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Financial Development and Income Inequality in Emerging Markets: A New Approach

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Abstract: Financial development has been considered an efficient and effective mechanism for the sustainable economic growth and development of emerging markets in past decades. However, various concerns have emerged in relation to the influences of financial sector development on income inequality. It is the claim of this paper that findings from the current literature are incomplete. This is because various proxies have been utilized inconsistently for both financial development and income inequality in previous empirical studies. This study extends the current literature on this important finance–inequality nexus by examining a sample of 21 emerging countries for the period of 1961–2017. Various estimation techniques were employed with the aim of ensuring robust findings. Findings from this paper confirm the existence of an inverted U-curve relationship between financial development and income inequality, implying that income inequality may rise at the early stage of financial development and fall after a certain level is achieved. Policy implications have emerged from the findings of this study.

Keywords: financial development; income inequality; FMOLS; DOLS; emerging markets

JEL Classification: O11; O12; O15; F62; F63

1. Introduction

It is generally accepted that financial development fosters economic growth by enabling the efficient allocation of capital together with reducing financial constraints (Rousseau and Yilmazkuday 2009; Yilmazkuday 2011; Vo et al. 2019a, 2019b). However, the current literature appears to largely overlook the effect of financial development on income inequality. Debates have emerged in relation to the influences of the financial sector on income inequality, especially after the global financial crisis in 2008. Understanding the relationship between financial development and income inequality is important because policymakers can assess the indirect impact of the financial sector on growth via income inequality.

The literature on the finance–inequality linkage is inconclusive. Greenwood and Jovanovic (1990) argued that income inequality increased at the early stage of financial development and then the degree of inequality decreased after a certain level of financial development. Galor and Zeira (1993) and Banerjee and Newman (1993) stated that income inequality would be lower when financial markets were fully developed. Similarly, a well-functioning financial market was said to be essential for reducing income inequality (Younsi and Bechtini 2018). In contrast, Rajan and Zingales (2003) posited that the development of the financial sector may widen existing income inequality.

In addition, a theoretical guide to the measurement of financial development has not been properly developed, although market-based and/or bank-based indicators are commonly used in empirical studies. Various proxies for financial development have been utilized, including the domestic credit to private sector–GDP ratio (Sehrawat and Giri 2015; Batuo et al. 2010; Law et al. 2014; Park and Shin 2017); the share of market capitalization-to-GDP ratio (Sehrawat and Giri 2015; Park and Shin 2017); and deposit money banks as a share of GDP (Kim and Lin 2011; Kappel 2010), among others. As such, the use of various proxies can influence the findings of empirical studies of the finance–inequality nexus.

In addition, previous empirical studies have been devoted to the examination of the short-run relationship between financial development and income inequality; this relationship in the long run has been largely ignored. We consider that a single-country investigation is necessary to provide useful policy implications. However, an examination of a group of various countries that share many similarities in relation to the level of financial development and economic growth is also desirable. As such, on the grounds of the theoretical ambiguity of the finance–inequality nexus and the lack of a theoretical guide to the measurement of financial development, we are motivated to consider the following fundamental questions: (i) How does financial development affect income inequality in the long-run? (ii) Does the foregoing relationship vary with the choice of a proxy for financial development? In response to these objectives, the aim of this study was to validate the relationship between financial development and income inequality in the long run and to verify the validity of the nexus by employing various variables as proxies for financial development.

On the grounds of the above considerations, emerging countries have attracted our attention. Two superpower economies—China and India—are generally recognized as emerging markets. These two countries continue to be increasingly influential players globally. Emerging markets play the key role in global economic growth and stability, according to the World Bank. However, despite the tremendous growth of emerging markets over the past decade, empirical analyses on the impact of financial development on income inequality have largely been ignored. As such, this study extends the current literature on the finance–inequality nexus through an investigation using available data for 21 emerging countries over the period of 1961–2017. Various robustness checks were conducted to ensure that the estimated results are unbiased.

The remainder of this paper is structured as follows. Section 2 provides an overview of the current literature on the issue. Data and methodology are presented in Section 3. Empirical results are discussed in Section 4, followed by a robustness check in Section 5. Section 6 provides concluding remarks.

2. An Overview of the Literature

The relationship between financial development and income inequality has received great attention from academics, practitioners, and in particular, policymakers in recent decades (Agnello et al. 2012; Ang 2010; Claessens and Perotti 2007; Clarke et al. 2006; De Haan and Sturm 2017), in addition to the determinants of income inequality (Afonso et al. 2010; Atkinson 2003; Dowrick and Akmal 2005; Roine et al. 2009; Malinen 2012; De Gregorio and Lee 2002; Huber and Stephens 2014; Li et al. 1998; Milanović 2000; Pan-Long 1995; Nguyen et al. 2019; Malinen 2012). For example, Atkinson (2003) considered explanatory factors of income inequality for nine OECD countries over the period of 1945–2001. The author found that various determinants could significantly affect income inequality variation, such as technological change, globalization, public policy, and sources of income. De Gregorio and Lee (2002) examined the relationship between human capital and income inequality for a broad range of countries from 1960 to 1990. Their empirical results showed an inverted U curve in the relationship, although a significant proportion of income inequality variation remains unexplained. In addition, Roine et al. (2009) investigated long-run determinants of income inequality for a group of 16 countries over the period of 1900 to 2000. They stated that income inequality was significantly affected by economic growth and financial development. In contrast, trade openness had no clear impact on income inequality.

