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The long-run effects of financial development on income inequality: Evidence from the Asia-Pacific countries

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ABSTRACT

Income inequality is a vexing developmental challenge for governments and policymakers as it impedes social transformation and economic growth and development. Meanwhile, promoting financial development is generally regarded as an effective way to achieve inclusive and sustainable growth. This study examines the long-run effects of financial development, economic growth, and their combined effects on income inequality for 12 Asia-Pacific countries from 1990 to 2021. This paper employs various econometric techniques and different financial development proxies to ensure the findings' robustness. The paper also constructs a financial development index using the principal component analysis to fully capture the comprehensive effect of financial development on income inequality. Empirical results reveal that the impact of financial development on income inequality follows the inverted U-shaped relationship – financial development widens income inequality and only reduces income when surpassing its turning point. Findings further reveal that the nonlinear effect of financial development on income inequality is contingent upon the level of per capita income. Thus, policies promoting financial development to reduce income inequality should consider the existing level of per capita income.

1. Introduction

Income inequality represents the disparities in income distribution among populations or countries. Income inequality can unfavourably affect many aspects of an individual's life and a nation's economic growth and development. As such, rising income inequality is a primary concern and a vexing developmental challenge that policymakers are often unaware of or unwilling to address [1]. Indeed, reducing income inequality is one of the Sustainable Development Goals (SDGs) of the 2030 Agenda by the United Nations [2]. Nonetheless, the emergence of the Covid-19 pandemic has accentuated global income inequality, partly reversing the downward trend of the previous two decades. The Asia-Pacific region's progress in closing the income gap is decelerated and affected by the pandemic [3]. Consequently, income inequality in the Asia-Pacific region remains high and continues to grow. Fig. 1 illustrates and compares income inequality (using the Gini index) across the Asia-Pacific subregions. The Asia-Pacific region shows a high-income inequality. Southeast Asia exhibits the most considerable income inequality, whereas the lowest income inequality is observed in Central Asia. Should such a rising trend of income inequality continue, the Asia-Pacific region will be unable to attain the important goal of sustainable development by 2030 [1].

The Asia-Pacific countries have considered financial development an effective way to reduce income inequality. Accordingly, many

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studies have been conducted to investigate the finance-inequality nexus. However, empirical evidence on this nexus is still inconclusive. One strand of research supports the inequality-widening hypothesis by considering that financial development helps the rich rather than the poor, so income inequality increases [4,5]. In contrast, the second strand substantiates the inequality-narrowing hypothesis, which posits that further financial development reduces income inequality by easing credit constraints, allowing the poor to borrow from financial institutions and invest in profitable investments [6,7]. Nevertheless, the last strand confirms that the finance-inequality nexus follows the inverted U-shaped relationship [8,9]. In particular, financial development initially exacerbates and only alleviates income inequality once it exceeds the respective threshold.

Existing studies on the finance-inequality nexus appear to focus on the short-term effects. Meanwhile, the long-run effects of financial development on income inequality have largely been under-examined, particularly in the Asia-Pacific region. Tackling income inequality to achieve sustainable economic growth and development takes time. This study aims to enrich the existing literature on income inequality by investigating the long-run linkage between financial development and income inequality in the Asia-Pacific region from 1990 to 2021. Various estimation techniques and different proxies of financial development are utilized to ensure the robustness of the findings. In addition, we also construct the financial development index using Principal Component Analysis to fully capture the comprehensive effect of financial development.

Empirical results from this study indicate that the finance-inequality follows an inverted U-shaped relationship. These findings imply that financial development can reduce income inequality when it exceeds its threshold. Financial development may affect economic opportunities in society. These opportunities are determined by individual skills, parental wealth, and social status, which thereby benefit the rich [10]. These opportunities contribute to larger income inequality between the rich and the poor. However, further financial development improves financial contracts, markets, and intermediaries. These improvements expand economic opportunities, leading to reduce income inequality. Besides, financial development will also foster economic growth by expanding economic opportunities, leading to further reduced income inequality. In addition, the nonlinear effect of financial development on income inequality varies depending on the level of per capita income. As such, governments in the region may need to consider appropriate instruments and policies to promote financial development as a starting point to achieve sustainable economic growth and reduce income inequality in the Asia-Pacific region.

Our study makes three contributions to the finance-inequality literature. First, we employ the principal component analysis to construct an index of financial development. This technique is used to reduce the dimensionality of the dataset while maintaining most of its important information, thereby enabling us to fully capture financial development in the Asia-Pacific region from various minor financial development indicators. Second, our study sheds light on the long-run dynamics of finance-inequality nexus, which has largely been ignored in the existing literature. Our analysis confirms that the impact of financial development on income inequality extends beyond the short run and persists in the long run. As such, our findings encourage governments to formulate and implement long-lasting measures, thereby assisting them in pursuing sustainable economic growth. Third, our study provides a fresh perspective on the effect of financial development on income inequality by indicating that such an effect is contingent on the level of per capita income. This insight is significant as it can assist policymakers in accurately assessing their countries' macro-conditions and formulating targeted measures to address the issue of increasing income inequality.

Following this introduction, the remainder of this paper is structured as follows. Section 2 provides an overview of related literature. Next, data and research methods are discussed in section 3. Finally, section 4 presents and discusses empirical findings from this analysis, including the robustness analysis, followed by the conclusions and policy implications in section 5 of the paper.

2. Literature review

This review sheds light on the nexus between financial development and income inequality. A large body of studies has examined

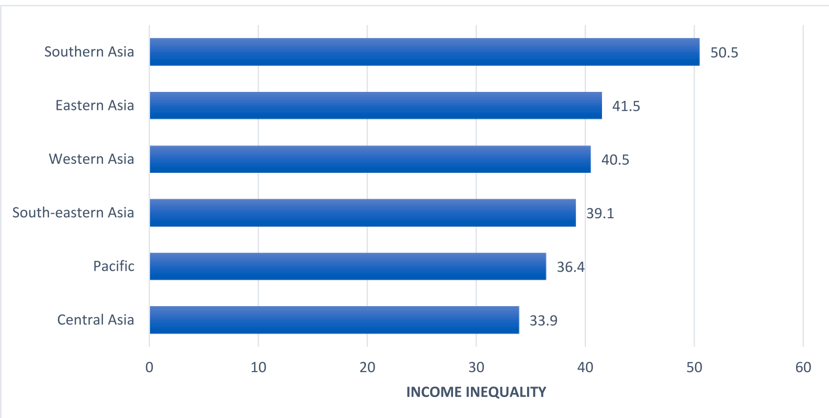


Fig. 1. Income inequality across the Asia-Pacific region.
Source: United Nations Development Programme (2022) | UNU-WIDER, World Income Inequality Database (WIID) Companion dataset. Version May 31, 2021

how financial development affects income inequality. These studies fall into one of the following hypotheses: (i) the inequality-widening hypothesis, (ii) the inequality-narrowing hypothesis, and (iii) the financial Kuznets curve hypothesis.

The first stream of research focusing on the inequality-widening hypothesis considers that further financial development does not reduce but widens income inequality [5,11,12,13]. This is because financial development enhances access to financial services for existing users rather than newcomers. In this case, wealthy individuals benefit more from financial development than the poor, increasing the disparity in income distribution. For instance, [4] analyze the finance-inequality nexus for 138 developed and developing countries from 1960 to 2008. They found a positive relationship between financial development and income inequality, implying that further financial sector development will increase income inequality. Seven & Coskun [14] support the inequality-widening hypothesis because they argue that the poorest segments of the population in emerging countries have not benefited from financial development from the banking and stock markets. Besides, [15] findings also found no compelling evidence to support the claim that financial development reduces income inequality. Their findings further indicate that advanced economies do not even experience the favourable effects of financial development on income inequality.

