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Financial Literacy, Financial Development and Economic Growth

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ABSTRACT

While significant progress has been made in exploring the importance of financial literacy, its impact on economic growth and financial development from a macroeconomic point of view remains thinly understood. This paper provides fresh evidence on the relationship between financial literacy, financial development and economic growth. We utilise a novel dataset for 61 countries over the period 1999–2014 and employ a panel quantile regression model. We provide strong evidence that higher financial literacy levels lead to higher GDP per capita growth, and the size of the impact is higher at lower quantiles of the conditional growth distribution. As financial development increases, its positive impact on economic growth diminishes, indicating an inverted U-shaped relationship. High levels of financial literacy mitigate the diminishing returns of financial development on GDP per capita growth by an average of 7.41%. Interestingly, in higher quantiles of the conditional growth distribution, the mitigating effect increases to 9.23%.

JEL Classification: O16, O40, G10, G53, C21, C23

1 | Introduction

Financial markets have been significantly integrated into our daily lives. An increasing number of people use a wide range of financial products and services, are familiar with loans, mortgages and insurance products, make purchases using credit and debit cards, invest in retirement funds and trade stocks and shares. However, not all people have the fundamental grounds for understanding financial principles and potential risks and engaging with financial markets effectively, and thus they are considered financially illiterate. According to the World Economic Forum (2024), one out of two US citizens lacks understanding of basic financial concepts, while in the EU, as reported by the European Commission (2023), only 18% of the population is equipped with high levels of financial knowledge.¹

Several studies in the literature have consistently shown that financial literacy plays an important role in the development of retirement and savings plans (Lusardi and Mitchell 2011; Brounen et al. 2016), improves financial management and behaviour (Mireku et al. 2023), increases the probability of participating in financial markets and investing in stocks (Van Rooij et al. 2011), contributes to wealth accumulation (Van Rooij et al. 2012), creates positive externalities (Haliassos et al. 2020), mitigates credit risk and increases bank profitability and stability (Jungo et al. 2024). Surprisingly, much attention has been drawn to the importance of financial literacy from a microeconomic point of view, with the macroeconomic perspective being relatively underrepresented in the literature. The latter becomes particularly profound, especially considering that financial literacy's broader implications extend beyond individual well-being.

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The existing literature identifies several mechanisms through which financial literacy can influence both individual financial behaviour and aggregate economic outcomes. More specifically, the acquisition and dissemination of financial information among economic agents could lead to financial efficiency, improving capital allocation, which in turn could promote economic growth (see also Greenwood and Jovanovic 1990). Importantly, increased financial education can help financial systems facilitate better decision-making, reduce information asymmetries, navigate investment opportunities efficiently and mitigate risks. In the long term, this could lead to efficient resource and capital allocation, higher productivity and innovation levels, and thus expanding economic growth (see also Widdowson and Hailwood 2007). Moreover, financial knowledge is recognised as a specialised form of human capital (Lusardi and Mitchell 2008; Bucci et al. 2025). Consequently, investing in human capital could enhance worker productivity and, hence, lead to economic expansion at the aggregate level (Black and Lynch 1996).²

As becomes apparent, in environments facing growing financialisation or targeting financial development, financial literacy becomes particularly significant. However, while financial development has long been perceived as a catalyst for economic growth (Levine 2005), its role in the growth process has recently been questioned (Arcand et al. 2015; Boikos et al. 2022). According to Law and Singh (2014), excessive levels of financial development could have an adverse impact on economic growth. Importantly, the finance-growth nexus is nonlinear and characterised by an inverted U-shaped relationship, highlighting the diminishing role of financial development (Samargandi et al. 2015).

Building on this understanding, the following question does arise: Can financial literacy mitigate the adverse effect of the 'financial curse'? Our paper addresses this question. In fact, many scholars have argued that excessive financialisation might trigger financial crises and increase macroeconomic volatility, which in turn harms economic growth (Kaminsky and Reinhart 1999; Rousseau and Wachtel 2011; Arcand et al. 2015). In particular, financial literacy can be the antidote to this issue. To this end, financial literacy encourages sustainable consumption and investment strategies that reduce economic volatility while helping to maintain financial stability, mitigate risks and prevent banking crises (Bernanke 2011). In addition, there is evidence showing that a financially literate population is resilient during crises and can handle unexpected macroeconomic shocks (Klapper et al. 2013).³ Finally, increased levels of financial development could harm productivity through the misallocation of skilled labour (Tobin 1984; Zhu et al. 2020). For instance, enhanced financial development tends to require higher-paid workers in the financial sector, potentially leading to a misallocation of talent. This could likely reduce the availability of skilled individuals in other important sectors (such as engineering and computer science) that are critical to fostering technological progress and economic growth. Talent allocation and economic growth are highly interconnected (Hsieh et al. 2019). The role of financial literacy in this matter could be explained with the following intuition: If more people acquire financial knowledge, then the financial decisions of individuals will be optimal, which will exert greater stability in the financial

system. In addition, individuals can manage their investments, make informed choices and benefit from higher returns on their savings without the necessity of requiring assistance from financial analysts and the financial system. This will reduce the demand for financial sector workers, which will not divert human resources from other more productive, in terms of economic growth, sectors. Thus, talent misallocation is expected to be lower, which will benefit economic growth.

Although significant efforts and progress have been made to explore the mechanisms and importance of financial literacy, its impact on economic growth and financial development from a macroeconomic point of view remains poorly understood. In this paper, our aim is to fill this gap and contribute to the literature in four important ways. First, we build upon a finance-growth model and investigate whether financial literacy is important in spurring economic growth. Second, we examine whether financial literacy can mitigate the potential negative impact of finance on growth. Third, to further enhance our understanding and dive into the nonlinear properties of the finance-growth nexus, we employ a quantile regression approach that, in contrast to simple regression techniques which focus on mean estimates, also sheds light on the heterogeneous effect throughout the conditional growth distribution. Fourth, in contrast to previous studies that rely primarily on survey data, which may not capture dynamic changes over time and between countries, we use a novel financial knowledge dataset provided by Oliver-Márquez et al. (2021), focusing on 61 developed and emerging countries over the period 1999–2014.

Our analysis provides strong evidence that higher levels of financial literacy lead to higher GDP per capita growth, and this effect is stronger at lower quantiles of the growth distribution. An increase in financial development positively affects GDP per capita growth, but the effect declines as we consider lower quantiles of the growth distribution. The relationship between financial development and economic growth is nonlinear and follows an inverse U-shape. In other words, beyond a certain point, further increases in financial development can lead to diminishing returns or negative effects on economic growth. High levels of financial literacy are found to play an important role in mitigating the diminishing returns or negative effects of financial development on GDP per capita growth. On average, the mitigation effect is 7.41%, while in higher quantiles of the growth distribution, the mitigating effect increases to 9.23%.

The remainder of the paper has the following structure. Section 2 presents the related literature. Section 3 describes the data and Section 4 outlines the empirical methodology. Section 5 includes the empirical findings and Section 6 presents the robustness analysis. Section 7 provides the concluding remarks.

2 | Related Literature

The link between financial development and economic growth is a well-established topic in the literature of Economics and Finance, with roots tracing back over a century. Since then, a number of foundational studies have advanced the understanding of how financial development contributes to economic growth.⁴ Until the 2000s, a large body of empirical evidence

supported the view that well-functioning financial systems are positively associated with economic growth. The general consensus underpinning this is that financial systems produce informed investment decisions, improve capital allocation, enhance firm monitoring and governance, facilitate risk management and thus are considered an important determinant of growth (Levine 2005).