Various studies were conducted to figure out how financial development affects income inequality. Empirical findings can be classified into three different groups. First, the finance–inequality widening hypothesis proposed by Rajan and Zingales (2003) posited that the development of financial sectors increases income inequality. Second, finance–inequality narrowing hypothesis suggested by Galor and Zeira (1993) and Banerjee and Newman (1993) argued that a better-functioning financial system reduced income inequality. Finally, the inverted U-shaped hypothesis suggested by Greenwood and Jovanovic (1990) fundamentally combined the two foregoing outcomes, where the finance–inequality linkage is non-linear. Specifically, this hypothesis suggests that income inequality increases at the early stage of financial development and then decreases after a certain level of financial sector development.

Some studies found a positive relationship between financial development and income inequality (Jauch and Watzka 2016; Seven and Coskun 2016; Jaumotte et al. 2013). For instance, Jauch and Watzka (2016) examined the relationship between financial development and income inequality in 138 developing and developed countries over the period of 1960–2008. Using the fixed effect and generalized method of moments (GMM) techniques, their results indicated that financial development provided a significantly positive effect on income inequality, indicating a rejection of a negative impact of financial development on income inequality or the finance–inequality narrowing hypothesis. Similarly, as countries were classified based on four different levels (e.g., high-income, upper-middle-income, lower-middle-income, and low-income), empirical findings on a sample including various countries also confirmed that there appeared to be a positive relationship between financial development and income inequality. Seven and Coskun (2016) found a statistically significant contribution of bank development on the growth effect of income inequality. The results emerged from the use of GMM techniques from a database of 45 emerging countries over the period 1987–2011. Prior to these studies, Jaumotte et al. (2013) stated that an increase of income inequality was associated with an increase of financial globalization, which was the case for 20 advanced countries as well as 31 developing and emerging countries for the research period from 1981 to 2003.

On the other hand, various scholars have demonstrated that the reduction of income inequality was triggered by the enhancement of financial sectors (Batuo et al. 2010; Hamori and Hashiguchi 2012; Kappel 2010; Mookerjee and Kalipioni 2010; Law et al. 2014). In other words, the development of the financial sector was negatively related to income inequality. For example, Hamori and Hashiguchi (2012) utilized a multi-step study, starting with fixed-effects estimation and then moving on with a dynamic panel model. In relation to the fixed-effects estimations, the authors found that the estimates of M_2–GDP ratio and domestic credit to private sector as a percentage of GDP, which represented the development of finance, were negative and statistically significant at the level of 1%. In addition, for the dynamic panel model where difference GMM was utilized, the contribution of financial development to income inequality was considered. Findings from this study presented evidence confirming the finance–inequality narrowing hypothesis, regardless of the proxies for financial development.

In addition, various empirical studies found a non-linearity in the relationship between financial development and income inequality (Kim and Lin 2011; Park and Shin 2017; Younsi and Bechtini 2018; Zhang and Chen 2015). Park and Shin (2017) confirmed that the impact of financial development on income inequality varied depending on the level of financial development. At the early stage of financial development, the development of the financial sector alleviated income inequality. In contrast, income inequality increased as financial development was further increased. Additionally, a non-linear effect of financial development on income inequality was found in a group of 65 countries from 1960 to 2005 (Kim and Lin 2011). Using a threshold regression technique, which allows one to simultaneously deal with endogeneity and to account for threshold nonlinearity, the authors found that after a certain level of financial development, income inequality would be reduced through the growth of finance and that income inequality would be counteracted by financial development.

In relation to various finance–inequality linkages, scholars have also been motivated by different types of proxies for financial development. Various proxies for financial development have been proposed, including the domestic credit to private sector–GDP ratio (Sehrawat and Giri 2015; Batuo et

al. 2010; Law et al. 2014; Park and Shin 2017); the share of market capitalization-to-GDP ratio (Sehrawat and Giri 2015; Park and Shin 2017); deposit money in banks as a share of GDP (Kim and Lin 2011; Kappel 2010), among others. As such, it is noticeable that the use of proxies for financial development influences the interpretation of its influence on the finance–inequality nexus.

3. Data and Model

3.1. Data

This paper employed unbalanced panel data of 21 emerging countries as classified by the International Monetary Fund (IMF) where required data were available. Only Venezuela and Russia, two emerging markets, were excluded due to a lack of required data. Data were collected from the World Development Indicators (WDI) from the World Bank. Annual data of economic growth per capita, financial development, inflation, and government expenditure–GDP ratio are available and accessible. Unfortunately, the WDI does not provide sufficient data on income inequality. In response to the problem, the Standardized World Income Inequality Database (SWIID), proposed by Solt (2016), was utilized. Our choice was largely based on data availability. Together with emerging countries, the SWIID also covers income inequality data for other countries, constituting a database of 192 countries, with the first observation dated back to 1960. Noted that only the Gini coefficient is provided in the SWIID database.

Although various methods have been developed to measure income inequality, the use of the Gini coefficient proposed by Deininger and Squire (1996) appears to be appropriate for the purpose of this paper, and the measurement is also widely adopted. As such, the Gini coefficient was utilized in this work to measure income inequality. Our choice was based on the following two considerations. First, the use of the Gini coefficient allows our results to be compared with previous studies. Second, the Gini coefficient achieves a high-quality standard (Li and Zou 1998; De Dominicis et al. 2008). In addition to the WDI, our dataset also incorporates the index of financial development (Svirydzenka 2016) developed by the IMF Strategy, Policy, and Review Department, in order to ensure that empirical findings achieved from the paper are robust. Details of variables are reported in Table 1. The descriptive statistics are presented in Table 2.

Our dataset consists of 21 emerging countries, including Argentina, Bangladesh, Brazil, Bulgaria, Chile, China, Colombia, Hungary, India, Indonesia, Malaysia, Mexico, Pakistan, Peru, the Philippines, Poland, Romania, South Africa, Thailand, Turkey, and Ukraine. Note that available data for Argentina, Brazil, and the Philippines are from 1961 to 2017, whereas the period is shorter for other countries.

