to 64.98% of GDP) and 258.22% (from 13.04% of GDP to 46.71% of GDP), respectively. These results infers the economy in transition period (See Table 6).

The threshold points are important to policy makers to set the appropriate financial cap to control the financial activities. Having known that financial liberalisation may be harmful to economic growth which requires further financial regulation control and activities, this tap does not mean and immediate reduction of moral hazard in financial activities. Since the financial sector is major contribution to growth through time, therefore, the central bank choose to imply soft-landing policy. Soft-landing policy is not immediately reduce the finance curse, but it take a longer period to be remedy. This may rise about another concern as to the duration of soft-landing policy should be implemented where the country can benefit from it. For example, when soft landing policy be fully materialised from 19.75% of GDP to 56.77% of GDP foresee the continuous financial activities control. As a result, the central bank anticipated that the amount of financial activities should be increase continuously during soft-landing period but in the control manner. However, this aspect has not been studied previously, there is a gap to be fill up in the present study.

Table 4: The relationship between Financial Development on Growth: Two-step Sys-GMM (Dependent Variable: Growth per capita)

	Full sample (1980-2015)		
	Model 1a: Domestic credit to private sector	**Model 1b: Liquid liabilities**	**Model 1c: Private credit**
GROWTH (-1)	0.203***	0.118***	0.128***
CPI	-0.041	-0.079	-0.025
FCAPITAL	1.817***	1.798***	2.245***
HC	-0.077**	-0.083	0.063
FDI	0.610***	0.860***	0.618***
FinDev	3.166***	20.154***	5.433***
$FinDev^2$	-0.512***	-2.764***	-0.884***
Constant	-8.035***	-39.157***	-12.707***
AR(2) (p-value)	0.910	0.515	0.743
J-test (p-value)	0.170	0.232	0.146
No. of groups	65	65	65
No. of instruments	56	56	56
Threshold value	3.092 (22.021%)	3.646 (38.321%)	3.073 (21.607%)

	Split sample: before and after global crisis					
	Regime 1: Before global crisis (1980-2008)			Regime 2: After global crisis (2009-2015)		
	Model 2a: Domestic credit to private sector	**Model 2b: Liquid liabilities**	**Model 2c: Private credit**	**Model 3a: Domestic credit to private sector**	**Model 3b: Liquid liabilities**	**Model 3c: Private credit**
GROWTH (-1)	0.078*	0.162**	0.094**	0.029**	0.038***	0.046***
CPI	-0.089*	-0.173**	-0.055	-0.626***	0.068	-0.908***
FCAPITAL	1.630**	1.451*	2.360***	1.979***	1.950***	1.756***
HC	0.472***	0.455**	0.320**	0.173***	0.049	0.255***
FDI	1.039***	1.144***	1.082***	0.690***	0.622***	0.745***
FinDev	7.649***	14.564***	2.229***	-6.398***	-6.344***	-6.850***
$FinDev^2$	-1.282***	-2.139***	-0.434***	0.792***	0.760***	0.891***
Constant	-13.969***	-26.811***	-7.992***	11.205***	8.911***	13.149***
AR(2) (p-value)	0.661	0.281	0.236	0.284	0.298	0.297
J-test (p-value)	0.134	0.105	0.123	0.409	0.341	0.466
No. of groups	65	65	65	65	65	65
No. of instruments	32	23	32	64	64	64
Threshold value	2.938 (19.747%)	3.404 (30.084%)	2.568 (13.040%)	4.039 (56.770%)	4.174 (64.975%)	3.844 (46.712%)

Notes: ***, ** and * denotes significant level at 1%, 5% and 10%, respectively. (ii) AR(2) are tests for autocorrelation in differences

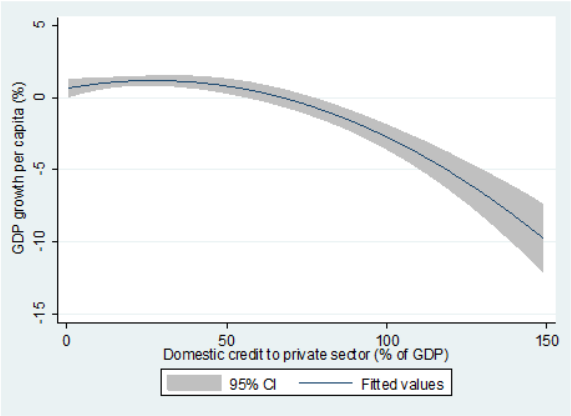
Table 5: Sasabuchi-Lind-Mehlum (SLM) test for U-shape