Meanwhile, the second strand of research focuses on the inequality-narrowing hypothesis [6,7,16,17,18]. This hypothesis posits that income inequality will reduce through the development of the financial sector. Only wealthy individuals will become entrepreneurs because profitable investments frequently require the amount of initial capital to the extent the poor cannot afford. Furthermore, credit constraints or capital market imperfections (such as information asymmetry or transaction costs) prevent people with low incomes from profitable investments. Thus, people experiencing poverty cannot invest and earn money by working for entrepreneurs. In this case, financial development is a means to alleviate credit constraints, allowing low-income people to finance via financial institutions to invest in human and physical capital. As a result, income inequality reduces.

The last stream is generally named the financial Kuznets curve hypothesis. This hypothesis postulates the finance-inequality nexus following the inverted U-shaped relationship similar to the growth-inequality linkage in [19]. Later, [8], in their seminal work, argue that economic growth and financial development are inextricably linked. Therefore, they can reduce income inequality. At the beginning of economic growth, financial infrastructure does not fully develop, and its progress is relatively slow. Thus, only the rich can access financial services due to the expensive costs. More people benefit from financial development in the next stage when economic growth leads to finance infrastructure development. Still, most are the wealthy or individuals who already have access to financial services - consequently, income inequality increases. In the later stage of economic growth, when financial infrastructure is developed or its development exceeds a particular threshold, a significant proportion of the population can access financial services. As such, income inequality is narrowed. Besides, numerous studies have also found evidence of an inverted U-shaped linkage between financial development and income inequality [9,20,21,22,23].

Our review indicates that although intensive studies investigate the finance-inequality nexus, no consensus has been reached on this linkage. Besides, to our best knowledge, surprisingly, few studies have been conducted on this linkage in the long run. As such, it is paramount to analyze the long-run effects of financial development on income inequality for the Asia-Pacific countries. These countries have put great effort into encouraging financial development supporting economic goals, and reducing income inequality in the region. Simultaneously, countries in the region have aimed to reduce income inequality to achieve sustainable economic growth and development.

3. Data and model specifications

3.1. Data and measurements

This study utilizes the annual data from the Asia-Pacific countries from 1990 to 2021. Our sample comprises twelve Asian-Pacific countries: Australia, China, India, Indonesia, Japan, Korea, Malaysia, Mongolia, New Zealand, Philippines, Thailand, and Vietnam. Table 1 presents definitions of variables used in this study.

This paper uses the Gini coefficient from the Standardized World Income Inequality Databases (SWIID) as a proxy for income inequality [6,15,16,24–26]. Utilizing the same proxy allows us to compare our results with the existing literature.

Table 1
Variables, proxies, and data sources.

Variable	Definition	Proxy	Sources
Dependent variable			
GINI	Income inequality	Gini coefficient of the disposable income	SWIID
Control variables			
HC	Human capital	School enrollment, tertiary (% gross)	WDI
INF	Inflation	Inflation, consumer price index	WDI
GOV	Government spending	General government final consumption expenditure (% of GDP)	WDI
PCGDP	Per capita income	Gross domestic product (GDP) per capita (constant 2015 US$)	WDI
Independent variables			
FD_1	Broad money	Broad money (% of GDP)	WDI
FD_2	Bank credit	Domestic credit to the private sector by banks (% of GDP)	WDI
FD_3	Private credit	Domestic credit to the private sector (% of GDP)	WDI
FDpca	Financial development index	The composite index of financial development proxies using Principal Component Analysis	Authors' Calculation

The following indicators are used to represent financial development: (i) broad money, (ii) bank credit, and (iii) private credit. In addition, we also use Principal Component Analysis to construct a composite index of financial development (as shown in Appendices – Table A1). This method is a machine learning technique used to reduce the dataset's number of features while retaining the data's most important information [27,28]. Three proxies, namely (i) broad money supply, (ii) bank credit, and (iii) private credit, are used to construct an index fully capturing financial development. Broad money supply captures financial deepening by measuring the liquid money available in an economy. Bank credit and private credit capture the development of the banking system and non-banking entities. By incorporating these three indicators into the constructed index, the development of financial markets and institutions is considered. Constructing this comprehensive index allows us to fully capture financial development's effect as it is a multi-dimensional phenomenon [9,29,30].

This paper also controls for other factors: per capita income, human capital, inflation, and government expenditure. [9,15,16,31,32]. These variables are sourced from World Development Indicators (WDI) – a database of the World Bank. These variables' descriptive statistics and correlation matrix are provided in Appendices – Table A2 and Table A3.

3.2. Research methodology

This study examines the finance-inequality nexus using a sample of the Asia-Pacific countries. We test this long-run nexus under the following specifications: (i) the "Linear – Quadratic" model, (ii) the "Linear – Interaction" model, and (iii) the "Complete Second-order" model. Using these three specifications will enable the observation of the standard functional forms for the finance-growth-inequality interrelationship.

Firstly, we examine the finance-inequality nexus considering the level of per capita income under the "Linear – Interaction" model. This specification is constructed because we examine the linear effects of financial development and per capita income on income inequality. The interaction term between financial development and per capita income is included as we observe that many studies have analyzed the effect of either financial development or per capita income on income inequality, but little is known about their combined effect [33–35]. The model is as follows.

$$GINI_{i,t} = \alpha + \beta_1 PCGDP_{i,t} + \beta_2 FD_{i,t} + \beta_3 PCGDP * FD_{i,t} + \delta X_{i,t} + \varepsilon_{i,t}$$

Secondly, we examine the "Linear – Quadratic" model to identify the nonlinear effects of financial development and per capita income on income inequality. This specification is developed by incorporating the quadratic terms of financial development into the highly regarded Kuznets model on the growth-inequality nexus, which is also known as the financial Kuznets curve [19,25,36,37]. The model is as follows.

$$GINI_{i,t} = \alpha + \beta_1 PCGDP_{i,t} + \beta_2 PCGDP^2_{i,t} + \beta_3 FD_{i,t} + \beta_4 FD^2_{i,t} + \delta X_{i,t} + \varepsilon_{i,t}$$

Finally, we construct the "Complete Second-order" model to fully capture the effects of financial development and per capita income on income inequality. Since numerous studies have examined the individual nonlinear effects of financial development and per capita income on income inequality, we examine them in conjunction with their interaction effect [15,21]. Accordingly, we can identify the threshold values of both financial development and per capita income that can reduce income inequality. The model is as follows.

$$GINI_{i,t} = \alpha + \beta_1 PCGDP_{i,t} + \beta_2 PCGDP^2_{i,t} + \beta_3 FD_{i,t} + \beta_4 FD^2_{i,t} + \beta_5 EG * FD_{i,t} + \delta X_{i,t} + \varepsilon_{i,t}$$

$GINI_{i,t}$ represents the dependent variable, capturing income inequality in each country i for period t. $PCGDP_{i,t}$ denotes per capita income. Each model is examined using four proxies of financial development. $FD_{i,t}$ represents financial development using the following proxies: (i) $FD_{1i,t}$ for broad money, (ii) $FD_{2i,t}$ for bank credit, (iii) $FD_{3i,t}$ for private credit, and (iv) $FD_{pca_{i,t}}$ for the composite index of financial development. $X_{i,t}$ captures control variables, including human capital (HC), inflation (INF), and government expenditure (GOV). In line with previous studies, all variables are transformed into the natural logarithm form to normalize data, reduce heteroskedasticity, and ease calculations [26,38,39].

One possible identification concern is the potential endogeneity in the finance-inequality relationship [4,16]. Previous studies often adopt the fixed effects model, two-stage least squares, or generalized method of moments to address this issue. However, these methods are more appropriate for explaining the short-run relationship rather than the long-run one [9].