Table 1. Summary of variables. IMF: International Monetary Fund; SWIID: Standardized World Income Inequality Database; WDI: World Development Indicators.

Variable	Definition	Proxy	Source
Gini	Income inequality measurement	Post-tax, post-transfer income	SWIID
		Pre-tax, pre-transfer income	SWIID
g	Economic growth	Annual percentage growth rate of GDP per capita	WDI
Inflation	A measurement of the overall level of prices in the economy	Percentage change in the cost to the average consumer of acquiring a basket of goods and services	WDI
GovExp/GDP	General government final consumption expenditure as a share of GDP	Ratio of government final consumption expenditure–GDP ratio	WDI

Table 1. *Cont.*

Variable	Definition	Proxy	Source
FD	A measurement of financial development	Domestic credit to private sector–GDP ratio	WDI
		Domestic credit to private sector by banks–GDP ratio	WDI
		Domestic credit to private sector by financial sector–GDP ratio	WDI
		Stock market capitalization as percentage of GDP	WDI
		New broad-based index of financial development	IMF

Table 2. Descriptive statistics.

Variable	Gini	g	FD	Inflation	GovExp/GDP
Min	26	−22.55	1.38	−7.63	2.97
Max	59.1	13.63	166.50	7481.66	27.39
Mean	42.45	2.75	43.52	63.60	12.46
S.D.	7.94	4.24	34.63	401.53	4.10
Observations	830	830	830	783	823

Note: The above table employs post-tax, post-transfer income as proxy for the Gini coefficient and the domestic credit to private sector–GDP ratio as proxy for financial development.

3.2. Model

This paper employs the following equation to consider the effects of financial development on income inequality. Following Kuznets (1955), we incorporate both linear and non-linear, proxied as a squared term of economic growth, denoted by g and g^2 respectively. We also add a set of control variables, denoted by $\boldsymbol{X}_{it}$, including inflation and government consumption–GDP ratio.[1] This is because wealthy people can hedge better against inflation through access to financial markets while the poor, who are generally geared with debt, tend to experience unexpected consequences from high inflation since the contracts are written in nominal terms (Yilmazkuday 2012). Moreover, a large proportion of government consumption-to-GDP ratio can be a consequence of either redistributing income or rent-seeking activities (Jauch and Watzka 2016):

$$Gini_{it} = \alpha + \beta_1 FD_{it} + \beta_2 FD^2{}_{it} + \beta_3 g_{it} + \beta_4 g^2{}_{it} + \boldsymbol{\beta}_j \boldsymbol{X}_{it} + \varepsilon_{it}.$$

The sign and significance of β_1 and β_2 reveal how financial development affects income inequality. Following the finance–inequality narrowing hypothesis, β_1 should be significant and negative and β_2 should be insignificant. According to the finance–inequality widening hypothesis, β_1 should be significant and positive and β_2 should be insignificant. As the inverted U-shaped hypothesis suggests, β_1 should be significant and positive and β_2 should be significant and negative.

There is extensive literature on the finance–inequality nexus using the fixed effect (FE) method and generalized method of moments (GMM). However, some issues have emerged in these techniques,

[1] We would like to thank an anonymous referee for suggesting other control variables, such as human capital and trade openness. It is arguable that human capital and trade openness may play an important role in determining a variation of income inequality. However, for the purpose of this paper, these two variables were not utilized for the following reasons. In relation to human capital, Milanović (2000) stated that human capital and economic growth should not be used concurrently due to a severe collinearity between them. In relation to trade openness, various empirical studies considered that its effects on income inequality were still a matter of controversy (Bensidoun et al. 2011; Mahesh 2016; Urata and Narjoko 2017).

leading to biased estimates. It is argued that the FE comes at a cost, and the GMM technique suffers from the problem of instrument proliferation as the time dimension increases (De Dominicis et al. 2008); (Grijalva 2011). In addition, these techniques are dedicated to the estimation of short-run relationships, which is not the focus of this study. As such, this paper utilizes the dynamic OLS (DOLS) and fully modified OLS (FMOLS).

It is widely noted that the relationship between income inequality and economic growth is endogenous. Therefore, estimations without considering a potential endogeneity will produce misleading results. Fortunately, the above issue can be reduced by employing FMOLS and DOLS regression techniques. Al Mamun et al. (2018) considered that endogeneity can be alleviated using the FMOLS regression technique. Risso et al. (2013) stated that the FMOLS and DOLS estimators deal with the problem of endogeneity.

4. Empirical Findings

In this section, we use appropriate econometric techniques to reveal the underlying relationship between income inequality and financial development for a sample of 21 emerging markets.

4.1. Slope Homogeneity Test

Table 3 reports the mean of each investigated variable. Variations in the averages could suggest heterogeneity across panels. For example, while the average GDP per capita growth was quite high in China (8.67%), Bulgaria (4.52%), and Thailand (4.48%), it was low in South Africa (0.46%) and Ukraine (−0.45%). Similarly, the magnitudes of financial development and inflation varied significantly across the analyzed countries. Breitung (2005) stated that if the panel was heterogeneous, the estimated coefficients would be biased.

Table 3. The mean of each variable.