	Full sample (1980-2015)		
	Model 4a: Domestic credit to private sector	**Model 4b: Liquid liabilities**	**Model 4c: Private credit**
Extreme point	3.091	3.646	3.072
95% Fieller interval	[2.789, 3.267]	[3.585, 3.709]	[2.914, 3.214]
Slope at FINDEVmin	3.861***	73.043***	24.264***
	(4.775)	(10.256)	(11.556)
Slope at FINDEVmax	-1.946***	-8.403***	-3.375***
	(-6.353)	(-9.872)	(-12.231)
Hypothesis test	H_0: U shape H_1: Inverted U shape	H_0: U shape H_1: Inverted U shape	H_0: U shape H_1: Inverted U shape
SLM test for U shape (t-value)	4.77***	9.87***	11.56***
p-value	0.000	0.000	0.000

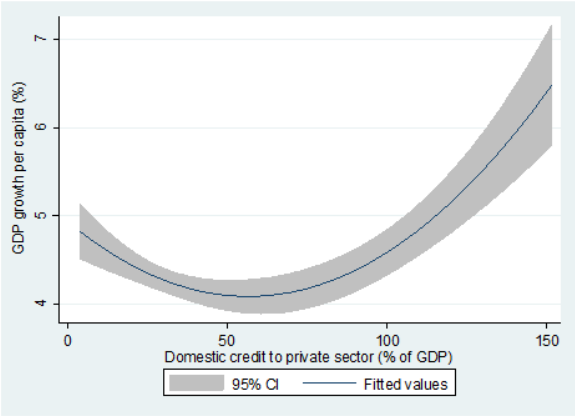
	Split sample: before and after global crisis					
	Regime 1: Before global crisis (1980-2008)			Regime 2: After global crisis (2009-2015)		
	Model 5a: Domestic credit to private sector	**Model 5b: Liquid liabilities**	**Model 5c: Private credit**	**Model 6a: Domestic credit to private sector**	**Model 6b: Liquid liabilities**	**Model 6c: Private credit**
Extreme point	2.983	3.040	2.567	4.041	4.173	3.844
95% Fieller interval	[2.616, 3.194]	[3.222, 3.556]	[2.145, 2.891]	[3.919, 4.193]	[3.933, 4.560]	[3.690, 4.019]
Slope at FINDEVmin	8.854***	55.498***	11.472***	-4.234***	-3.452***	-5.024***
	(3.312)	(4.261)	(4.908)	(-20.373)	(-8.438)	(-25.846)
Slope at FINDEVmax	-5.178***	-6.583***	-2.094***	1.551***	1.574***	2.072***
	(-3.714)	(-4.339)	(-5.256)	(7.727)	(3.613)	(9.067)
Hypothesis test	H_0: U-shape H_1: Inverted U-shape	H_0: U-shape H_1: Inverted U-shape	H_0: U-shape H_1: Inverted U-shape	H_0: Inverted U-shape H_1: U-shape	H_0: Inverted U-shape H_1: U-shape	H_0: Inverted U-shape H_1: U-shape
SLM test for U shape (t-value)	3.31***	4.26***	4.91***	7.73***	3.61***	9.07***
p-value	0.000	0.000	0.000	0.000	0.000	0.000

Notes: (i) *** denotes significant level at 1%. (ii) t-value in parentheses. (iii) The hypothesis testing is based on the SLM estimation

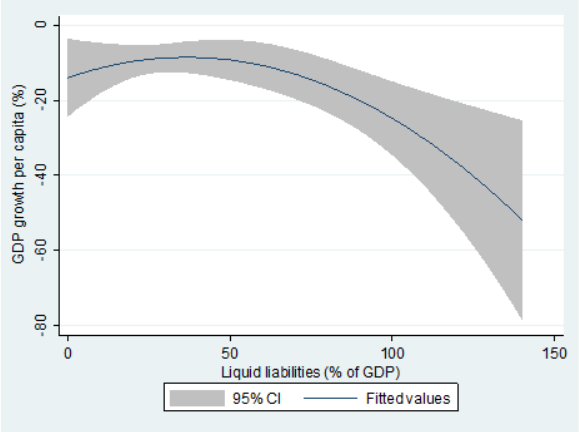
Domestic credit to private sector:
Before the global crisis (1980-2008)