As such, this paper employs the feasible generalized least squares (FGLS) to examine the long-run relationships between the selected variables. The FGLS is generally considered efficient under heteroskedasticity and cross-sectional correlations [40–42]. Additionally, this paper employs the fully modified OLS (FMOLS) and dynamic OLS (DOLS) for a robustness check. FMOLS was introduced as a technique that produces efficient results for cointegrated variables and addresses the potential endogeneity and serial correlation [43,44]. Later, [45] developed the DOLS estimation, which provides robust results and eliminates correlation among regressors [46].

4. Preliminary analyses

4.1. The cross-sectional dependence and slope homogeneity tests

First, we test whether cross-sectional dependence exists in our panel. This study uses [47] cross-sectional dependence test. The test is highly recommended for balanced and unbalanced panels and the standard normal distribution of a sum of pairwise correlation between panel units. Empirical results from [47] cross-sectional dependence test, as shown in Table 2, reject the null hypotheses of cross-sectional independence for all variables, indicating that the residuals are autocorrelated. Thus, it is vital to use an econometric technique to address the cross-sectional dependence issue.

Later, we test for the slope homogeneity for each proxy of financial development, as shown in Table 3. At the level, the panel data experiences the heterogeneous slope in the cross-sectional dimension at a 1% level. Our results from the slope homogeneity test indicate that null hypotheses of slope homogeneity are all rejected by the "Delta" and "Adjusted Delta" statistics. Instead, these results confirm slope heterogeneity. Thus, appropriate techniques should be employed to address the cross-sectional dependence and slope homogeneity to avoid misleading results.

4.2. Panel unit-root test

The unit-root test is used to examine the stationarity of the series and identify the order of integration. We adopt the first-generation [48,49] and second-generation [47] unit-root tests to ensure the robustness of our results.

Empirical findings, as presented in Table 4, are consistent. Our variables have unit roots and are non-stationary at the level. However, at their first differences, all variables are stationary. The findings imply that all variables are integrated at I(1). Therefore, it is appropriate to conduct a long-run analysis.

4.3. The long-run cointegration test

This section tests the long-run cointegration across different financial development indicators [50]. As shown in Table 5, our results are consistent and highly significant at a 1% level. The null hypothesis of no cointegration is rejected, indicating that there are long-run relationships between the selected variables.

5. Empirical results and discussions

This paper examines the long-run finance-inequality nexus, considering the effect of per capita income for 12 Asia-Pacific countries from 1990 to 2021. This linkage is tested under three specifications: (i) the "Linear – Interaction" model, (ii) the "Linear – Quadratic" model, and (iii) the "Complete Second-order" model.

5.1. The long-run effect of financial development on income inequality

First, we test the "Linear – Interaction" model across financial development indicators. This model allows us to test the individual and conditional effect of financial development and per capita income on income inequality. Table 6 presents the empirical results for the "Linear – Interaction" model using the feasible generalized least squares (FGLS).

Our findings indicate that the unconditional effect of financial development on income inequality is positive and highly significant. However, per capita income counteracts financial development's positive effect on income inequality. These results indicate that the effect of financial development on income inequality, whether positive or negative, is contingent upon the level of per capita income. In particular, at a low level of per capita income, financial development exacerbates income inequality among the Asia-Pacific countries. However, financial development can reduce income inequality if per capita income is sufficiently high.

Second, we examine the "Linear – Quadratic model", which captures the nonlinear effects of financial development and per capita

Table 2
Results from Pesaran's CD test of cross-sectional dependence.

Variables	CD test	p-value
lnGINI	2.624	0.009
lnHC	40.246	0.000
lnINF	12.675	0.000
lnGOV	7.653	0.000
lnPCGDP	43.515	0.00o
$lnFD_1$	25.509	0.000
$lnFD_2$	10.963	0.000
$lnFD_3$	14.511	0.000
lnFDpca	16.485	0.000

Notes: All variables are significant at a 1% level. "ln" represents natural logarithmic form.

Table 3
Results of the slope homogeneity test.

Model	Delta	Adjusted Delta
lnFDpca	20.236***	23.243***
$lnFD_1$	21.090***	24.225***
$lnFD_2$	19.992***	22.964***
$lnFD_3$	20.003***	22.976***

Notes: The null hypothesis of the test is slope homogeneity. *** denotes a significant level at 1%.

Table 4
Results from panel unit-root test.

Variable	LLC		IPS		CADF		Note
	Level	First Difference	Level	First Difference	Level	First Difference	
lnGINI	0.489	−5.197***	0.017	−6.374***	3.611	−4.101***	I(1)
lnHC	−1.951	−6.668***	0.2935	−6.911***	−1.212	−4.337***	I(1)
lnINF	11.356	−23.609***	−1.014	−2.927***	−0.737	−5.035	I(1)
lnGOV	−0.984	−7.971***	−0.371	−6.831***	−0.313	−5.768***	I(1)
lnPCGDP	0.039	−2.283**	−1.225	−5.528***	−0.677	−3.562***	I(1)
$lnFD_1$	−0.969	−2.487***	−0.371	−6.831***	0.338	−3.424***	I(1)
$lnFD_2$	−0.764	−3.849***	−0.604	−6.232***	2.589	−3.175***	I(1)
$lnFD_3$	−0.637	−4.972***	−0.943	−6.255***	−0.877	−2.972 ***	I(1)
lnFDpca	0.482	−9.643***	1.3441	−9.272***	−1.195	−7.137***	I(1)

Notes: Symbols *** denote significance at 1%. "ln" represents natural logarithmic form. The Adjusted t*, W[t-bar], and Z[t-bar] are reported for the LLC, IPS, and CADF tests, respectively. All variables are cointegrated at I(1).

Table 5
Results from panel unit-root test.

	lnFDpca	$lnFD_1$	$lnFD_2$	$lnFD_3$
Modified Phillips–Perron t	3.629***	3.251***	3.568***	3.03***
Phillips–Perron t	3.545***	2.874***	3.016***	1.993**
Augmented Dickey-Fuller t	4.341***	3.750***	3.863***	2.412***

Notes: Symbols ***, ** denote significance at 1 and 5% levels.

income on income inequality. The rationale for this estimation is that the existing literature provides evidence of the nonlinear relationships between financial development and income inequality and between per capita income and income inequality. Table 7 presents the empirical results for the "Linear – Quadratic model" using the feasible generalized least squares (FGLS). We find that the relationships between financial development, income inequality, and per capita income and income inequality are inverted U-shaped. The coefficients of financial development and per capita income are positive, whereas the coefficients of their squared terms are negative. That is, financial development initially widens the income gap but then can reduce it as the financial sector is sufficiently mature.

Finally, we examine the "Complete Second-order model", which captures both the quadratic and interaction effects between financial development and per capita income on income inequality. This estimation aims to investigate the complete quadratic effect of financial development, conditioning per capita income, on income inequality. Table 8 presents the empirical results using the feasible generalized least squares (FGLS). Our analysis confirms the inverted U-shaped effects of financial development and per capita income on income inequality (GINI). In addition, the coefficients of the interaction between financial development and per capita income are positive and highly significant. These findings imply that the nonlinear effect of financial development on income inequality is contingent upon the effect of per capita income on income inequality.

Since the "Complete Second-order" model incorporates both the quadratic and interaction terms, interpreting the coefficients in such a model is complicated and requires extreme care. Therefore, we compute each financial development indicator's average partial effects (APE) and then graph statistics from fitted models to support our interpretation. As indicated in Table 8, the APE of the financial development index (FDpca) on income inequality is 0.025 and significant at a 5% level. This means that a 10-percentage point increase in financial development increases GINI by 0.25 standard deviations from the mean GINI. In addition, the effects of a ten percentage point increase on income inequality from FD_1 and FD_2 are 0.4 standard deviations from the mean GINI. Meanwhile, the effect of FD_3 on GINI at the mean is insignificant.