Country	Gini	g	FD	Inflation	GovExp/GDP	Observed Period
Argentina	40.13	1.31	17.71	185.73	11.16	1961–2015
Bangladesh	32.50	2.76	21.00	6.32	4.83	1974–2016
Brazil	50.61	2.27	45.86	335.17	14.72	1961–2015
Bulgaria	33.09	4.52	50.24	4.10	17.73	2001–2016
Chile	46.87	2.63	56.18	45.42	11.79	1968–2015
China	36.28	8.67	95.37	5.44	13.91	1978–2015
Colombia	50.86	2.24	33.02	15.79	13.43	1970–2015
Hungary	27.86	2.30	45.94	4.24	21.11	2001–2016
India	43.03	3.81	29.91	7.54	10.97	1980–2017
Indonesia	35.81	3.49	32.24	9.83	8.94	1980–2017
Malaysia	44.72	3.93	90.24	3.53	13.97	1970–2016
Mexico	47.90	1.77	22.18	21.07	9.50	1963–2016
Pakistan	34.59	2.37	24.32	8.75	11.13	1964–2013
Peru	52.25	1.41	19.41	293.18	11.09	1972–2011
Philippines	43.05	1.70	27.89	9.10	9.90	1961–2015
Poland	31.45	3.64	39.23	2.23	18.37	2001–2016
Romania	31.38	3.60	23.09	22.87	15.31	1996–2016
South Africa	57.17	0.46	104.65	9.67	17.78	1975–2015
Thailand	42.79	4.48	71.22	4.62	11.88	1962–2013
Turkey	42.69	3.03	29.05	41.31	12.48	1987–2016
Ukraine	28.03	−0.45	36.31	264.86	19.64	1992–2016

Source: The above table employs post-tax, post-transfer income as a proxy for the Gini coefficient and a domestic credit to private sector–GDP ratio as a proxy for financial development.

4.2. Cross-Section Dependence Test

Correlation of the residual across entities seems to be common in macro data where a group of highly connected countries are examined. Spill-over effects across countries are often considered as

sources of the linkages. Estimations which ignore cross-section dependence will result in inconsistent estimates or lead to inaccurate conclusions. Thus, in order to verify the existence of cross-section dependence, we conducted the CD test proposed by Pesaran (2015). The empirical results are reported in Table 4.

Table 4. Results from Pesaran's CD test for cross-section dependence.

Variable	Gini	g	g^2	FD	FD^2	Inflation	GovExp/GDP
CD test	1.30	17.65 ***	4.88 ***	23.78 ***	22.27 ***	17.69 ***	1.12
p-value	0.19	0.00	0.00	0.00	0.00	0.00	0.26

Note: *** significant at 1% level. Null hypothesis is of cross-section independence.

For our dataset, the null hypothesis of cross-section independence was rejected at the 1% level of significance to some variables of economic growth, financial development, and inflation, suggesting that cross-section dependence should be accounted for in the regression techniques.

4.3. Panel Unit Root Test

On the grounds of the issue of heterogeneous panels and cross-section dependence, we employed the *t*-test for unit roots, as proposed by Pesaran (2003). As presented in Table 5, referring to the *p*-value in the first and second columns, it is suggested that all variables contained unit roots. However, the statistical estimates in the third and fourth columns indicate that the first difference of those was stationary. In summary, the considered variables were integrated of order one, or I(1).

Table 5. Results from panel unit root test.

Variable	Level		First Difference		Order of Integration
	Constant (1)	Constant and Trend (2)	Constant (3)	Constant and Trend (4)	
Gini	0.77 (0.77)	1.74 (0.96)	−11.50 *** (0.00)	−9.55 *** (0.00)	I (1)
g	0.01 (0.50)	0.53 (0.70)	−13.41 *** (0.00)	−11.04 *** (0.00)	I (1)
g^2	0.52 (0.70)	1.07 (0.85)	−1.70 ** (0.04)	−4.62 *** (0.00)	I (1)
FD	2.56 (0.99)	4.48 (1.00)	−4.38 *** (0.00)	−3.28 *** (0.00)	I (1)
FD^2	2.04 (0.97)	3.37 (1.00)	−4.40 *** (0.00)	−2.93 *** (0.00)	I (1)
Inflation	0.55 (0.71)	1.27 (0.89)	−11.45 *** (0.00)	−9.64 *** (0.00)	I (1)
GovExp/GDP	−1.03 (0.15)	0.25 (0.60)	−6.03 *** (0.00)	−3.78 *** (0.00)	I (1)

Note: The *p*-values are reported in parentheses. The Z[t-bar] is reported. ** significant at 5% level, *** significant at 1% level. Null hypothesis assumes that all series are non-stationary.

4.4. Panel Cointegration Test

We continued to conduct another test—the panel cointegration test—before determining how financial development affects income inequality. To examine the existence of a long-run equilibrium relationship between the variables of interest, we employed the tests of Kao (1999); Pedroni (1999, 2004); and Westerlund (2005). Findings are presented in Table 6. The results of the Pedroni and Kao tests were statistically significant at the level of 1%, and significant estimates emerged from the Westerlund test. These results indicate that the variables were cointegrated in all panels or there was a long-run equilibrium relationship between them.

Table 6. Panel cointegration test results.

Cointegration Test	Statistics
Pedroni	
Phillips–Perron *t*	3.58 *** (0.00)
Panel ADF statistic	3.85 *** (0.00)
Kao	
Modified Dickey–Fuller *t*	2.61 *** (0.00)
Dickey–Fuller *t*	2.83 *** (0.00)
Augmented Dickey–Fuller *t*	3.09 *** (0.00)
Unadjusted modified Dickey–Fuller *t*	2.40 *** (0.00)
Unadjusted Dickey–Fuller *t*	2.55 *** (0.00)
Westerlund	
Variance Ratio	1.42 * (0.07)

Note: The *p*-values are reported in parentheses. * significant at 10% level, *** significant at 1% level. Null hypothesis assumes no cointegration.

4.5. Estimation Results

Table 7 presents the long-run estimates of a pool of 21 selected emerging countries. We proceeded in several steps, starting with the panel FMOLS and then dealing with the DOLS estimators. Note that the domestic credit to private sector–GDP ratio and the post-tax income were employed to measure financial development and income inequality, respectively.

Table 7. Regression results (post-tax, post-transfer income).

