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Article

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Financial development and economic growth in Ethiopia: Is there a causal link?

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Abstract: The relationship between financial development and economic growth has been widely debated in the economics literature, but the results have been inconsistent and vary between the short and long run. In this study, we investigate the causal relationship between financial development and economic growth in Ethiopia using annual data from 1980 to 2021. We employ the Toda-Yamamoto causality test and the nonlinear autoregressive distributed lag (NARDL) modeling framework to analyze the data. Our results show that none of the variables are stationary at the level, but after applying first differences, all variables become stationary. Using the Toda-Yamamoto causality test, we find no causality running from financial development to economic growth, but there is evidence of reverse causality from economic growth to financial development. Furthermore, the NARDL model results suggest that economic growth drives financial development, and the relationship between financial development and economic growth in Ethiopia is nonlinear and asymmetric. Specifically, neither positive nor negative shocks to economic growth affect financial development in the short run, but both affect it in the long run and in joint short run and long run effects. We conclude from our study that financial development may not guarantee economic growth without building better institutions and following sound and stable fiscal policies. Consequently, constructing an effective economic growth strategy that maintains financial development is crucial. Our findings have significant implications for policymakers, academics, and investors and underscore the importance of informed decision-making based on a thorough understanding of the relationship between financial development and economic growth.

PUBLIC INTEREST STATEMENT

The present paper examines the causal relationship between financial development and economic growth in Ethiopia and challenges the conventional view that financial development is a prerequisite for economic growth. The paper finds that economic growth actually drives financial development, rather than the other way around. One possible explanation for this finding is that the Ethiopian financial system is relatively closed to foreign competition, has one of the lowest levels of financial inclusion in Africa and is not as well-developed as it could be. The findings have important implications for policymakers, as they suggest that focusing solely on financial sector reforms may not be sufficient for promoting sustainable economic growth. Instead, policies that promote broad-based economic growth may be more effective in stimulating financial sector growth. These findings will be of interest to anyone interested in understanding the complex relationship between financial development and economic growth in developing countries.

Subjects: Development Studies; Development Policy; Economics and Development; Economics; Finance

Keywords: financial development; economic growth; cointegration; ARDL model; causality; Toda-Yamamoto Test; developing country

1. Introduction

Historically, debates about the link between economic growth and financial development have been ongoing since Bagehot (1873), whose ideas were later popularized by Schumpeter (1912), who argued that financial sectors drive innovation, leading to economic growth (Taivan & Nene, 2016). The field of endogenous growth theory has shown significant interest in the beneficial impact of financial development on the advancement of the economy. According to this theory, investing in financial development results in positive externalities and spill over effects within a knowledge- and technology-based economy, which ultimately leads to economic growth (Bencivenga & Smith, 1991; King & Levine, 1993).

As Bhole (2004) (R. Levine, 1997), and (Luintel & Khan, 1999) assert that a robust financial system has the potential to greatly enhance economic growth by facilitating the mobilization of savings, directing resources towards the most profitable investments, minimizing transaction costs, spreading out risks, promoting innovation, and fostering technological advancements. Financial development leads to an increase in the range of financial services and transactions within a nation when money is being saved or transferred, which further leads to an enhancement in the country's production and productivity (Omri et al., 2015). It is argued that financial development accelerates not only the economy but also creates job opportunities, reduces poverty and income disparity, by accumulating capital and introducing technological advancements, especially in developing nations (Abbas et al., 2022; Cetin et al., 2018; Honohan & Beck, 2007; M. R. Levine, 2021; Wen et al., 2021). At the same time, it is not rare to come across written works that state economic growth as the primary catalyst and powerhouse behind the progress of financial development. For example, Gurgul and Łukasz (2011), and Song et al. (2021) argue that as people's incomes rise as a result of economic growth, so will their demand for financial services.

However, the causal relationship between financial development and the growth of a country's national output has been a highly debated topic for many decades, but there is still little agreement on the issue (Bist & Read, 2018; Zhuang et al., 2009). Central to this debate is the question of whether solid economic growth is driven by financial development or the other way around. This question holds significant importance as identifying the causal relationship between financial progress and economic expansion can have crucial consequences for policymakers when devising suitable strategies and policies for growth and development

(R. Levine, 1997). The literature has well documented that previous empirical studies that employed various causality tests to examine the nature and direction of the causal relationship between financial development and national output growth produced mixed and inconsistent results (Akinci et al., 2014; Bist & Read, 2018; Durusu-Ciftci et al., 2017; Guru & Yadav, 2019; Haque et al., 2022; Jung, 1986; Khan & Senhadji, 2003; R. Levine, 1997; H. M. Nguyen et al., 2022; Nyasha et al., 2016; Odhiambo & Nyasha, 2022; Okuyan, 2022; Omoke, 2009; Opoku et al., 2019; Swamy & Dharani, 2019; Taivan & Nene, 2016; Wolde Rufael, 2009; Zhuang et al., 2009).