Furthermore, the effect of financial development on income inequality will change from positive to negative if it reaches its turning point. Nevertheless, the effect of financial development on income inequality will vary depending on the level of per capita income. Fig. 2 illustrates and compares the margin plots of the "Linear – Quadratic" and "Complete Second-order" models. As shown in Fig. 2, the inequality-increasing effects of all financial development indicators in the "Complete Second-order" model are more severe than

Table 6
Empirical results for the "Linear–Interaction" model using FGLS.

	(1)	(2)	(3)	(4)
	lnGINI	lnGINI	lnGINI	lnGINI
lnHC	0.041***	0.053***	0.047***	0.047***
	(0.000)	(0.000)	(0.000)	(0.000)
lnINF	−0.001	−0.002	−0.003	−0.001
	(0.869)	(0.650)	(0.551)	(0.794)
lnGOV	−0.042*	−0.033	−0.034	−0.042*
	(0.063)	(0.159)	(0.154)	(0.076)
lnPCGDP	0.013	−0.084***	−0.024	−0.029
	(0.654)	(0.001)	(0.375)	(0.364)
$lnFD_1$	0.325***			
	(0.000)			
$lnPCGDP*lnFD_1$	−0.028***			
	(0.000)			
$lnFD_2$		0.148***		
		(0.001)		
$lnPCGDP*lnFD_2$		−0.010*		
		(0.059)		
$lnFD_3$			0.232***	
			(0.000)	
$lnPCGDP*lnFD_3$			−0.022***	
			(0.000)	
lnFDpca				0.229***
				(0.000)
lnPCGDP*lnFDpca				−0.019***
				(0.003)
Constant	3.159***	4.023***	3.609***	3.527***
	(0.000)	(0.000)	(0.000)	(0.000)
Observations	347	347	347	347

Notes: All variables are in the form of natural logarithm "ln". Symbols ***, **, * denote significance at 1%, 5%, and 10% confidence levels, respectively.

those in the "Linear – Quadratic" model. When the effects of financial development indicators change from positive to negative, the inequality-reducing impacts of financial development indicators in the "Complete Second-order" model are also more significant than in the "Linear – Quadratic" model.

5.2. A robustness analysis

We re-estimate our models through two long-run estimation techniques – fully modified OLS (FMOLS) and dynamic OLS (DOLS) to ensure that our analysis is robust and produces unbiased estimations. Three models are tested: (i) the "Linear – Interaction" model, (ii) the "Linear – Quadratic" model, and (iii) the "Complete Second-order" model. The robustness results are consistent with the empirical results previously reported. Details are provided in Appendices – Table A4, Table A5, and Table A6.

5.3. Discussions

Overall, our findings substantiate the inverted U-shaped relationship between financial development and income inequality, which aligns with several studies on this strand of research [8,23,51]. This insight suggests that a minimum financial sector size is critical, particularly since the region desires to reduce income inequality through financial development. Such a threshold exists due to natural economic impediments (e.g., capital accumulation or information accumulation requirements for financial services) or entry regulations barriers (e.g., identification requirement for financial services) [8,20]. When the financial sector achieves a certain threshold, rent seeking is more expensive while credit constraints are alleviated, and the poor can benefit from financial development. Income inequality, in turn, reduces. In addition, financial development supports improving financial systems, which ameliorate information and transaction costs and enhance the screening and funding of firms and individuals [10]. These improvements support economic growth (higher per capita income). As a result, more opportunities are created for the poor, further reducing income inequality.

Besides, the analysis reveals that the nonlinear effect of financial development on income inequality depends on the level of per capita income. That is, the effect of financial development on income inequality is still inverted U-shaped; however, the magnitude of this effect may vary depending on different levels of per capita income. Notably, at a high level of per capita income, the unfavourable effect of financial development on income distribution is not extreme, but the favourable one will also be weakened. This observation can be explained based on the theory of exponential population growth, which states that population growth may be rapid, but this will not continue forever (exponentially) (Samuelson, 1975). In this regard, the marginal effect of financial development on income inequality will be diminished at a higher level of per capita income. When the economy develops slowly in the early stage of economic development, the financial sector is virtually non-exist or relatively small. At this stage, only the rich can benefit from financial

Table 7
Empirical results for "Linear – Quadratic" model using FGLS.

	(1)	(2)	(3)	(4)
	lnGINI	lnGINI	lnGINI	lnGINI
lnHC	−0.005	0.029***	0.025**	0.019*
	(0.573)	(0.004)	(0.012)	(0.056)
lnINF	−0.000	0.001	−0.002	−0.001
	(0.945)	(0.918)	(0.742)	(0.917)
lnGOV	0.004	0.008	0.028	0.022
	(0.849)	(0.715)	(0.227)	(0.310)
lnPCGDP	0.200***	0.214***	0.206***	0.182***
	(0.000)	(0.001)	(0.002)	(0.004)
lnPCGDP^2	−0.017***	−0.018***	−0.018***	−0.016***
	(0.000)	(0.000)	(0.000)	(0.000)
lnFD_1	0.768***			
	(0.000)			
lnFD_1^2	−0.082***			
	(0.000)			
lnFD_2		0.165**		
		(0.012)		
lnFD_2^2		−0.016*		
		(0.053)		
lnFD_3			0.337***	
			(0.000)	
lnFD_3^2			−0.038***	
			(0.000)	
lnFDpca				0.509***
				(0.000)
lnFDpca^2				−0.050***
				(0.000)
Constant	1.438***	2.669***	2.340***	1.927***
	(0.000)	(0.000)	(0.000)	(0.000)
Observations	347	347	347	347

Notes: All variables are in the form of natural logarithm "ln". Symbols ***, **, * denote significance at 1%, 5%, and 10% confidence levels, respectively.

development, and with binding credit constraints, the poor are prevented from accessing financial services. However, people have more income and opportunities to approach those financial services when the economy continues to develop. Once the financial sector is relatively developed, financial constraints are reduced, and a larger proportion of the population, including the low-income, can access financial services at affordable costs, thereby reducing income inequality [8,37].

6. Concluding remarks and policy implications

Reducing income inequality is one of the key Sustainable Development Goals of the United Nations [2]. However, the worldwide spread of the Covid-19 pandemic has raised concerns regarding a widened income gap between the rich and the poor. The Asia-Pacific region's progress in closing the income gap is slow-moving and adversely impacted by the pandemic [3]. As such, achieving the "reduced income inequalities" target seems unattainable for the Asia-Pacific countries [1].

Previous studies consider that financial development can help reduce income inequality. As such, the financial development – income inequality nexus has attracted significant attention from economists and policymakers for the past three decades. However, findings from previous studies are mixed. Moreover, the long-term effects of financial development, particularly the combined effects of financial development and economic growth, on income inequality have largely been under-examined in the Asia-Pacific region. As such, this study is conducted to fill in the gap in the existing literature using a sample of 12 Asia-Pacific countries from 1990 to 2021. Various estimation techniques and different financial development indicators are used to ensure the robustness of our findings.

Empirical findings from this study provide evidence of the inverted U-shaped relationship between financial development and income inequality. Financial development leads to increased income inequality until it exceeds its threshold, where further financial development reduces income inequality. In addition, the magnitude of the nonlinear effect of financial development on income inequality is influenced by the level of per capita income. In particular, when the level of per capita income is low, the inequality-widening effect of financial development is more severe, but the inequality-reducing effect is also more significant. However, at a higher level of per capita income, the inequality-widening effect of financial development will be less severe, and the inequality-reducing effect will be diminished.