Regressors	FMOLS	DOLS
g	0.037 * (0.096)	1.435 *** (0.000)
g^2	−0.002 (0.536)	−0.083 *** (0.001)
FD	0.197 *** (0.000)	0.295 * (0.052)
FD^2	−0.003 *** (0.000)	−0.006 * (0.064)
Inflation	−0.010 (0.122)	−0.175 *** (0.000)
GovExp/GDP	0.017 (0.542)	0.679 *** (0.000)
Number of observations	754	705
R^2	0.499	0.93

Note: * significant at 10% level, *** significant at 1% level. *p*-values are in parentheses. DOLS: dynamic OLS; FMOLS: fully modified OLS.

Regardless of the estimation techniques employed in this paper, the results were similar to the estimates of economic growth. The coefficient of g was positive and significant and the coefficient of g^2 was negative, although it was only significant under the FMOLS estimation. The results imply that the

income inequality–economic growth nexus follows the prediction of Kuznets (1955). Furthermore, they indicate a turning point for annual percentage growth rate of GDP per capita of 9.25 and 8.6 for FMOLS and DOLS, respectively.

Both FMOLS and DOLS estimators support an inverted U curve between financial development and income inequality. At the level of 10%, the coefficient of *FD* was positive while that of FD^2 was negative, indicating that the hypothesis of Greenwood and Jovanovic (1990) is confirmed in our study. The estimated turning point for *FD* was 32.8 and 24.5 for the above two estimations.

This finding is also supported by the study of Younsi and Bechtini (2018), in which the BRICS members were investigated, or the study of Zhang and Chen (2015), which is dedicated to China. From another point of view, the results also indicate a rejection of the linearity of the financial development–inequality nexus.

Regardless of the control variables, we suggest that their effects on income inequality were quite consistent across estimations. Particularly, inflation was negatively related to income inequality, indicating that as inflation increases, income inequality decreases. Jauch and Watzka (2016) argued that debtors would benefit from high inflation due to a reduction in their debt obligation, as most contracts are written in nominal terms. That relationship was also found in the study of Park and Shin (2017). On the other hand, the government expenditure–GDP ratio was positively associated with income inequality. Jauch and Watzka (2016) stated that a large share of government expenditure in the economy operated by the elite through rent-seeking activities could widen inequality.

Overall, the use of the domestic credit to private sector–GDP ratio as a measure of financial development rejects the linearity of the financial development–inequality nexus and supports its non-linearity, as presented in Table 7. However, the conclusion seems to be somewhat arbitrary due to the choice of proxy for income inequality and financial development. Thus, in the following section, we perform robustness checks in relation to the use of various proxies for financial development.

5. Robustness Checks

Thus far, this paper has used inequality in disposable (post-tax, post-transfer) income. As such, we use the inequality in market (pre-tax, pre-transfer) income as a robustness check.

The results from Table 8 suggest that there is an inverted U curve in the relationship between income inequality and economic growth as well as between income inequality and financial development. The results not only further strengthen the findings presented in Table 7 but also confirm the inverted U curve hypothesis of Greenwood and Jovanovic (1990).

Table 8. Regression results (pre-tax, pre-transfer income).

Regressor	FMOLS	DOLS
g	0.044 * (0.07)	0.499 (0.379)
g^2	−0.003 (0.239)	−0.031 (0.381)
FD	0.254 *** (0.000)	0.423 *** (0.009)
FD^2	−0.004 *** (0.000)	−0.008 ** (0.022)
Inflation	−0.011 (0.140)	−0.103 ** (0.047)
GovExp/GDP	−0.045 (0.148)	−0.319 (0.208)
Number of observations	754	705
R^2	0.529	0.913

Note: * significant at 10% level, ** significant at 5% level, *** significant at 1% level. *p*-values are in parentheses.

Development finance refers to economic analysis of the role of financial resources and financial institutions in the development of an economy (Rao 2003). Ouyang and Li (2018) argued that financial development was a multifaceted phenomenon. From that argument, they stated that using only one proxy variable to measure financial development would provide misleading conclusions. Indeed, it is observable that financial structure, financial market size, and the efficiency of financial intermediaries for each country are quite different from their counterparts in other countries (Ang 2008). Thus, in addition to the domestic credit to private sector–GDP ratio variable, we also employed other variables as proxies for financial development, including (i) stock market capitalization as percentage of GDP, (ii) domestic credit to private sector by banks-to-GDP ratio, (iii) domestic credit provided by financial sector-to-GDP ratio, and (iv) the IMF-proposed financial development index. The first three variables were obtained from the WDI while the last is available in the IMF database.

The IMF-proposed financial development index is an overall index which accounts for the depth, access, and efficiency of the financial sector. It was developed on a sample of 183 countries and is available on an annual basis over the period of 1980–2013. As such, we expected that the variable would provide a comprehensive picture of how financial development affects income inequality. Empirical estimates are presented in Table 9.

Table 9. Regression results using various proxies for financial development including stock market capitalization as percentage of GDP, domestic credit to private sector by banks-to-GDP ratio, domestic credit provided by financial sector-to-GDP ratio, and the IMF-proposed financial development index.