Although financial development is often seen as a driver of economic growth, recent studies have questioned the strength of this relationship. For example, Rousseau and Wachtel (2011) argue that the finance–growth nexus has weakened over time; Boikos et al. (2022) emphasise that it is not financial development per se, but rather the implementation of sound financial reforms that plays a more critical role in driving growth; and Chen and Ji (2024) show that financial development adversely affected local economic growth in China during the decade following the global financial crisis.

Some researchers suggest that too much finance could also harm growth. In addition, several studies also find that once financial development passes a certain level, its impact on growth can turn negative (e.g., Law and Singh 2014; Arcand et al. 2015). Recent contributions have increasingly emphasised the complexity of this relationship, moving beyond the traditional linear and symmetric framework. For instance, Shahbaz et al. (2022) demonstrate that the effect of financial development is asymmetric and varies across regimes, with positive effects in some advanced economies and negative ones in others, thus confirming the presence of nonlinear dynamics. A growing number of studies explore how institutional quality, macroeconomic stability and structural factors condition the impact of financial development on economic growth. For instance, Law et al. (2018) suggest that the negative impact of excessive financial development is more likely to emerge in countries with weak institutions. Yusheng et al. (2021) emphasise that the growth-enhancing effect of financial development in Sub-Saharan Africa is significantly strengthened when combined with higher levels of human capital. Ehigiamusoe and Samsurijan (2021) provide a critical review of the finance–growth literature and emphasise the need for sound institutional and macroeconomic environments to sustain the positive effects of finance. Cavallaro and Villani (2022) argue that the growth impact of financial development is not uniform across countries and whether financial systems are inclusive, efficient and resilient plays an important role. Asteriou et al. (2024) show that although financial development generally supports economic growth under normal conditions, its impact can turn negative or insignificant during periods of financial stress, and the relationship is highly sensitive to the quality of fiscal policy shocks.

In recent years, scholars have turned their attention to the role of financial literacy as a driver of economic growth. The economic significance of financial literacy and its decisive role in personal welfare has been well documented in the literature. Interested readers can refer to Lusardi and Mitchell (2014) and the recent contributions of Zaimovic et al. (2023) and Kaiser and Lusardi (2024) for an extensive overview of the literature on financial literacy and its implications. Remarkably, as previously noted, the vast majority of research papers focus on investigating its role from a microeconomic perspective. In the following,

we highlight the limited number of studies that focus on the macroeconomic effects of financial literacy and demonstrate where our paper fits into the existing literature.

To advance the theoretical understanding of how financial literacy affects long-run growth at the macro level, Bucci et al. (2025) build upon an Uzawa–Lucas endogenous growth framework in which agents are allowed to invest in general knowledge (e.g., human capital) and financial knowledge (e.g., financial literacy). The authors provide evidence supporting that financial knowledge affects financial efficiency, enabling households to achieve higher returns on their savings and assets (see also Jappelli and Padula 2013). However, it simultaneously comes at a cost by raising the opportunity cost of investing in general human capital. In an empirical study, Paşa et al. (2022) use survey data, employ regression analysis and reveal that financial literacy is an important determinant of economic growth in Romania, Bulgaria and Croatia. In addition, a strand of literature reinforces the important role of financial literacy by focusing on other macroeconomic outcomes. For instance, Oliver–Márquez et al. (2022), by utilising data for 63 countries, find that financial knowledge reduces income inequality and this effect vanishes above a specific threshold, revealing a nonlinear relationship. In a cross-country study, Grohmann et al. (2018) support that financial literacy has a positive impact on financial inclusion. Interestingly, Fornero and Prete (2019) show that financial literacy reduces the electoral cost of reforms, while Montagnoli et al. (2017) reveal that the financially literate population may be less supportive of redistribution policies.

Financial literacy is increasingly important for a stable and healthy economy, yet several important questions remain unanswered. At the empirical level, our paper relates to the finance–growth literature that defines the implications of financial literacy on economic growth and financial development.⁵ We contribute to this literature by introducing the first empirical study that examines the macroeconomic impact of financial literacy and financial development on economic growth using a novel panel dataset that captures financial literacy in a wide range of countries for more than one decade. Compared to the existing literature, our paper aims to implement a more effective empirical strategy that not only estimates mean effects but also uncovers heterogeneous effects across the entire conditional distribution of economic growth. In fact, countries experience diverse growth patterns, and thus simple regression analysis may not fully convey the heterogeneous effects across different stages of growth. In addition, our empirical methodology assures that the nonlinearities of the finance–growth nexus will be taken into account.

3 | Data

We utilise data from a sample of 61 countries over the period 1999–2014 from multiple sources. To start with, as far as the financial literacy variable is concerned, we differentiate from the existing literature that relies on survey questions and exercises to proxy the financial level of the adult population. Existing indices generated from survey questions often face limitations when it comes to capturing dynamic changes over time. At the same time, issues such as attrition and subjective and sampling biases

could raise concerns about their reliability and consistency. In this paper, we use the novel index of Financial Knowledge proposed by Oliver-Márquez et al. (2021). The distinct feature of this index is its longitudinal nature, which allows comparisons not only across countries but also over time. The index has been constructed following the methodological guidelines suggested by OECD (2008) and using country-level information on economic capacity, educational training and experience acquired from using financial assets as well as contingencies that individuals need.⁶ To continue, we proxy financial development with private credit by deposit money banks as % of GDP (e.g., Beck and Levine 2004).⁷ With regard to the rest of the explanatory variables, we follow the literature on finance growth and include the following variables, which we retrieved from various sources. That is, the gross capital formation as % of GDP as a proxy of physical capital, years of schooling as a quantity measure of education, government's final consumption expenditure as % of GDP that captures the size of the government, the sum

of imports and exports as % of GDP to measure the degree of trade openness, regulatory quality index to capture the extent to which the government can implement effective policies to promote the development of the private sector and a banking crisis binary variable that captures periods of banking crises.

Table 1 reports the descriptive statistics and the sources of our data. To better understand the nature of the data, we present the following figures. Figure 1 illustrates the relationship between economic growth and financial literacy on average values and shows evidence of heterogeneity across countries. Importantly, for most countries in our sample, the graph suggests that, at each given level of financial literacy, economic growth exhibits significant variability. Figure 2 visualises the relationship between financial development and financial literacy. The red line corresponds to a quadratic fit to the data and indicates a nonlinear relationship. While the plot suggests an upward trend, as an increase in financial literacy is associated with higher values

TABLE 1 | Descriptive statistics.

Variable	Mean	SD	Min	Max	Data source
GDP _{pc} growth	0.024	0.035	−0.156	0.173	World Bank (2024)
FinDev	4.048	0.719	1.413	5.719	World Bank (2024)
FinLit	0.230	0.178	0.025	0.918	Oliver-Márquez et al. (2021)
Capital	3.143	0.209	2.385	3.870	Feenstra et al. (2015); Barro and Lee (2013)
SchoolingYears	10.060	2.213	4.817	13.552	World Bank (2024)
GovernmentSize	2.807	0.286	1.877	3.330	World Bank (2024)
TradeOpenness	4.371	0.517	2.897	5.809	World Bank (2024)
RegQuality	0.780	0.711	−1.066	1.944	Kaufmann and Kraay (2023)
BankingCrisis	0.249	0.433	0	1	World Bank (2024)

Note: 932 observations, 61 countries. GDP_{pc} Growth is the log difference of the GDP per capita in real terms. FinDev, Capital, GovernmentSize and TradeOpenness are expressed in natural logarithms. BankCrisis takes the value 1 if a country faces a banking crisis and the value 0 otherwise. Higher values of the indices of FinLit and RegQuality correspond to higher levels of financial literacy and regulatory quality, respectively. In some cases, linear interpolation was used to fill gaps in the series.