Policy implications have emerged based on these findings. The well-functioning financial sectors can spur economic growth and reduce income inequality. Financial development, directly and indirectly, reduces income inequality. As such, the starting point for the governments in the Asia-Pacific region to consider is to formulate and implement policies supporting the development of financial markets, including the banking sector. Well-developed banking sector improves the efficient allocation of capital. A more efficient

Table 8
Empirical results for "Complete Second-order Model" using FGLS.

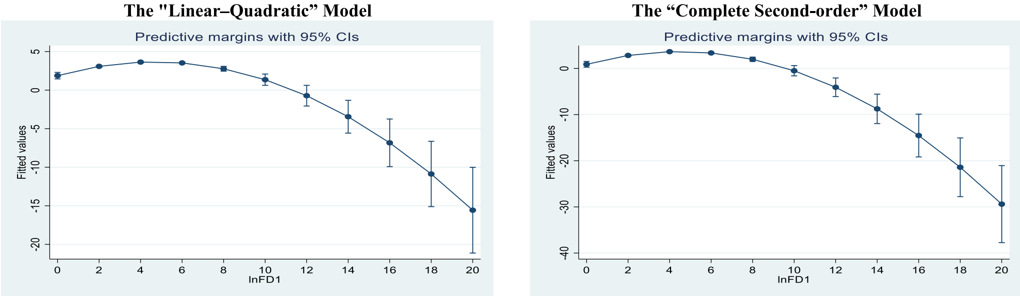
	(1)	(2)	(3)	(4)
	lnGINI	lnGINI	lnGINI	lnGINI
lnHC	−0.015*	0.016*	0.019**	0.010
	(0.061)	(0.095)	(0.044)	(0.268)
lnINF	0.002	0.002	−0.001	0.002
	(0.672)	(0.680)	(0.861)	(0.718)
lnGOV	0.013	−0.007	0.032	0.032
	(0.516)	(0.751)	(0.147)	(0.120)
lnPCGDP	0.233***	0.374***	0.328***	0.274***
	(0.000)	(0.000)	(0.000)	(0.000)
$lnPCGDP^2$	−0.032***	−0.043***	−0.031***	−0.034***
	(0.000)	(0.000)	(0.000)	(0.000)
$lnFD_1$	0.749***			
	(0.000)			
$lnFD_1^2$	−0.137***			
	(0.000)			
$lnPCGDP*lnFD_1$	0.057***			
	(0.000)			
$lnFD_2$		−0.093		
		(0.169)		
$lnFD_2^2$		−0.053***		
		(0.000)		
$lnPCGDP*lnFD_2$		0.067***		
		(0.000)		
$lnFD_3$			0.225***	
			(0.001)	
$lnFD_3^2$			−0.054***	
			(0.000)	
$lnPCGDP*lnFD_3$			0.028**	
			(0.018)	
lnFDpca				0.406***
				(0.000)
$lnFDpca^2$				−0.080***
				(0.000)
lnPCGDP*lnFDpca				0.046***
				(0.000)
Constant	1.327***	2.547***	2.044***	1.756***
	(0.000)	(0.000)	(0.000)	(0.000)
Financial development APE	0.042***	0.040*	0.004	0.025**
Number of observations	347	347	347	347

Notes: All variables are in the form of natural logarithm "ln". Symbols ***, **, * denote significance at 1%, 5%, and 10% confidence levels, respectively. APE denotes Average Partial Effect.

banking sector is associated with reduced credit constraints, creating more economic opportunities for everyone in the economy. These opportunities encourage the dynamics of the labour markets where the demand for lower-skilled workers is higher, leading to higher income for the poor. As a result, income inequality reduces. In addition, financial development provides financial resources to support economic growth, creating more economic opportunities, particularly for the poor. As such, policies supporting well-functioning financial markets will enhance economic growth, which fosters further financial development and reduces income inequality to achieve sustainable development goals. Developing and supporting the development of financial markets should be considered a priority in the policy agenda because financial development exerts a first-order effect on economic growth. In addition, financial development will support financial innovation, which appears to be a key pillar for sustainable economic growth and development in the future. The governments of the Asia-Pacific countries may also consider policies supporting both financial development and economic growth simultaneously because they can jointly reduce income inequality further in the Asia-Pacific countries.

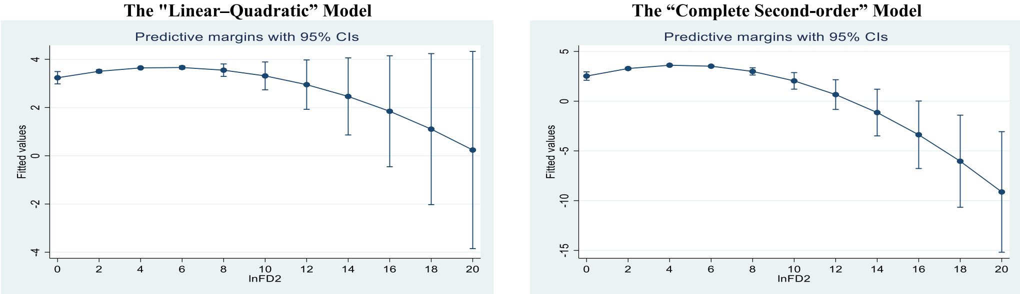
Furthermore, countries should consider the initial level of per capita income when promoting financial development to reduce income inequality, as the marginal effect of financial development on income inequality is diminished at a higher level of per capita income. Also, implementing these policies should be more towards inclusive economic growth. These inclusive growth policies can help reduce income inequality. Besides, financial inclusion is generally considered an important driver of financial development. Financial inclusion can narrow income inequality and support sustainable economic growth. When financial development can accompany financial inclusion, the impact on inequality reduction would be even greater. Thus, to effectively alleviate income inequality, governments in the region should ensure that the increase in "access" to financial services (e.g., account ownership) is followed by the increase in the "use" of those services (e.g., savings and borrowing). Policies focusing on financial inclusion and inclusive economic growth will reduce the thresholds of economic growth and financial development for countries in the region, leading to a stronger reduction in income inequality and sustainable economic growth.

The "Linear–Quadratic" Model **The "Complete Second-order" Model**



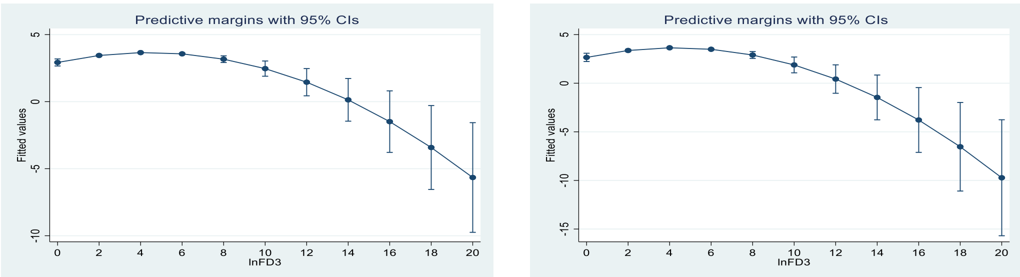
Panel A. Models using broad money ($lnFD_1$) as proxy for financial development.

The "Linear–Quadratic" Model **The "Complete Second-order" Model**



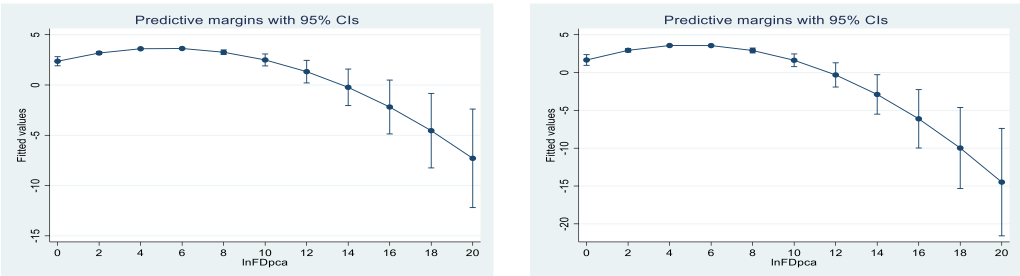
Panel B. Models using bank credit ($lnFD_2$) as proxy for financial development.