Regressors	Gini (Disposable Income)		Gini (Market Income)	
	FMOLS	**DOLS**	**FMOLS**	**DOLS**
Panel A: Stock market capitalization as percentage of GDP				
g	0.219 ***	0.105 *	−0.053	0.147
	(0.000)	(0.096)	(0.494)	(0.405)
g^2	−0.016 **	0.009	0.003	0.040 *
	(0.016)	(0.397)	(0.762)	(0.084)
FD	0.014	−0.045 ***	0.012	0.083 *
	(0.348)	(0.001)	(0.477)	(0.081)
FD^2	−0.000 ***	0.000 ***	−0.001 ***	−0.002 ***
	(0.000)	(0.001)	(0.001)	(0.000)
Inflation	−0.025	−0.035 **	−0.017	−0.02
	(0.184)	(0.020)	(0.392)	(0.715)
GovExp/GDP	−0.083	0.179 **	−0.108	0.285
	(0.324)	(0.036)	(0.199)	(0.223)
Number of observations	436	214	436	214
R^2	0.502	0.982	0.58	0.914
Panel B: Domestic credit to private sector by banks-to-GDP ratio				
g	0.027	−0.034 *	0.056 **	−0.058 **
	(0.210)	(0.078)	(0.047)	(0.019)
g^2	−0.001	−0.002	−0.005	0.004
	(0.572)	(0.280)	(0.124)	(0.125)
FD	0.147 ***	0.054 ***	0.227 ***	0.084 ***
	(0.000)	(0.000)	(0.000)	(0.000)
FD^2	−0.002 ***	−0.000 ***	−0.004 ***	−0.000 ***
	(0.000)	(0.000)	(0.000)	(0.000)
Inflation	−0.012 *	0.000	−0.017	0.000 *
	(0.064)	(0.105)	(0.102)	(0.086)
GovExp/GDP	0.028	−0.405 ***	−0.042	−0.360 ***
	(0.300)	(0.000)	(0.292)	(0.000)
Number of observations	754	712	754	712
R^2	0.506	0.951	0.611	0.925

Table 9. *Cont.*

Regressors	Gini (Disposable Income)		Gini (Market Income)	
	FMOLS	**DOLS**	**FMOLS**	**DOLS**
Panel C: Domestic credit provided by financial sector-to-GDP ratio				
g	0.118 ***	−0.146 ***	0.089 ***	−0.029
	(0.000)	(0.000)	(0.000)	(0.328)
g^2	−0.009 ***	−0.003	−0.009 ***	0.008 **
	(0.002)	(0.313)	(0.000)	(0.020)
FD	0.201 ***	0.031 ***	0.118 ***	0.030 ***
	(0.000)	(0.000)	(0.000)	(0.002)
FD^2	−0.001 ***	−0.000 ***	−0.000 **	−0.000 *
	(0.000)	(0.000)	(0.035)	(0.063)
Inflation	−0.014	0.000 ***	−0.006	0.008 **
	(0.141)	(0.000)	(0.491)	(0.010)
GovExp/GDP	0.062	−0.023	−0.070 *	0.004
	(0.168)	(0.203)	(0.067)	(0.881)
Number of observations	709	709	709	711
R^2	0.5252	0.936	0.536	0.934
Panel D: IMF-proposed financial development index				
g	0.083 *	0.015	0.115 **	0.029
	(0.063)	(0.755)	(0.010)	(0.646)
g^2	−0.041	0.001	−0.043	0.003
	(0.381)	(0.896)	(0.365)	(0.743)
FD	10.479 ***	7.375	7.933 ***	10.982 *
	(0.000)	(0.116)	(0.000)	(0.0600)
FD^2	−18.003 ***	−18.614 ***	−12.283 ***	−25.116 ***
	(0.000)	(0.000)	(0.000)	(0.000)
Inflation	−0.024	0.002	−0.027	0.002
	(0.278)	(0.190)	(0.226)	(0.181)
GovExp/GDP	0.058 ***	−0.003	0.083 ***	0.118
	(0.001)	(0.966)	(0.000)	(0.130)
Number of observations	652	473	652	474
R^2	0.558	0.970	0.632	0.974

Note: * significant at 10% level, ** significant at 5% level, *** significant at 1% level. *p*-values are in parentheses. The IMF-proposed financial development index starts in 1980 and ends in 2013.

It is observed that the impact of financial development on income inequality holds firmly. That is, there is an inverted U curve in the relationship between them. These findings imply that the growth of the financial sector exacerbates income inequality at its early stages of development before it narrows income inequality after a certain threshold.

6. Concluding Remarks

The relationship between financial development and inequality has attached great attention from academics, practitioners, and policymakers in the past few decades. Various debates have emerged in relation to the influences of the financial sector on income inequality, especially after the global financial crisis of 2008. In addition, a theoretical consensus on the finance–inequality nexus has not been reached among scholars. As such, this study was conducted to provide additional empirical evidence on the influence of financial development, which is heavily pursued by many emerging markets, on income inequality. We extended the finance–inequality nexus framework through an investigation on a sample of 21 emerging countries over the period of 1961–2017. Various proxies of financial development were utilized in this paper. In addition, this paper employed various estimation techniques, focusing on the long-run relationship between financial development and income inequality, accounting for endogeneity in order to ensure that the estimated findings are robust.

Our results indicate that there is an inverted U curve relationship between financial development and income inequality in emerging markets. That is, it seems that at the early stage of financial

development, the expansion of a financial sector is likely to be associated with an increase in income inequality. Once a certain level of a financial development is achieved, income inequality is expected to fall. These findings hold for various proxies of financial development as well as income inequality.

The empirical findings of this paper offer additional evidence for the governments of emerging countries to formulate and implement their respective economic policies. As there is a tradeoff between income inequality and the development of a national financial sector, it is necessary for any policy to ensure that the achievements of the economic development are redistributed to the people—especially those at the bottom of the national income distribution level. In addition, it appears to be crucial to target financial development towards the poor in society, and to the small and medium firms. Our results also indicate that income inequality is expected to be reduced after a certain level of financial development. In other words, financial development is essential for reducing income inequality. Moreover, there is no doubt that financial development plays a key role in sustainable economic growth and development. Overall, these considerations suggest that the development of a financial sector should receive proper attention from policy makers. Financial development continues to be considered as an important and effective mechanism to achieve sustainable economic growth and development of the emerging markets. However, financial reform should be carefully implemented. Policy makers should be aware of valuable lessons learned from the global financial crisis of 2008.