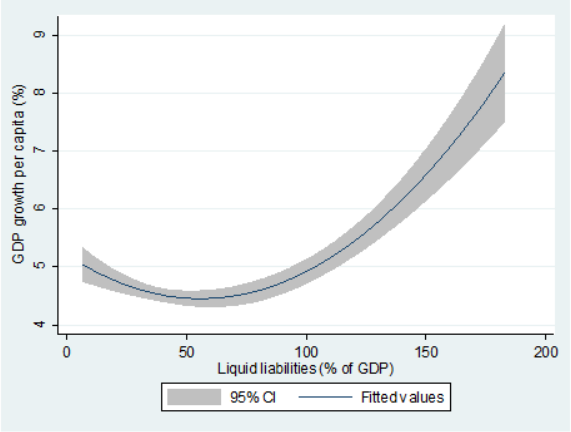
Domestic credit to private sector:
After the global crisis (2009-2015)



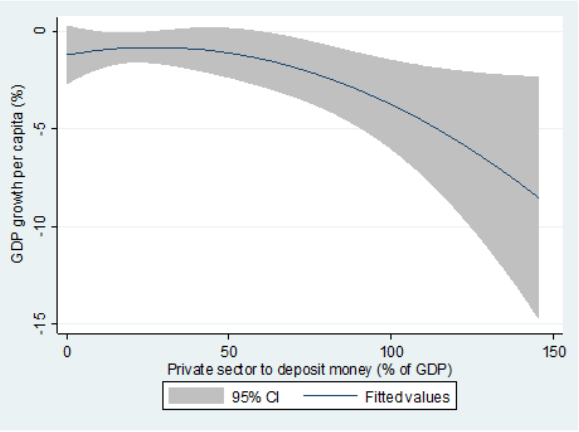
Liquid liabilities:
Before the global crisis (1980-2008)



Liquid liabilities:
After the global crisis (2009-2015)



Private credit to deposit money:
Before the global crisis (1980-2008)



Private credit to deposit money:
After the global crisis (2009-2015)

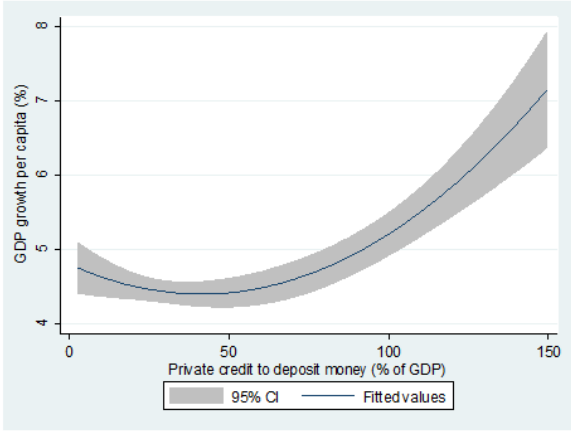


Figure 1: Nonlinear mixture on the relationship between financial development and economic growth by splitting sample into two regimes

Table 6: Transition value between two sub-periods

Financial indicators	Threshold		
	Regime 1: 1980-2008	Regime 2: 2009-2015	Percentage change (%)
Domestic credit to private sector (% of GDP)	19.75 (50 percentile)	56.77 (75 percentile)	187.49
Liquid liabilities (% of GDP)	30.08 (75 percentile)	64.98 (75 percentile)	115.98
Private credit to deposit money (% of GDP)	13.04 (25 percentile)	46.71 (50 percentile)	258.22

Note: The summary statistics based on percentage quantile in the parentheses

6. Concluding Remarks

This study examines the nonlinearity of the relationship between financial development and economic growth for the case of 65 developing countries by considering the condition with global financial crisis in 2008 and the period after the crisis. The use of panel data is appropriate in this study since we can increase the data points and the degree of freedom, thereby providing the most robust estimation. The two-step system-GMM is said to be the appropriate model compared to the one-step system-GMM and also diff-GMM. The results from two-step system-GMM demonstrated that financial development has a positively significant relationship on economic growth until to the certain point, but after surpassed the threshold value (domestic credit to private sector, 22.02% of GDP; liquid liabilities, 38.32% of GDP, private sector credit, 21.61% of GDP), the financial development will dampen the economic growth. Thus, the relationship is confirm inverted U-shape for full sample that covering the period from 1980 to 2015. Similarly, the relationship between financial development and economic growth in the first regime of the period from 1980 through 2008 that ended with the global financial crisis in 2008 results the nonlinear relationship of inverted U-shape or Kuznets curve. Our findings are consistent with the past studies such as Arcand et al. (2012), Checetti and Kharoubbi (2012), Law and Singh (2014) and Samargandi et al. (2015) that supported the 'vanishing effect' hypothesis developed by Schumpeter.