The "Linear–Quadratic" Model **The "Complete Second-order" Model**



Panel C. Models using private credit ($lnFD_3$) as proxy for financial development.

The "Linear–Quadratic" Model **The "Complete Second-order" Model**



Panel D. Models using the composite index ($lnFD_{pca}$) as proxy for financial development.

Fig. 2. The margins plots of the "Linear – Quadratic" and "Complete Second-order" models.

Author contribution statement

Duc Hong Vo: Conceived and designed the experiments; Wrote the paper.
Anh Tuan Pham, Quan Tran: Performed the experiments; Contributed reagents, materials, analysis tools or data.
Nam Thanh Vu: Analyzed and interpreted the data; Wrote the paper.

Data availability statement

Data will be made available on request.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendices.

Table A1
Results from Principal Component Analysis

Covariance	Eigenvalue	Difference	Proportion	Cumulative
Comp1	7219.130	6569.750	0.898	0.898
Comp2	649.376	478.169	0.081	0.979
Comp3	171.208	–	0.021	1.000
Eigenvectors	**Component 1**	**Component 2**	**Explained**	**Unexplained**
FD1	0.593	−0.798	98.03	1.97
FD2	0.511	0.476	12.31	87.69
FD3	0.622	0.370	18.45	81.55

Table A2
Descriptive statistics

Variables	Obs	Mean	Std. Dev.	Min	Max	p10	p99	Skew.	Kurt.
lnGINI	372	3.616	.144	3.321	3.884	3.346	3.867	.024	1.664
lnHC	372	3.426	.864	.427	4.796	.783	4.753	−.926	3.649
lnINF	347	1.225	1.078	−3.135	5.592	−1.991	4.473	−.256	6.161
lnGOV	372	2.542	.324	1.698	3.226	1.727	3.046	−.611	2.776
lnPCGDP	372	8.673	1.36	6.268	10.982	6.302	10.963	.208	1.721
lnFD1	372	4.388	.607	2.751	5.635	2.903	5.497	−.332	2.654
lnFD2	372	4.202	.745	1.557	5.236	1.948	5.202	−.93	3.246
lnFD3	372	4.286	.789	1.641	5.383	2.007	5.331	−.818	2.913
lnFDpca	372	4.863	.681	2.8	5.907	2.958	5.846	−.734	2.771

Notes: "ln" represents natural logarithmic form.

Table A3
Correlation matrix

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) lnGINI	1.0								
(2) lnHC	−0.5	1.0							
(3) lnINF	0.3	−0.4	1.0						
(4) lnGOV	−0.5	0.5	−0.4	1.0					
(5) lnPCGDP	−0.7	0.8	−0.5	0.7	1.0				
(6) lnFD1	−0.2	0.4	−0.5	0.4	0.5	1.0			
(7) lnFD2	−0.3	0.5	−0.5	0.4	0.7	0.9	1.0		
(8) lnFD3	−0.3	0.5	−0.5	0.4	0.7	0.9	1.0	1.0	

Notes: "ln" represents natural logarithmic form.

Table A4
Robustness check for the "Linear–Interaction" model

	FMOLS	DOLS	FMOLS	DOLS	FMOLS	DOLS	FMOLS	DOLS
	lnGINI	lnGINI	lnGINI	lnGINI	lnGINI	lnGINI	lnGINI	lnGINI
lnHC	0.017	−0.012	0.025**	−0.009	0.020	−0.011	0.021*	−0.013
	(0.272)	(0.832)	(0.026)	(0.899)	(0.249)	(0.876)	(0.077)	(0.846)

(continued on next page)

Table A4 (*continued*)

	FMOLS	DOLS	FMOLS	DOLS	FMOLS	DOLS	FMOLS	DOLS
	lnGINI	lnGINI	lnGINI	lnGINI	lnGINI	lnGINI	lnGINI	lnGINI
lnINF	−0.006	−0.022	−0.007	−0.008	−0.007	0.004	−0.007	−0.009
	(0.484)	(0.727)	(0.233)	(0.908)	(0.471)	(0.957)	(0.279)	(0.901)
lnGOV	−0.009	−0.039	−0.001	0.005	0.006	0.007	−0.002	−0.006
	(0.776)	(0.680)	(0.960)	(0.968)	(0.874)	(0.957)	(0.923)	(0.957)
lnPCGDP	0.080	0.333*	0.027	0.109	0.040	0.115	0.073	0.257
	(0.143)	(0.073)	(0.509)	(0.647)	(0.518)	(0.616)	(0.151)	(0.346)
$lnFD_1$	0.395***	0.881**						
	(0.000)	(0.010)						
$lnPCGDP*lnFD_1$	−0.040***	−0.098**						
	(0.001)	(0.020)						
$lnFD_2$			0.285***	0.455				
			(0.000)	(0.244)				
$lnPCGDP*lnFD_2$			−0.030***	−0.049				
			(0.001)	(0.331)				
$lnFD_3$					0.305***	0.467		
					(0.002)	(0.198)		
$lnPCGDP*lnFD_3$					−0.032**	−0.050		
					(0.012)	(0.297)		
lnFDpca							0.344***	0.652
							(0.000)	(0.108)
lnPCGDP*lnFDpca							−0.035***	−0.072
							(0.000)	(0.170)
Constant	2.691***	0.828	3.215***	2.627	3.103***	2.527	2.767***	1.397
	(0.000)	(0.569)	(0.000)	(0.143)	(0.000)	(0.134)	(0.000)	(0.490)
Observations	346	336	346	336	346	336	346	336
Adjusted R^2	0.122	0.571	0.054	0.505	0.094	0.524	0.102	0.535

Notes: All variables are in the form of natural logarithm "ln". Symbols ***, **, * denote significance at 1%, 5%, and 10% confidence levels, respectively.

Table A5
Robustness check for the "Linear – Quadratic" model

	FMOLS	DOLS	FMOLS	DOLS	FMOLS	DOLS	FMOLS	DOLS
	lnGINI	lnGINI	lnGINI	lnGINI	lnGINI	lnGINI	lnGINI	lnGINI
lnHC	−0.010	−0.034	−0.005	−0.023	−0.007	−0.006	−0.007	−0.018
	(0.392)	(0.441)	(0.804)	(0.697)	(0.719)	(0.912)	(0.714)	(0.692)
lnINF	−0.010	0.001	−0.004	0.025	−0.005	0.010	−0.008	−0.001
	(0.115)	(0.976)	(0.706)	(0.657)	(0.595)	(0.861)	(0.399)	(0.990)
lnGOV	0.006	0.024	0.024	0.082	0.040	0.115	0.029	0.085
	(0.796)	(0.735)	(0.577)	(0.413)	(0.316)	(0.229)	(0.452)	(0.253)
lnPCGDP	0.320***	0.272	0.330**	0.246	0.314**	0.175	0.302**	0.220
	(0.000)	(0.224)	(0.018)	(0.402)	(0.015)	(0.520)	(0.016)	(0.330)
$lnPCGDP^2$	−0.023***	−0.021*	−0.023***	−0.019	−0.022***	−0.016	−0.022***	−0.019
	(0.000)	(0.085)	(0.002)	(0.209)	(0.001)	(0.253)	(0.001)	(0.121)
$lnFD_1$	0.764***	1.742***						
	(0.000)	(0.000)						
$lnFD_1^2$	−0.085***	−0.195***						
	(0.000)	(0.000)						
$lnFD_2$			0.353***	0.814**				
			(0.003)	(0.012)				
$lnFD_2^2$			−0.043***	−0.097**				
			(0.007)	(0.022)				
$lnFD_3$					0.407***	0.950***		
					(0.000)	(0.002)		
$lnFD_3^2$					−0.049***	−0.112***		
					(0.001)	(0.004)		
lnFDpca							0.651***	1.550***
							(0.000)	(0.000)
$lnFDpca^2$							−0.068***	−0.161***
							(0.000)	(0.000)
Constant	0.941**	−0.921	1.797***	1.166	1.721***	1.132	1.097*	−0.672
	(0.021)	(0.457)	(0.005)	(0.418)	(0.003)	(0.382)	(0.096)	(0.604)
Observations	346	336	346	336	346	336	346	336
Adjusted R^2	0.008	0.672	0.004	0.569	0.039	0.605	0.002	0.631

Notes: All variables are in the form of natural logarithm "ln". Symbols ***, **, * denote significance at 1%, 5%, and 10% confidence levels, respectively.