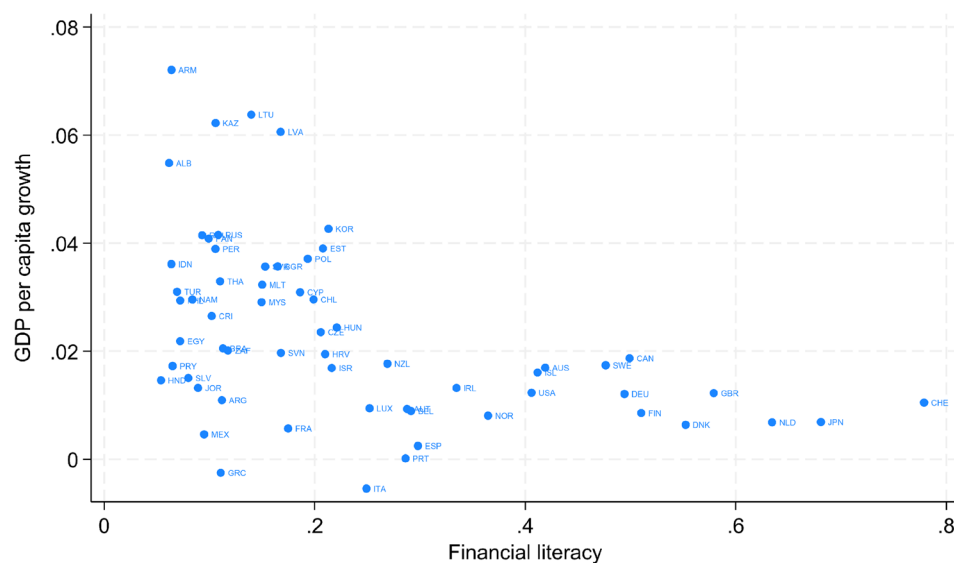


FIGURE 1 | Average economic growth plotted against financial literacy for each country (61 countries, authors' own calculations). [Colour figure can be viewed at [wileyonlinelibrary.com](https://onlinelibrary.wiley.com/doi/10.1002/ijfe.2074)]

of financial development, the nexus is not perfectly uniform and shows evidence of dispersion. Figure 3 represents the relationship between economic growth and financial development across different levels of financial literacy. In countries with similar levels of economic growth, financial development can vary significantly. While low and medium levels of financial literacy show higher dispersion, in most cases, higher financial development corresponds to relatively higher levels of financial literacy.

4 | Empirical Strategy

In this paper, we employ a panel quantile regression model. In fact, the nonuniform distribution of the data across the variables of interest presented in Section 3 suggests a compelling reason for following a quantile regression methodology. Compared to a mean-based regression approach, such as OLS which estimates how ‘on average’ covariates affect the outcome variable, quantile regression offers a more comprehensive

and robust approach. Thus, it allows us to estimate how financial literacy, financial development and their interaction affect economic growth in different parts of the conditional growth distribution. The latter would be quite useful from a policy point of view. For instance, if increased financial literacy levels increase economic growth at the bottom of the conditional distribution of economic growth, this could indicate that countries experiencing economic stagnation could be at a greater advantage.

A quantile regression approach for longitudinal data was introduced by Koenker (2004) and since then, considerable advances have been reported in the literature.⁸

In this paper, we apply the well-established quantile regression estimator proposed by Canay (2011) which accounts for country-specific unobservable heterogeneity in two computationally simple stages. In its general form, for a panel dataset with N countries and T time periods, the first stage concerns the estimation of the equation of interest with a fixed-effects

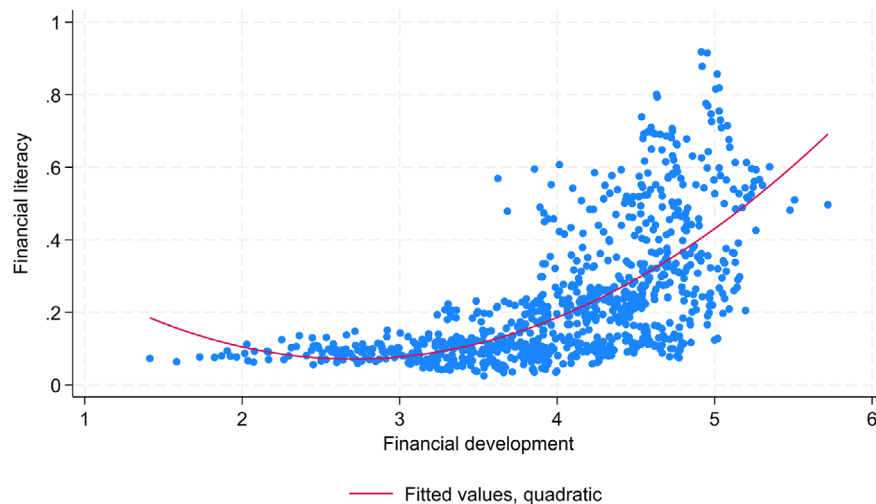


FIGURE 2 | The relationship between financial development and financial literacy (932 observations; authors' own calculations). [Colour figure can be viewed at [wileyonlinelibrary.com](https://onlinelibrary.wiley.com/doi/10.1002/ijfe.2074)]

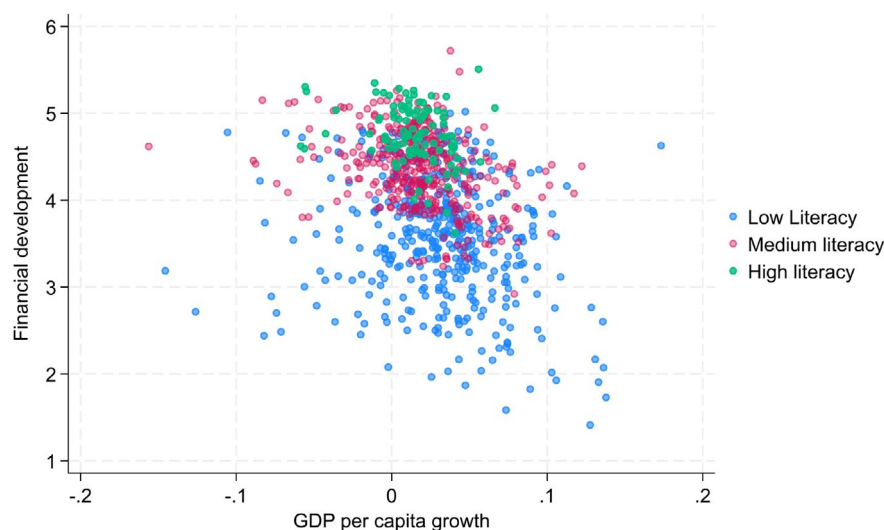


FIGURE 3 | The relationship between financial development and economic growth across literacy levels (932 observations; authors' own calculations). [Colour figure can be viewed at [wileyonlinelibrary.com](https://onlinelibrary.wiley.com/doi/10.1002/ijfe.2074)]

regression approach (Equation (1), where Y is the dependent variable, X is a vector of covariates and η_i represents cross-country heterogeneity). In the second stage, the fixed effects are obtained and subtracted from the dependent variable and the standard quantile regression function is minimised (Equation (2), for every τ -quantile, where ρ is the check loss function).

$$Y_{it} = \beta_0 + \beta X'_{it} + \eta_i + u_{it} \quad (1)$$

$$Q_\tau(\beta) = \frac{1}{NT} \sum_{i=1}^N \sum_{t=1}^T \rho_\tau(\widehat{Y}_{it} - X_{it}\beta) \quad (2)$$

The novelty of this estimator lies in the fact that the unobserved heterogeneity that is considered a 'location-shifter' is eliminated before estimating the quantile regression function and without incorporating penalisation parameters as previous contributions do (e.g., Koenker 2004; Lamarche 2010).