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References

Afonso, António, Ludger Schuknecht, and Vito Tanzi. 2010. Income distribution determinants and public spending efficiency. *The Journal of Economic Inequality* 8: 367–89. [CrossRef]

Agnello, Luca, Sushanta K. Mallick, and Ricardo M. Sousa. 2012. Financial reforms and income inequality. *Economics Letters* 116: 583–87. [CrossRef]

Al Mamun, Md, Kazi Sohag, Muhammad Shahbaz, and Shawkat Hammoudeh. 2018. Financial markets, innovations and cleaner energy production in OECD countries. *Energy Economics* 72: 236–54. [CrossRef]

Ang, James B. 2008. A survey of recent developments in the literature of finance and growth. *Journal of Economic Surveys* 22: 536–76. [CrossRef]

Ang, James B. 2010. Finance and inequality: the case of India. *Southern Economic Journal* 76: 738–61. [CrossRef]

Atkinson, Anthony Barnes. 2003. Income inequality in OECD countries: Data and explanations. *CESifo Economic Studies* 49: 479–513. [CrossRef]

Banerjee, Abhijit V., and Andrew F. Newman. 1993. Occupational Choice and the Process of Development. *Journal of Political Economy* 101: 274–98. [CrossRef]

Batuo, Michael Enowbi, Francesco Guidi, and Kupukile Mlambo. 2010. Financial Development and Income Inequality: Evidence from African Countries. Available online: https://mpra.ub.uni-muenchen.de/25658/ (accessed on 5 March 2019).

Bensidoun, Isabelle, Sébastien Jean, and Aude Sztulman. 2011. International trade and income distribution: reconsidering the evidence. *Review of World Economics* 147: 593–619. [CrossRef]

Breitung, Jörg. 2005. A parametric approach to the estimation of cointegration vectors in panel data. *Econometric Reviews* 24: 151–73. [CrossRef]

Claessens, Stijin, and Enrico Perotti. 2007. Finance and inequality: Channels and evidence. *Journal of comparative Economics* 35: 748–73. [CrossRef]

Clarke, Geogre R. G., Lixin Colin Xu, and Heng-Fu Zou. 2006. Finance and income inequality: what do the data tell us? *Southern Economic Journal* 72: 578–96. [CrossRef]

De Dominicis, Laura, Raymond J. G. M. Florax, and Henri L. F. de Groot. 2008. A Meta-Analysis on the Relationship between Income Inequality and Economic Growth. *Scottish Journal of Political Economy* 55: 654–82. [CrossRef]

De Haan, Jakob, and Jan-Egbert Sturm. 2017. Finance and income inequality: A review and new evidence. *European Journal of Political Economy* 50: 171–95. [CrossRef]

Deininger, Klaus, and Lyn Squire. 1996. A New Data Set Measuring Income Inequality. *World Bank Economic Review* 10: 565–91. [CrossRef]

Dowrick, Steve, and Muhammad Akmal. 2005. Contradictory trends in global income inequality: A tale of two biases. *Review of Income and Wealth* 51: 201–29. [CrossRef]

Galor, Oded, and Joseph Zeira. 1993. Income Distribution Macroeconomics. *The Review of Economic Studies* 60: 35–52. [CrossRef]

Greenwood, Jeremy, and Boyan Jovanovic. 1990. Financial Development, Growth, and the Distribution of Income. *Journal of Political Economy* 98: 1076–107. [CrossRef]

De Gregorio, José, and Jong-Wha Lee. 2002. Education and income inequality: New evidence from cros-country data. *Review of Income and Wealth* 48: 395–416. [CrossRef]

Grijalva, Diego F. 2011. Inequality and Economic Growth: Bridging the Short-run and the Long-run. EScholarship, Univ of California. Available online: http://escholarship.org/uc/item/4kf1t5pb (accessed on 5 March 2019).

Hamori, Shigeyuki, and Yoshihiro Hashiguchi. 2012. The effect of financial deepening on inequality: Some international evidence. *Journal of Asian Economics* 23: 353–59. [CrossRef]

Huber, Evelune, and John D. Stephens. 2014. Income inequality and redistribution in post-industrial democracies: demographic, economic and political determinants. *Socio-Economic Review* 12: 245–67. [CrossRef]

Jauch, Sebastian, and Sebastian Watzka. 2016. Financial development and income inequality: A panel data approach. *Empirical Economics* 51: 291–314. [CrossRef]

Jaumotte, Florence, Subir Lall, and Chris Papageorgiou. 2013. Rising income inequality: technology, or trade and financial globalization? *IMF Economic Review* 61: 271–309. [CrossRef]

Kao, Chihwa. 1999. Spurious regression and residual-based tests for cointegration in panel data. *Journal of Econometrics* 90: 1–44. [CrossRef]

Kappel, Vivien. 2010. The Effects of Financial Development on Income Inequality and Poverty. Available online: https://ssrn.com/abstract=1585148 (accessed on 8 January 2019).

Kim, Dong-Hyeon, and Shu-Chin Lin. 2011. Nonlinearity in the financial development-income inequality nexus. *Journal of Comparative Economics* 39: 310–25. [CrossRef]

Kuznets, Simon. 1955. Economic Growth and Income Inequality. *American Economic Review* 45: 1–28. [CrossRef]

Law, Siong Hook, Hui Boon Tan, and W. N. W. Azman-Saini. 2014. Financial Development and Income Inequality at Different Levels of Institutional Quality. *Emerging Markets Finance and Trade* 50: 21–33. [CrossRef]

Li, Hongyi, and Heng-Fu Zou. 1998. Income inequality is not harmful for growth: theory and evidence. *Review of Development Economics* 2: 318–34. [CrossRef]

Li, Hongyi, Lyn Squire, and Heng-fu Zou. 1998. Explaining international and intertemporal variations in income inequality. *The Economic Journal* 108: 26–43. [CrossRef]

Mahesh, Malvika. 2016. The effects of trade openness on income inequality: Evidence from BRIC countries. *Economics Bulletin* 36: 1751–61.