Table A6
Robustness check for the "Complete Second-order" model

	FMOLS	DOLS	FMOLS	DOLS	FMOLS	DOLS	FMOLS	DOLS
	lnGINI	lnGINI	lnGINI	lnGINI	lnGINI	lnGINI	lnGINI	lnGINI
lnHC	−0.013	−0.053	−0.004	−0.038	−0.001	−0.006	−0.005	−0.025
	(0.382)	(0.201)	(0.823)	(0.516)	(0.960)	(0.909)	(0.710)	(0.524)
lnINF	−0.009	0.011	−0.003	0.034	−0.004	0.015	−0.007	0.016
	(0.239)	(0.802)	(0.716)	(0.551)	(0.679)	(0.781)	(0.315)	(0.700)
lnGOV	0.001	0.022	0.009	0.066	0.028	0.114	0.016	0.084
	(0.961)	(0.759)	(0.768)	(0.540)	(0.471)	(0.264)	(0.518)	(0.257)
lnPCGDP	0.290***	0.193	0.363***	0.317	0.340***	0.222	0.268***	0.168
	(0.003)	(0.366)	(0.001)	(0.280)	(0.007)	(0.384)	(0.001)	(0.404)
$lnPCGDP^2$	−0.031***	−0.029**	−0.039***	−0.046*	−0.036***	−0.035	−0.036***	−0.037**
	(0.000)	(0.035)	(0.000)	(0.089)	(0.000)	(0.124)	(0.000)	(0.027)
$lnFD_1$	0.792***	1.846***						
	(0.000)	(0.000)						
$lnFD_1^2$	−0.131***	−0.262***						
	(0.000)	(0.000)						
$lnPCGDP*lnFD_1$	0.043**	0.056						
	(0.018)	(0.268)						
$lnFD_2$			0.106	0.455				
			(0.371)	(0.297)				
$lnFD_2^2$			−0.070***	−0.147**				
			(0.000)	(0.013)				
$lnPCGDP*lnFD_2$			0.058***	0.093				
			(0.006)	(0.229)				
$lnFD_3$					0.203	0.718*		
					(0.126)	(0.060)		
$lnFD_3^2$					−0.072***	−0.149***		
					(0.000)	(0.004)		
$lnPCGDP*lnFD_3$					0.048**	0.065		
					(0.036)	(0.323)		
lnFDpca							0.547***	1.467***
							(0.000)	(0.000)
$lnFDpca^2$							−0.105***	−0.220***
							(0.000)	(0.000)
lnPCGDP*lnFDpca							0.056***	0.078
							(0.001)	(0.152)
Constant	1.028**	−0.799	2.186***	1.615	2.054***	1.401	1.504***	−0.298
	(0.043)	(0.495)	(0.000)	(0.278)	(0.000)	(0.279)	(0.000)	(0.804)
Observations	346	336	346	336	346	336	346	336
Adjusted R^2	0.172	0.694	0.054	0.575	0.066	0.599	0.165	0.641

Notes: All variables are in the form of natural logarithm "ln". Symbols ***, **, * denote significance at 1%, 5%, and 10% confidence levels, respectively.

References

[1] United Nations Development Programme, Inequality And Social Security In The Asia-Pacific Region, 2022. https://www.undp.org/publications/inequality-and-social-security-asia-pacific-region. (Accessed 12 July 2022).
[2] United Nations DESA, The Sustainable Development Goals Report 2022, 2022. https://unstats.un.org/sdgs/report/2022/. (Accessed 12 July 2022).
[3] Escap Statistics Division, Asia And The Pacific SDG Progress Report 2022 | Widening Disparities Amid COVID-19, 2022. https://www.unescap.org/kp/2022/asia-and-pacific-sdg-progress-report-2022. (Accessed 12 July 2022).
[4] S. Jauch, S. Watzka, Financial development and income inequality: a panel data approach, Empir. Econ. 51 (2016) 291–314, https://doi.org/10.1007/s00181-015-1008-x.
[5] R.G. Rajan, L. Zingales, The great reversals: the politics of financial development in the twentieth century, J. Financ. Econ. 69 (2003) 5–50, https://doi.org/10.1016/S0304-405X(03)00125-9.
[6] A.v. Banerjee, A.F. Newman, Occupational choice and the process of development, J. Polit. Econ. 101 (1993) 274–298, https://doi.org/10.1086/261876.
[7] T. Beck, A. Demirgüç-Kunt, R. Levine, Finance, inequality and the poor, J. Econ. Growth 12 (2007) 27–49, https://doi.org/10.1007/s10887-007-9010-6.
[8] J. Greenwood, B. Jovanovic, Financial development, growth, and the distribution of income, J. Polit. Econ. 98 (1990) 1076–1107, https://doi.org/10.1086/261720.
[9] C.T. Nguyen, N.T. Vu, H.D. Vo, T.-T.D. Ha, Financial development and income inequality in emerging markets: a New approach, J. Risk Financ. Manag. 12 (2019) 173, https://doi.org/10.3390/jrfm12040173.
[10] Levine, R. (2021). Finance, Growth, and Inequality, *IMF Working Papers, 2021*(164), A001. Retrieved from https://doi.org/10.5089/9781513583365.001.A001.
[11] C. Gimet, T. Lagoarde-Segot, A closer look at financial development and income distribution, J. Bank. Finance 35 (2011) 1698–1713, https://doi.org/10.1016/j.jbankfin.2010.11.011.
[12] P. Sethi, S. Bhattacharjee, D. Chakrabarti, C. Tiwari, The impact of globalization and financial development on India's income inequality, J. Pol. Model. 43 (2021) 639–656, https://doi.org/10.1016/j.jpolmod.2021.01.002.
[13] Y.-B. Chiu, C.-C. Lee, Financial development, income inequality, and country risk, J. Int. Money Finance 93 (2019), https://doi.org/10.1016/j.jimonfin.2019.01.001, 1–18.