To make the methodological approach more specific and better adapted to our context, we consider our baseline regression model (Equation (3)) that is in line with the traditional finance-growth literature (e.g., King and Levine 1993) and at the same time incorporates financial literacy, the squared term of financial development to capture its nonlinear effect, and other important covariates.

$$\Delta(Y_{it}) = \alpha + \beta_0 Y_{it-1} + \beta_1 FinLit_{it} + \beta_2 FinDev_{it} + \beta_3 FinDev_{it}^2 + \beta_4 X'_{it} + \eta_i + \lambda_t + \epsilon_{it} \quad (3)$$

For every country i and year t in our sample, $\Delta(Y_{it})$ is the growth rate of the real GDP per capita (i.e., the first difference of the natural logarithm of real GDP per capita), Y_{it-1} is the log of real GDP per capita lagged by one period, $Findev$ is financial development, $FinLit$ is financial literacy, X is a vector that includes *Capital*, *SchoolingYears*, *GovernmentSize*, *TradeOpenness*, *RegQuality* and *BankingCrisis*, as described in Section 3.⁹ We additionally control for country-specific (η_i) and time-specific (λ_t) effects.

5 | Empirical Findings

5.1 | Financial Literacy, Financial Development and Growth

To facilitate interpretation, we start the empirical analysis with the fixed-effects model and the corresponding mean effects of the variables of interest on economic growth. Column 1, in Table 2, shows that both financial literacy and financial development are positively associated with the growth rate of GDP per capita and the relationship is statistically significant at the 1% and 10% levels, respectively. The squared term of financial development is negative and statistically significant confirming the nonlinear (in our case, inverse U-shaped) nexus of finance-growth. Moving beyond average effects, we consider columns 2–6 in Table 2, where we present the quantile regression findings for specific conditional quantiles of the growth distribution. That is, the 10th and 30th conditional quantiles (q_{10} and q_{30}) that capture the lower end of the growth distribution, the 50th quantile (q_{50}) that captures the median effects and the 70th and 90th

conditional quantiles (q_{70} and q_{90}) that reflect the upper end of the growth distribution. As it becomes apparent, financial literacy is an important determinant of economic growth especially at the bottom end of the conditional growth distribution and its effect remains statistically significant across quantiles. Our findings enhance our understanding of the important role of financial literacy in driving economic growth, complement the literature presented in Section 2 and, for the first time, uncover additional insights across the entire distribution of economic growth.

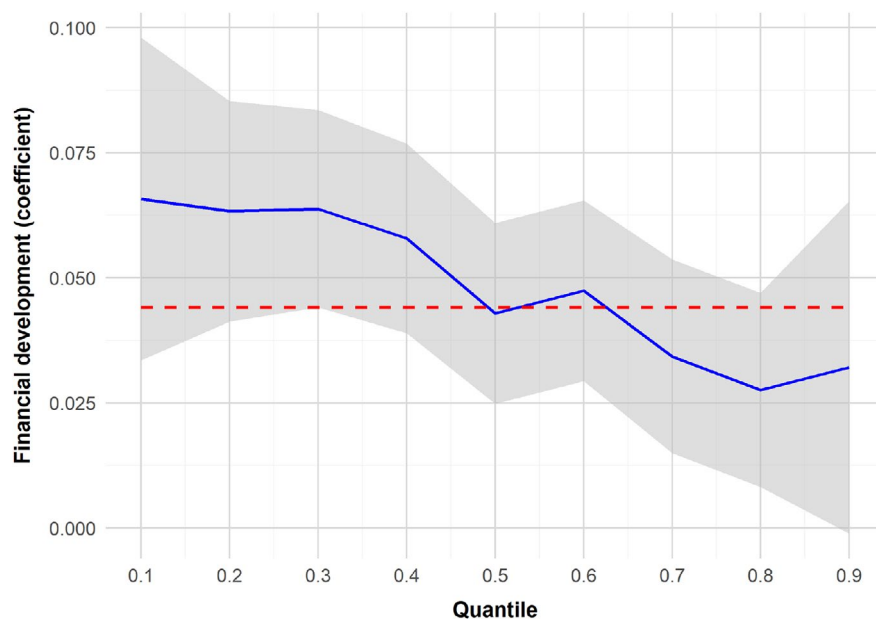
In addition, consistent with the fixed effects findings and recent contributions (e.g., Bucci et al. (2020); Ahmad and Law (2024); Asteriou et al. (2024), among others), the impact of financial development on economic growth appears to be nonlinear. Ultimately, the added value of the quantile regression findings lies in the fact that the effect of financial development is heterogeneous across different parts of the conditional distribution of growth rates. The magnitude of the effect is larger in lower quantiles and decreases when we consider higher ones.¹⁰ In other words, our findings could imply that countries with relatively low GDP per capita growth rates could benefit to a larger extent compared to those with relatively high growth rates. Figures 4 and 5 plot the coefficients of financial literacy and financial development, respectively, along the entire conditional growth distribution. The shaded area corresponds to the confidence interval at the 90% level. The red dashed line shows the average effect drawn from the fixed effects model.

With respect to the rest of the variables included in our model, fixed effects and quantile regression specifications provide consistent findings in terms of sign; however, the statistical significance of the findings differs to some extent. In fact, quantile regression provides us with richer insights and delivers a more comprehensive picture of the effects of the variables at different points of the growth distribution. More specifically, the convergence hypothesis is confirmed in both models with the GDP per capita lagged by one period being negative and statistically significant in both models. As predicted in the literature, capital formation is positively associated with economic growth, while countries at the higher end of the conditional growth distribution tend to benefit more. On average, the effect of the years of schooling is not statistically significant, in contrast to the quantile regression specification, where it appears to be negatively associated with economic growth in some cases. This is not surprising considering that quantity measures of education (such as the years of schooling) are 'losing their predictive power for economic growth' (Laverde-Rojas et al. 2019) and do not necessarily lead to higher growth rates (Hanushek and Woessmann 2008).¹¹ There is a strong positive link between trade openness and economic growth, and the magnitude of the effect is greater at higher quantiles, a finding that is consistent with Lee (2011).¹² Similarly, as expected, regulatory quality, which can be considered a proxy for institutional quality, is important for economic growth (e.g., Acemoglu and Robinson 2008). Importantly, the effect is greater at lower quantiles of the growth distribution and is not captured by the fixed effects model. Finally, as both models support, the coefficients capturing the size of the government and banking crises are negatively associated with economic growth.¹³

TABLE 2 | Financial literacy, financial development and growth.