Malinen, Tuomas. 2012. Inequality and growth: Another look with a new measure and method. *Journal of International Development* 25: 122–38. [CrossRef]

Milanović, Branko. 2000. *Equality, Participation, Transition*. London: Palgrave Macmillan, pp. 48–79.

Mookerjee, Rajen, and Paul Kalipioni. 2010. Availability of financial services and income inequality: The evidence from many countries. *Emerging Markets Review* 11: 404–8. [CrossRef]

Nguyen, Cong Thang, Vo The Anh, Pham Ngoc Thach, Do Thanh Trung, and Vo Hong Duc. 2019. Gender-Based Attitudes toward Income Inequality in the Asia-Pacific Region. *Emerging Markets Finance and Trade*, 1–15. [CrossRef]

Ouyang, Yaofu, and Peng Li. 2018. On the nexus of financial development, economic growth, and energy consumption in China: New perspective from a GMM panel VAR approach. *Energy Economics* 71: 238–52. [CrossRef]

Pan-Long, Tsai. 1995. Foreign direct investment and income inequality: Further evidence. *World Development* 23: 469–83. [CrossRef]

Park, Donghyun, and Kwanho Shin. 2017. Economic Growth, Financial Development, and Income Inequality. *Emerging Markets Finance and Trade* 53: 2794–25. [CrossRef]

Pedroni, Peter. 1999. Critical Values for Cointegration Tests in Heterogeneous Panels with Multiple Regressors. *Oxford Bulletin of Economics and Statistics* 61: 653–70. [CrossRef]

Pedroni, Peter. 2004. Panel cointegration: Asymptotic and finite sample properties of pooled time series tests with an application to the PPP hypothesis. *Econometric Theory* 20: 597–625. [CrossRef]

Pesaran, M. Hashem. 2003. A Simple Panel Unit Root Test in the Presence of Cross-Section Dependence. Available online: http://www.econ.cam.ac.uk/research-files/repec/cam/pdf/cwpe0346.pdf (accessed on 5 March 2019).

Pesaran, M. Hashem. 2015. Testing Weak Cross-Sectional Dependence in Large Panels. *Econometric Reviews* 34: 1089–117. [CrossRef]

Rajan, Raghuram G., and Luigi Zingales. 2003. *Saving Capitalism from the Capitalists*. New York: Crown Business.

Rao, Pinninti K. 2003. *Development Finance*. New York: Springer. [CrossRef]

Risso, W. Andrián, Lionello F. Punzo, and Edgar J. Sánchez Carrera. 2013. Economic growth and income distribution in Mexico: A cointegration exercise. *Economic Modelling* 35: 708–14. [CrossRef]

Roine, Jesper, Jonas Vlachos, and Daniel Waldenström. 2009. The long-run determinants of inequality: What can we learn from top income data? *Journal of Public Economics* 93: 974–88. [CrossRef]

Rousseau, Peter L., and Hakan Yilmazkuday. 2009. Inflation, financial development, and growth: A trilateral analysis. *Economic Systems* 33: 310–24. [CrossRef]

Sehrawat, Madhu, and A. K. Giri. 2015. Financial development and income inequality in India: An application of ARDL approach. *International Journal of Social Economics* 42: 64–81. [CrossRef]

Seven, Unal, and Yener Coskun. 2016. Does financial development reduce income inequality and poverty? Evidence from emerging countries. *Emerging Markets Review* 26: 34–63. [CrossRef]

Solt, Frederick. 2016. The Standardized World Income Inequality Database. *Social Science Quarterly* 97: 1267–81. [CrossRef]

Svirydzenka, Katsiaryna. 2016. Introducing a New Broad-Based Index of Financial Development. International Monetary Fund. Available online: https://www.imf.org/external/pubs/ft/wp/2016/wp1605.pdf (accessed on 3 March 2019).

Urata, Shujiro, and Dionisius A. Narjoko. 2017. International Trade and Inequality. Available online: https://www.adb.org/publications/international-trade-and-inequality (accessed on 5 September 2019).

Vo, Hong Duc, Huynh Van Son, Vo The Anh, and Ha Thi Thieu Dao. 2019a. The importance of the financial derivatives markets to economic development in the world's four major economies. *Journal of Risk and Financial Management* 12: 35. [CrossRef]

Vo, Hong Duc, Nguyen Van Phuc, Nguyen Minh Ha, Vo The Anh, and Nguyen Cong Thang. 2019b. Derivatives Market and Economic Growth Nexus: Policy Implications for Emerging Markets. *The North American Journal of Economics and Finance*. [CrossRef]

Westerlund, Joakim. 2005. New simple tests for panel cointegration. *Econometric Reviews* 24: 297–316. [CrossRef]

Yilmazkuday, Hakan. 2011. Thresholds in the finance-growth nexus: A cross-country analysis. *The World Bank Economic Review* 25: 278–95. [CrossRef]

Yilmazkuday, Hakan. 2012. Inflation thresholds and growth. *International Economic Journal* 27: 1–10. [CrossRef]

Younsi, Moheddine, and Marwa Bechtini. 2018. Economic Growth, Financial Development and Income Inequality in BRICS Countries: Evidence from Panel Granger Causality Tests. Available online: https://mpra.ub.uni-muenchen.de/85182/1/MPRA_paper_85181.pdf (accessed on 6 August 2019).

Zhang, Quanda, and Rongda Chen. 2015. Financial development and income inequality in China: An application of SVAR approach. *Procedia Computer Science* 55: 774–81. [CrossRef]