[14] U. Seven, Y. Coskun, Does financial development reduce income inequality and poverty? Evidence from emerging countries, Emerg. Mark. Rev. 26 (2016) 34–63, https://doi.org/10.1016/j.ememar.2016.02.002.
[15] T.B. Kavya, S. Shijin, Economic development, financial development, and income inequality nexus, Borsa Istanbul Rev. 20 (2020) 80–93, https://doi.org/10.1016/j.bir.2019.12.002.
[16] G.R.G. Clarke, L.C. Xu, H. Zou, Finance and income inequality: what do the data tell us? South. Econ. J. 72 (2006) 578–596, https://doi.org/10.1002/j.2325-8012.2006.tb00721.x.
[17] M. von Ehrlich, T. Seidel, Regional implications of financial market development: industry location and income inequality, Eur. Econ. Rev. 73 (2015) 85–102, https://doi.org/10.1016/j.euroecorev.2014.10.008.
[18] O. Galor, J. Zeira, Income distribution and macroeconomics, Rev. Econ. Stud. 60 (1993) 35, https://doi.org/10.2307/2297811.
[19] S. Kuznets, Economic growth and income inequality, Am. Econ. Rev. 45 (1955) 1–28. http://www.jstor.org/stable/1811581.
[20] D.-H. Kim, S.-C. Lin, Nonlinearity in the financial development–income inequality nexus, J. Comp. Econ. 39 (2011) 310–325, https://doi.org/10.1016/j.jce.2011.07.002.
[21] D. Park, K. Shin, Economic growth, financial development, and income inequality, Emerg. Mark. Finance Trade 53 (2017) 2794–2825, https://doi.org/10.1080/1540496X.2017.1333958.
[22] R.M. Townsend, K. Ueda, Financial deepening, inequality, and growth: a model-based quantitative Evaluation1, Rev. Econ. Stud. 73 (2006) 251–293, https://doi.org/10.1111/j.1467-937X.2006.00376.x.
[23] C. Lee, C. Lee, C. Cheng, The impact of FDI on income inequality: evidence from the perspective of financial development, Int. J. Finance Econ. 27 (2022) 137–157, https://doi.org/10.1002/ijfe.2143.
[24] F. Solt, Measuring income inequality across countries and over time: the standardized World income inequality database, Soc. Sci. Q. 101 (2020) 1183–1199, https://doi.org/10.1111/SSQU.12795.
[25] D. Baiardi, C. Morana, Financial development and income distribution inequality in the euro area, Econ. Modell. 70 (2018) 40–55, https://doi.org/10.1016/j.econmod.2017.10.008.
[26] Y.-B. Chiu, C.-C. Lee, Financial development, income inequality, and country risk, J. Int. Money Finance 93 (2019), https://doi.org/10.1016/j.jimonfin.2019.01.001, 1–18.
[27] C.-Y. Cheng, M.-S. Chien, C.-C. Lee, ICT diffusion, financial development, and economic growth: an international cross-country analysis, Econ. Modell. 94 (2021) 662–671, https://doi.org/10.1016/j.econmod.2020.02.008.
[28] H. Abdi, L.J. Williams, Principal Component Analysis, vol. 2, Wiley Interdiscip Rev Comput Stat, 2010, pp. 433–459, https://doi.org/10.1002/wics.101.
[29] Y. Ouyang, P. Li, On the nexus of financial development, economic growth, and energy consumption in China: New perspective from a GMM panel VAR approach, Energy Econ. 71 (2018) 238–252, https://doi.org/10.1016/j.eneco.2018.02.015.
[30] K. Svirydzenka, Introducing a New Broad-Based Index of Financial Development, International Monetary Fund, 2016. https://www.imf.org/en/Publications/WP/Issues/2016/12/31/Introducing-a-New-Broad-based-Index-of-Financial-Development-43621. (Accessed 10 July 2022).
[31] G.S. Becker, B.R. Chiswick, Education and the distribution of earnings, Am. Econ. Rev. 56 (1966) 358–369. http://www.jstor.org/stable/1821299.
[32] W. Easterly, S. Fischer, Inflation and the poor, J. Money Credit Bank. 33 (2001) 160, https://doi.org/10.2307/2673879.
[33] A. Rubin, D. Segal, The effects of economic growth on income inequality in the US, J. Macroecon. 45 (2015) 258–273, https://doi.org/10.1016/j.jmacro.2015.05.007.
[34] M. Sehrawat, A.K. Giri, The impact of financial development, economic growth, income inequality on poverty: evidence from India, Empir. Econ. 55 (2018) 1585–1602, https://doi.org/10.1007/s00181-017-1321-7.
[35] P. Valickova, T. Havranek, R. Horvath, Financial development and economic growth: a meta-analysis, J. Econ. Surv. 29 (2015) 506–526, https://doi.org/10.1111/joes.12068.
[36] D. Baiardi, C. Morana, The financial Kuznets curve: evidence for the euro area, J. Empir. Finance 39 (2016) 265–269, https://doi.org/10.1016/J.JEMPFIN.2016.08.003.
[37] Z. Nikoloski, Financial sector development and inequality: is there A financial Kuznets curve? J. Int. Dev. 25 (2013) 897–911, https://doi.org/10.1002/jid.2843.
[38] A.F. Assi, A. Zhakanova Isiksal, T. Tursoy, Renewable energy consumption, financial development, environmental pollution, and innovations in the ASEAN + 3 group: evidence from (P-ARDL) model, Renew. Energy 165 (2021) 689–700, https://doi.org/10.1016/J.RENENE.2020.11.052.
[39] C.P. Nguyen, C. Schinckus, T.D. Su, The drivers of economic complexity: international evidence from financial development and patents, Int. Econ. 164 (2020) 140–150, https://doi.org/10.1016/J.INTECO.2020.09.004.
[40] T.H. Le, A.T. Chuc, F. Taghizadeh-Hesary, Financial inclusion and its impact on financial efficiency and sustainability: empirical evidence from Asia, Borsa Istanbul Rev. 19 (2019) 310–322, https://doi.org/10.1016/J.BIR.2019.07.002.
[41] J. Bai, S.H. Choi, Y. Liao, Feasible generalized least squares for panel data with cross-sectional and serial correlations, Empir. Econ. 60 (2021) 309–326, https://doi.org/10.1007/s00181-020-01977-2.
[42] S. Islam, Do personal remittances influence economic growth in South Asia? A panel analysis, Rev. Dev. Econ. 26 (2022) 242–258, https://doi.org/10.1111/RODE.12842.
[43] P. Pedroni, Fully modified OLS for heterogeneous cointegrated panels, Adv. Econom. 15 (2000) 93–130, https://doi.org/10.1016/S0731-9053(00)15004-2/FULL/XML.
[44] M. Hamit-Haggar, Greenhouse gas emissions, energy consumption and economic growth: a panel cointegration analysis from Canadian industrial sector perspective, Energy Econ. 34 (2012) 358–364, https://doi.org/10.1016/J.ENECO.2011.06.005.
[45] J.H. Stock, M.W. Watson, A simple estimator of cointegrating vectors in higher order integrated systems, Econometrica 61 (1993) 783, https://doi.org/10.2307/2951763.
[46] C. Kao, M.H. Chiang, On the estimation and inference of a cointegrated regression in panel data, Adv. Econom. 15 (2000) 179–222, https://doi.org/10.1016/S0731-9053(00)15007-8/FULL/XML.
[47] M.H. Pesaran, A simple panel unit root test in the presence of cross-section dependence, J. Appl. Econom. 22 (2007) 265–312, https://doi.org/10.1002/JAE.951.
[48] K.S. Im, M.H. Pesaran, Y. Shin, Testing for unit roots in heterogeneous panels, J. Econom. 115 (2003) 53–74, https://doi.org/10.1016/S0304-4076(03)00092-7.
[49] A. Levin, C.F. Lin, C.S.J. Chu, Unit root tests in panel data: asymptotic and finite-sample properties, J. Econom. 108 (2002) 1–24, https://doi.org/10.1016/S0304-4076(01)00098-7.
[50] P. Pedroni, Critical values for cointegration tests in heterogeneous panels with multiple regressors, Oxf. Bull. Econ. Stat. 61 (1999) 653–670, https://doi.org/10.1111/1468-0084.0610S1653.
[51] M. Younsi, M. Bechtini, Economic growth, financial development, and income inequality in BRICS countries: does Kuznets' inverted U-shaped curve exist? J. Knowled. Econ. 11 (2020) 721–742, https://doi.org/10.1007/s13132-018-0569-2.