Dependent variable	(1)	(2)	(3)	(4)	(5)	(6)
GDP _{pc} Growth	FE	q ₁₀	q ₃₀	q ₅₀	q ₇₀	q ₉₀
lagGDP _{pc}	−0.1291*** (0.0214)	−0.1303*** (0.0024)	−0.1301*** (0.0018)	−0.1291*** (0.0016)	−0.1281*** (0.0019)	−0.1283*** (0.0024)
FinLit	0.0848*** (0.0313)	0.0924*** (0.0106)	0.0889*** (0.0066)	0.0818*** (0.0060)	0.0811*** (0.0066)	0.0768*** (0.0093)
FinDev	0.0441* (0.0234)	0.0658*** (0.0196)	0.0638*** (0.0120)	0.0429*** (0.0110)	0.0343*** (0.0119)	0.0321 (0.0205)
FinDev ²	−0.0082** (0.0031)	−0.0114*** (0.0026)	−0.0106*** (0.0015)	−0.0082*** (0.0014)	−0.0071*** (0.0015)	−0.0069*** (0.0025)
Capital	0.0936*** (0.0143)	0.0847*** (0.0068)	0.0915*** (0.0044)	0.0911*** (0.0048)	0.0955*** (0.0046)	0.1077*** (0.0058)
SchoolingYears	−0.0018 (0.0049)	−0.0010 (0.0009)	−0.0018*** (0.0006)	−0.0018*** (0.0005)	−0.0014*** (0.0005)	−0.0009 (0.0009)
GovernmentSize	−0.0632*** (0.0225)	−0.0661*** (0.0048)	−0.0601*** (0.0036)	−0.0613*** (0.0030)	−0.0632*** (0.0031)	−0.0557*** (0.0048)
TradeOpenness	0.0124 (0.0125)	0.0119*** (0.0021)	0.0098*** (0.0015)	0.0130*** (0.0014)	0.0147*** (0.0015)	0.0160*** (0.0020)
RegQuality	0.0073 (0.0073)	0.0134*** (0.0042)	0.0083*** (0.0025)	0.0080*** (0.0021)	0.0040 (0.0030)	−0.0015 (0.0034)
BankingCrisis	−0.0105*** (0.0034)	−0.0132*** (0.0042)	−0.0126*** (0.0036)	−0.0129*** (0.0037)	−0.0098* (0.0054)	−0.0181** (0.0084)

Note: The sample includes 61 countries (932 observations). R-squared (FE): 0.56. In column 1 we present the findings of the fixed effects model. The corresponding robust standard errors clustered at the country level are reported in parentheses. In columns 2–6, we report the results of the two-step quantile regression model (FEQR). The corresponding bootstrapped standard errors using 500 replications are presented in parentheses. We include a constant term and time dummies in all regressions. ***, **, * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

**FIGURE 4** | The effect of financial literacy across quantiles. [Colour figure can be viewed at [wileyonlinelibrary.com](https://onlinelibrary.wiley.com/doi/10.1002/ijfe.20074)]

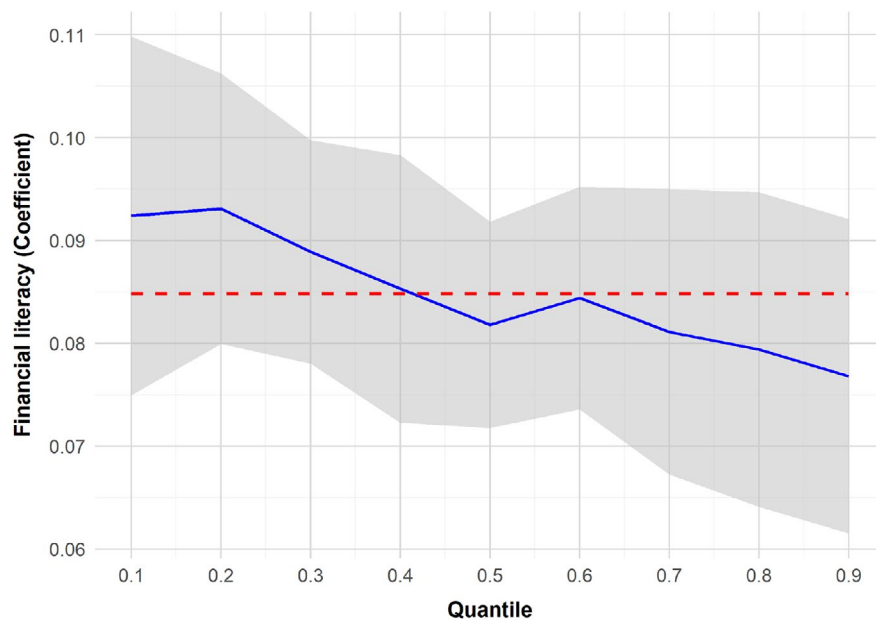


FIGURE 5 | The effect of financial development across quantiles. [Colour figure can be viewed at [wileyonlinelibrary.com](https://onlinelibrary.wiley.com/doi/10.1002/jfe.20074)]

5.2 | The Role of Financial Literacy in Mitigating the Negative Effects of Financial Development

In the previous section, we identified a nonlinear relationship between financial development and economic growth. Specifically, the coefficient of the financial development variable ($FinDev$) was positive and significant, whereas the coefficient of its squared term ($FinDev^2$) was negative and significant. This suggests that as financial development increases, its positive impact on economic growth eventually diminishes. Our main interest now turns to exploring strategies to mitigate these diminishing returns. In addition to this, we explore whether financial literacy plays an important role in compensating for the negative effects of financial development (captured in the squared term of $FinDev$) on economic growth. To this end, we introduce the interaction term $FinDev^2 \cdot HighLit$ in our model (Equation (4)), where $HighLit$ denotes a binary variable equal to one when the level of financial literacy is relatively high in our sample. We set $HighLit$ equal to 1 when financial literacy is greater than 0.5. The choice of threshold is based on selecting the midpoint of the financial literacy index, which, by design, ranges from 0 to 1. Since the index reflects a normalised scale where 0 indicates the lowest possible level of literacy and 1 the highest, the value of 0.5 serves as a natural dividing line between relatively low and high levels of financial literacy.¹⁴ In what follows, our model takes the following form:

$$\Delta(Y_{it}) = \alpha + \beta_0 Y_{it-1} + \beta_1 FinLit_{it} + \beta_2 FinDev_{it} + \beta_3 FinDev_{it}^2 + \beta_4 FinDev_{it}^2 HighLit_{it} + \beta_5 X'_{it} + \eta_i + \lambda_t + \epsilon_{it} \quad (4)$$