However, for the case of second regime of period after global financial crisis started from 2009 to 2015, the nonlinearity of these variables has been change into U-shape or anti-Kuznets curve. Interestingly, the findings of this study have challenged the 'too much finance' hypothesis, but support the 'more finance, more growth' proposition by Levine (1993). This study found that the financial development has negative and significant impact on economic growth, but after reach the threshold level (domestic credit to private sector, 56.77% of GDP; liquid liabilities, 64.98% of GDP, private sector credit, 46.71% of GDP), financial development had a positive impact on economic growth. Thus, our findings become a new evidence in the recent economy that has been contrast to the previous findings.

Moreover, the nonlinearity of these three samples (full sample, subsample of first regime and subsample of second regime) has been supported by Sasabuchi-Lind-Mehlum test of U shape. The hypotheses of U test are based on the previous estimation (Lind and Mehlum, 2010). The extreme point of U-test is closed to the first order condition from the GMM estimation result, with 90% Fieller confidence interval. The findings for second regime are inconsistent with the Kuznets hypothesis, the test results overwhelmingly reject the combined null hypothesis of an inverted-U or monotone relationship in favour of a U-shaped linkage

between financial development and economic growth for all finance indicators. Moreover, the results are robust with Levine (1993) hypothesis of 'more finance, more growth'. In addition, the threshold point for the second regime are higher than the first regime. By considering the linkages between these two regimes, the changes of the threshold point between regimes indicates the transition period from cataclysm to remedy period before the financial development boost the economic growth in the recent economies.

Our findings have contributed to enhancing the existing finance-growth literature in two aspects. First, there exists nonlinear mixture of inverted U-shape and U-shape relationship between financial development and economic growth when the relationship is studied in two different regimes covering the period before and after global financial crisis – an approach less attempted in the past. Second, this study has also proposed the transition period required in investing for further financial development from the catastrophic period to the remedy period, before the financial development regains its strength to boost economic growth once again. This is made possible by identifying the two threshold points found our study. Thus, these findings can be claimed as a new evidence to be contributed to the finance-growth literature.

In general, the policy makers should enhance the financial sector at least beyond the 90 percentile (refer to Table 2) to utilize the financial development in order to boost the economic growth. In terms of policy implication, findings from the study suggest that policy makers should not only expand on financial development in fostering economic growth but also increase the quality of financial sector. This implies the concurrent expansion and tightening of financial regulations with attendant control and monitoring of financial activities to ensure the effectiveness of financial development on economic growth as well as to avoid the 'vanishing effect' that may lead to recurrence of economic crises in the future. In lieu of the nonlinearity of the U-shaped profile in finance-growth relationship in our findings, does financial regulation and its implementation, such as Basel III, positioned on the right track? The financial policy as suggested by the previous studies need to be revised and to benefit from the 'more finance, more growth' proposition. By take into account not only the quantity of finance but also the quality, this study leads to 'more and better finance, more growth' proposition.

Despite, the nonlinearity of finance-growth relationship of U-shaped in our study contradicted with the previous study in different time period indicate that the financial development effect on economic growth may contingent on the economic situation. The study also challenged the findings by Arcand et al. (2015) who suggested that the 'vanishing effect' was not influenced by output volatility and banking crises. In addition, the effect of financial development on economic growth also depends on the level of macroeconomic variable and economic regulation such as inflation (Yilmazkuday 2011), financial sector policies (Abiad & Mody 2005), financial openness (Rajan & Zingales 2003) as a precondition, therefore this dependency indicates the fragility of financial in boosting the economic growth. Hence, as highlighted by Reinert (2012), which element should be controlled by policy makers, either to save the financial economy or save the real economy? The paper suggests that policy makers should control the financial mediating variables as well as the real economy instead only expanding the financial sector development with contemporaneous banking quality to improve the financial performance in promoting economic growth.

The findings also contribute to the finance-growth study to be extend and may lead to feasibility study ties to reassess the nonlinearity of finance-growth based on different situations. Research findings prior to the 2007-2008 Global Financial crisis produced the inverted U-shaped profile while post-crisis research studies produced the U-shaped profile in finance-growth relationship. For the future, is there the possibility of discovering a S-shaped relationship? Such a profile, may likely postulate the transition period from catastrophic to remedy period. The question may arise that, does the recent economy postulated as remedial

period? If S-shaped profile is possible then policy makers should be cautious that a regime-switch trigger in the cycle of finance-growth may likely occur in the future. Hence, further research is necessary to elucidate on this possibility.

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