We replicate the analysis performed in Section 5.1, incorporating also the interaction term. We present the results in Table 3. Despite some variation in the magnitude of the effects in some cases, the findings exhibit considerable consistency with the results of our baseline model. The most notable aspect of the findings is the positive and statistically significant interaction

term, which indicates that at relatively high levels of financial literacy (e.g., $HighLit = 1$), the negative effect of increased financial development is mitigated. To provide deeper insight into the nature of this effect, we present Figure 6 which consists of six panels. The blue solid line corresponds to the case where financial literacy is low (Equation (5)) and the green dashed line represents the case where financial literacy is high (Equation (6)). High levels of financial literacy mitigate the negative effect of financial development on GDP per capita growth by an average of 7.41% (fixed effects specification, top left panel). Interestingly, in higher quantiles of the growth distribution (q_{70} , bottom left panel), the mitigating effect increases to 9.23%.¹⁵

$$\Delta(Y_{it}) = \hat{\beta}_2 FinDev_{it} + \hat{\beta}_3 FinDev_{it}^2, \quad \text{when } HighLit = 0 \quad (5)$$

$$\Delta(Y_{it}) = \hat{\beta}_2 FinDev_{it} + (\hat{\beta}_3 + \hat{\beta}_4) FinDev_{it}^2, \quad \text{when } HighLit = 1 \quad (6)$$

6 | Robustness Analysis

In this section, we report the results of the robustness analysis in response to endogeneity issues and alternative quantile regression estimators. Our variables of interest could potentially be endogenous and this could lead to biased estimates. To the best of our knowledge, as of now, there is no estimator to simultaneously address unobserved heterogeneity and handle potential bias from endogenous regressions. At the same time, the absence of suitable instruments poses further challenges. In an attempt to control for endogeneity, we introduce lags in the potential endogenous regressors.¹⁶ Table 4 reports the findings after using lagged regressors and repeating the analysis presented in the previous section.¹⁷ As it becomes apparent, the findings are consistent with our initial findings. Financial literacy is found to be a robust determinant

TABLE 3 | The mitigating role of financial literacy.

Dependent variable	(1)	(2)	(3)	(4)	(5)	(6)
GDP _{pc} Growth	FE	q ₁₀	q ₃₀	q ₅₀	q ₇₀	q ₉₀
lagGDP _{pc}	−0.1288*** (0.0212)	−0.1304*** (0.0025)	−0.1287*** (0.0019)	−0.1286*** (0.0017)	−0.1284*** (0.0020)	−0.1287*** (0.0026)
FinLit	0.0665* (0.0345)	0.0725*** (0.0144)	0.0648*** (0.0103)	0.0591*** (0.0096)	0.0611*** (0.0100)	0.0661*** (0.0136)
FinDev	0.0433* (0.0234)	0.0638*** (0.0178)	0.0654*** (0.0129)	0.0467*** (0.0109)	0.0307*** (0.0118)	0.0345* (0.0209)
FinDev ²	−0.0081** (0.0031)	−0.0111*** (0.0023)	−0.0108*** (0.0016)	−0.0088*** (0.0014)	−0.0065*** (0.0015)	−0.0073*** (0.0025)
FinDev ² × HighLit	0.0006** (0.0002)	0.0007*** (0.0002)	0.0007*** (0.0002)	0.0007*** (0.0001)	0.0006*** (0.0001)	0.0005*** (0.0002)
Capital	0.0930*** (0.0142)	0.0904*** (0.0067)	0.0936*** (0.0045)	0.0921*** (0.0047)	0.0936*** (0.0046)	0.1072*** (0.0059)
SchoolingYears	−0.0021 (0.0049)	−0.0023*** (0.0008)	−0.0023*** (0.0006)	−0.0020*** (0.0005)	−0.0015*** (0.0005)	−0.0012 (0.0009)
GovernmentSize	−0.0639*** (0.0226)	−0.0634*** (0.0043)	−0.0628*** (0.0035)	−0.0631*** (0.0029)	−0.0650*** (0.0030)	−0.0559*** (0.0050)
TradeOpenness	0.0127 (0.0124)	0.0121*** (0.0022)	0.0108*** (0.0015)	0.0125*** (0.0015)	0.0142*** (0.0016)	0.0166*** (0.0020)
RegQuality	0.0084 (0.0071)	0.0155*** (0.0042)	0.0091*** (0.0025)	0.0100*** (0.0020)	0.0052* (0.0031)	−0.0002 (0.0034)
BankingCrisis	−0.0107*** (0.0034)	−0.0136*** (0.0043)	−0.0131*** (0.0034)	−0.0135*** (0.0038)	−0.0115** (0.0054)	−0.0178** (0.0081)

Note: The sample includes 61 countries (932 observations). R-squared (FE): 0.57. In column 1 we present the findings of the fixed effects model. The corresponding robust standard errors clustered at the country level are reported in parentheses. In columns 2–6, we report the results of the two-step quantile regression model (FEQR). The corresponding bootstrapped standard errors using 500 replications are presented in parentheses. We include a constant term and time dummies in all regressions. ***, **, * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

of economic growth, however, the size of its effect is smaller in this specification. As before, the effect of financial development on growth follows an inverted U-shape relationship. Notably, the mitigating factor (interaction term) is considerably greater in size. Specifically, high literacy levels offset the diminishing returns of financial development by 33.3% and 50.6% at the lower tail of the growth spectrum, 46.5% in the median and 61.1% and 46.3% at the upper end of the growth distribution. In order to ensure that our findings are not driven by a single quantile regression approach, we investigate alternative quantile regression estimators. We employ the ‘method of moments’ panel quantile regression model (MMQR) of Machado and Silva (2019). The MMQR estimator is based on a conditional location-scale model. The covariates affect the distribution under investigation via location and scale functions, while the fixed effects are allowed to affect the whole distribution (e.g., are not considered ‘constant’ or ‘location shifters’ as in Canay 2011).¹⁸ Table 5 presents the findings. Although at first glance the findings seem consistent

with previous specifications, we draw attention to the following points in this table. Financial development is significant at the lower end and the median of the conditional growth distribution, while its effect becomes insignificant when higher quantiles are taken into account.¹⁹ In addition, high levels of financial literacy can mitigate the negative coefficient of *FinDev*² by 10.1% at the 10th quantile, 8.3% at the 30th and 7.4% at the 50th quantile, a finding that is close to our baseline estimations.

7 | Conclusion

This is the first paper to empirically examine both the macroeconomic impact of financial literacy and financial development on economic growth, by using financial literacy data at the aggregate level and building on a panel quantile regression framework. The recently developed financial literacy index employed in this study allows for a global comparison

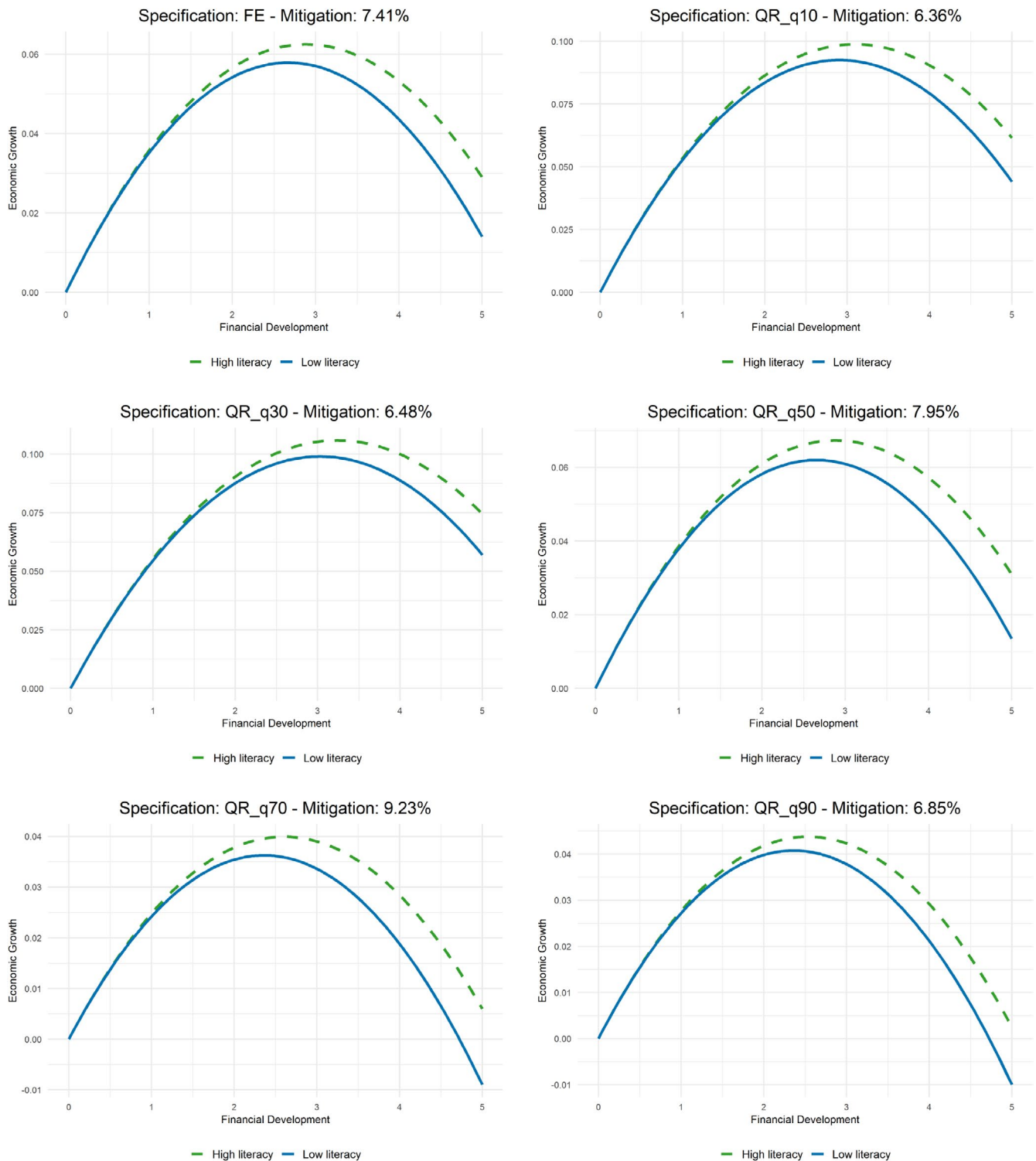


FIGURE 6 | Growth effects of financial development with high and low literacy. [Colour figure can be viewed at [wileyonlinelibrary.com](https://onlinelibrary.wiley.com/doi/10.1002/ijfe.2074)]

across developed and emerging countries over multiple years, and thus addresses one of the key limitations of survey-based financial literacy indices, which typically capture individual countries at a specific time point. Additionally, our empirical strategy of quantile regression allows us to capture the asymmetric and nonlinear effect of the finance-growth nexus and uncover heterogeneous effects across the entire conditional distribution of economic growth.

Our findings reveal that financial literacy is positively associated with economic growth and its effect is found to be stronger at lower quantiles of the conditional distribution of growth. These findings complement the voluminous microeconomic literature supporting the critical role of financial knowledge and additionally enhance the macroeconomic perspective that remains relatively unrepresented. Importantly, we find evidence supporting a nonlinear finance-growth relationship as recent contributions

TABLE 4 | Endogeneity concerns: Lagged variables.

Dependent variable	(1)	(2)	(3)	(4)	(5)
GDP _{pc} Growth	q ₁₀	q ₃₀	q ₅₀	q ₇₀	q ₉₀
lag2GDP _{pc}	−0.1506*** (0.0026)	−0.1490*** (0.0018)	−0.1474*** (0.0018)	−0.1452*** (0.0017)	−0.1460*** (0.0026)
lagFinLit	0.0445** (0.0178)	0.0307*** (0.0095)	0.0286*** (0.0094)	0.0295*** (0.0105)	0.0252 (0.0164)
lagFinDev	0.0486*** (0.0141)	0.0447*** (0.0088)	0.0379*** (0.0110)	0.0257*** (0.0077)	0.0346*** (0.0120)
lagFinDev ²	−0.0084*** (0.0019)	−0.0077*** (0.0011)	−0.0071*** (0.0014)	−0.0054*** (0.0010)	−0.0067*** (0.0015)
lagFinDev ² × HighLit	0.0028** (0.0013)	0.0039*** (0.0007)	0.0033*** (0.0007)	0.0033*** (0.0007)	0.0031*** (0.0010)
Capital	0.0791*** (0.0068)	0.0798*** (0.0043)	0.0793*** (0.0049)	0.0846*** (0.0040)	0.0898*** (0.0065)
SchoolingYears	−0.0044*** (0.0008)	−0.0046*** (0.0005)	−0.0044*** (0.0005)	−0.0046*** (0.0005)	−0.0033*** (0.0008)
GovernmentSize	−0.0618*** (0.0041)	−0.0594*** (0.0030)	−0.0584*** (0.0031)	−0.0612*** (0.0028)	−0.0594*** (0.0051)
TradeOpenness	0.0137*** (0.0026)	0.0142*** (0.0015)	0.0150*** (0.0016)	0.0174*** (0.0016)	0.0218*** (0.0025)
RegQuality	0.0184*** (0.0034)	0.0142*** (0.0022)	0.0124*** (0.0024)	0.0085*** (0.0025)	0.0042 (0.0038)
BankingCrisis	−0.0118** (0.0049)	−0.0139*** (0.0034)	−0.0150*** (0.0040)	−0.0160*** (0.0043)	−0.0151* (0.0090)

Note: The sample includes 61 countries (873 observations). In columns 1–5, we report the results of the two-step quantile regression model (FEQR) where lagGDP_{pc} , FinLit , FinDev^2 and $\text{FinDev}^2 \times \text{HighLit}$ are lagged by one period. The corresponding bootstrapped standard errors using 500 replications are presented in parentheses. We include a constant term and time dummies in all regressions. ***, **, * represent statistical significance at the 1%, 5% and 10% levels, respectively.

predict. Specifically, as financial development increases, its contribution to growth declines, indicating an inverted U-shaped nexus. Notably, we show evidence that financial literacy can mitigate this diminishing effect. In fact, in our main analysis, increased levels of financial literacy mitigate the effect by 7.41% in the mean-based approach and between 6.36% and 9.23% in the quantile regression specification.

The response of growth performance to financial literacy and financial development varies across the entire conditional growth distribution, indicating evidence of parameter heterogeneity. This can be quite useful from a policy perspective. Our findings indicate that increased financial literacy levels increase economic growth at the lower end of the conditional growth distribution. Hence, this could indicate that countries experiencing economic stagnation or relatively low growth rates could benefit more compared to those facing high levels of economic growth. While universal financial literacy policies can offer broad benefits, a one-size-fits-all approach may fall short of being maximally effective. Instead, policies should

be adapted to the specific economic and structural contexts of each country, particularly considering their position within the growth distribution. For example, low-growth countries may yield high marginal returns on growth and benefit from integrating basic financial education into primary and secondary school curricula, whereas high-income countries could prioritise more advanced competencies such as investment literacy or digital finance skills. Taken together, our findings suggest that strengthening financial literacy is not only a microeconomic priority but also a significant tool for boosting economic growth. This is particularly relevant in light of current efforts to promote inclusive growth, close financial literacy gaps and meet global development goals.

Our results also carry important implications for the ongoing debate around the ‘too much finance’ hypothesis. While financial development may hinder growth, our findings suggest that strengthening financial literacy can help mitigate these negative effects. This could imply that in economies with large financial sectors, financial education policies could play a stabilising role

TABLE 5 | Alternative QR estimator.

Dependent variable	(1)	(2)	(3)	(4)	(5)
GDP _{pc} Growth	q ₁₀	q ₃₀	q ₅₀	q ₇₀	q ₉₀
lagGDP _{pc}	−0.1410*** (0.0276)	−0.1336*** (0.0201)	−0.1287*** (0.0166)	−0.1238*** (0.0165)	−0.1179*** (0.0201)
FinLit	0.0880** (0.0360)	0.0750*** (0.0269)	0.0663*** (0.0226)	0.0576*** (0.0219)	0.0473* (0.0256)
FinDev	0.0558** (0.0269)	0.0483** (0.0226)	0.0432* (0.0239)	0.0382 (0.0283)	0.0322 (0.0359)
FinDev ²	−0.0119*** (0.0035)	−0.0096*** (0.0029)	−0.0081*** (0.0030)	−0.0065* (0.0035)	−0.0047 (0.0044)
FinDev ² × HighLit	0.0012*** (0.0002)	0.0008*** (0.0002)	0.0006*** (0.0001)	0.0003** (0.0002)	0.0000 (0.0002)
Capital	0.1204*** (0.0141)	0.1039*** (0.0108)	0.0927*** (0.0096)	0.0817*** (0.0098)	0.0685*** (0.0115)
SchoolingYears	−0.0057 (0.0041)	−0.0035 (0.0032)	−0.0020 (0.0029)	−0.0005 (0.0032)	0.0012 (0.0040)
GovernmentSize	−0.0664** (0.0269)	−0.0649*** (0.0202)	−0.0639*** (0.0167)	−0.0629*** (0.0152)	−0.0617*** (0.0166)
TradeOpenness	0.0426*** (0.0129)	0.0246** (0.0096)	0.0124 (0.0082)	0.0004 (0.0082)	−0.0140 (0.0099)
RegQuality	0.0288*** (0.0088)	0.0165** (0.0064)	0.0082 (0.0057)	0.0000 (0.0060)	−0.0098 (0.0077)
BankingCrisis	−0.0029 (0.0058)	−0.0076* (0.0044)	−0.0108*** (0.0039)	−0.0139*** (0.0042)	−0.0177*** (0.0051)

Note: The sample includes 61 countries (932 observations). In columns 1–5, we report the results of the method of moments quantile regression model (MMQR). The corresponding bootstrapped standard errors using 500 replications are presented in parentheses. We include a constant term and time dummies in all regressions. ***, **, * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

by supporting more informed and efficient financial decisions. Thus, in these cases, policymakers could consider complementing financial development strategies with targeted investments in financial literacy to ensure that financial deepening remains growth-enhancing.

While financial knowledge remains an important driver of economic growth, a significant portion of the population worldwide still lacks adequate access to it. Our paper reinforces the crucial role of financial literacy and encourages policymakers to implement concrete policies targeting the increase of financial knowledge levels. Finally, our study motivates future research on the topic. For instance, of particular interest is the fact that countries may respond differently not only concerning their relative growth level but also based on the income group they belong to. Thus, future research could benefit from separately investigating relatively poor and rich countries. In addition, future contributions could expand financial knowledge indices with newer data and wider

coverage. In parallel, monitoring and evaluating the long-term impact of financial literacy initiatives through regular and extensive data collection and international assessments will be essential to track progress and guide effective policy design. It should be emphasised that future research should also investigate the specific age groups and educational stages in which financial literacy exerts the most significant influence on the general population. In particular, more work is needed to understand how socioeconomic background affects access to financial knowledge and learning outcomes. Addressing these challenges could provide us with valuable insight into the dynamics of financial literacy and financial development.

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Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Endnotes

- ¹ The general consensus is that financially literate individuals are considered those who possess skills and knowledge that allow them to understand financial principles and risks and make effective financial decisions (see also Noctor et al. 1992; Remund 2010; Atkinson and Messy 2012, among others).
- ² For a more detailed discussion of the trade-off between financial and general human capital, see also Bucci et al. (2025).
- ³ Importantly, ongoing research by Calcagno and Marsiglio (2025) supports the idea that financial literacy improves long-run outcomes by reducing the likelihood of adverse macroeconomic shocks, supporting stable development paths.
- ⁴ Reviews and meta-analytical studies of the role of financial development in economic growth are provided by Bumann et al. (2013), Valickova et al. (2015), Arestis et al. (2015), Bijlsma et al. (2018), Panagiotidis and Voucharas (2023) and Iwasaki and Ono (2024), among others.
- ⁵ While there might be the case of reverse causality and hence economic growth contributing to financial literacy, we leave this for future research as it is beyond the scope of this paper.
- ⁶ More information regarding the construction of the Financial Knowledge Index as well as an overview of existing financial literacy indices based on survey contributions can be found in Oliver-Márquez et al. (2021).
- ⁷ The use of alternative measures of financial development, such as the financial development index provided by the IMF, provides consistent results in most cases.
- ⁸ Similar approaches have been adopted by scholars to investigate the finance-growth nexus, for example, Andini and Andini (2014), Boikos et al. (2022) and Dinh Su and Phuc Nguyen (2022).
- ⁹ *FinDev*, *Capital*, *GovernmentSize* and *TradeOpenness* are expressed in natural logarithms.
- ¹⁰ In similar contexts, quantile parameter heterogeneity is also reported by Andini and Andini (2014) and Boikos et al. (2022).
- ¹¹ Several studies report a negative relationship between education and growth. For a meta-analysis on the education-growth nexus, see also Benos and Zotou (2014).
- ¹² In another contribution, Mohamed Sghaier (2023) shows that trade openness is, in fact, important for growth and its effect is more profound when the financial sector is well-developed.
- ¹³ Yet, the literature has not provided a clear-cut answer on the relationship between government size and growth, with some papers reporting a negative relationship (e.g., Dar and AmirKhalkhali 2002) and others suggesting a positive one (e.g., Romero-Avila and Strauch 2008).
- ¹⁴ To further support our threshold choice, we implemented a nonparametric estimation examining how the marginal effect of financial development on growth varies with financial literacy. The results show that while the effect is negative at low literacy levels, it weakens as literacy rises and begins to increase steadily beyond the 0.5 threshold, reinforcing its role as a moderating factor.
- ¹⁵ We calculate the mitigating effect as the percentage ratio of $|\hat{\beta}_4 / \hat{\beta}_3|$.

- ¹⁶ Martínez-Zarzoso et al. (2017) adopt a similar strategy in a panel quantile regression framework.
- ¹⁷ The findings of the baseline model are consistent with the findings of Tables 4 and 5 and are available upon request.
- ¹⁸ In situations involving endogenous variables, the MMQR estimator performs well (see also Machado and Silva 2019).
- ¹⁹ This finding is consistent with the strand of literature supporting the vanishing effect of financial development on economic growth.

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