One or more reasons can explain why there are significant differences in the empirical results. One possible explanation is that the tests for causality can be affected by the omission of relevant variables, leading to omitted variable bias (Almassri et al., 2020). Using a bivariate model, one might conclude that financial development is not related to economic growth, but a multivariate model that includes other relevant variables may not necessarily confirm this. Furthermore, numerous previous studies failed to incorporate financial development into their estimates of

production functions, though financial development is partly endogenous within an output equation. However, omitting the financial development variable can result in spurious conclusions regarding the financial development—economic growth nexus. Therefore, this leads to a strong bias towards favouring a connection between the two variables, regardless of their actual cause-and-effect association (P. T. Nguyen & Pham, 2021).

It was also evident during the literature review that significant financial investments, particularly in developing countries, are necessary to attain the Sustainable Development Goals (Tinta, 2022). However, the need to guide the existing financial system toward this goal requires further investigation of the relationship between financial development and economic growth (Odhiambo & Nyasha, 2022). There are also clear indications that the financial sector is still in its infancy in the East African region (of which Ethiopia is a part) and is dominated by government-owned banks (Worku, 2016), despite the fact that the banking sector has experienced growth in recent years as a result of branch expansion, total banking industry capital, deposit mobilization, and credit facilities (NBE, 2022).

Furthermore, to our knowledge, there are only a limited number of studies that investigate the relationship between financial development and economic growth in Ethiopia, and these studies have produced different results depending on the research methods and the financial development indicators used. Previous analyses have mainly used a narrow indicator of financial development, which is the credit available to domestic firms as a percentage to GDP, to proxy for financial development (See Table A1). However, in accordance with the IMF's 2016 working paper titled "Introducing a New Broad-based Index of Financial Development", it is explicitly stated that the credit available to domestic firms as a percentage of GDP only accounts a quarter of the overall depth component within the realm of financial institutions (FI). Moreover, this depth component itself accounts for less than half of the subcomponent associated with financial institutions (FI) (Svirydzenka, 2016, p. 5). It would, therefore, be intriguing to see the effect of the broad-based financial development index on the economic growth, or vice versa.

Against this backdrop, the study's overarching objective was to investigate the causal relationship between financial development and economic growth in Ethiopia using annual time series data between 1980 and 2021. In order to achieve this objective, the researchers have employed advanced and rigorous econometric techniques, including the Toda-Yamamoto causality test, which is commonly used for evaluating causal relationships in time series data, and the NARDL model, which enables the estimation of non-linear relationships among variables in time series data. This latter method is particularly valuable for examining the asymmetric effects of variables during different phases, such as expansion and contraction. By applying these advanced econometric techniques, the study enhances the methodological rigor of the analysis and contributes to the existing literature on the subject.

The examination of the causal relationship between financial development and economic growth in Ethiopia is of paramount importance for policymaking, investment decision-making, and academic research, as well as for advancing the overall economic growth of the country. The findings of this study can be used by policymakers to assess the causal link between financial development and economic growth, particularly in unstable economic environments. A comprehensive understanding of this relationship can also aid policymakers in formulating policies that encourage economic growth, which, in turn, can foster financial development. For investors, the study's insights can be used to make informed decisions on resource allocation, identify opportunities for growth, and maximize returns. Additionally, this study can provide valuable insights to the existing body of academic research in the field of economics focusing on developing countries.

The remaining portion of the paper is structured in the subsequent manner: the next part concentrates on examining pertinent literature, succeeded by the methodology section. The penultimate section comprises the results section. The paper ends with a section discussing the conclusions and limitations.

2. Financial development and economic growth nexus: Theoretical framework

The relationship between financial development and economic growth has been studied long ago in economics (Akinci et al., 2014; Bist & Read, 2018; R. Levine, 1997) and has been well recognized and emphasized in economic development (Acemoglu, 2012; Gurley & Shaw, 1955). It's important to be skeptical of the claim that financial development will always result in economic growth because it's a highly intricate matter that is influenced by various factors. These factors include country-specific circumstances, the specific empirical model employed, the proxy that's utilized to measure the level of financial development, and the method of data analysis employed (Nyasha & Odhiambo, 2018). Existing studies in the field have produced inconsistent results when examining the connection between financial development and economic growth (Bist & Read, 2018; Guru & Yadav, 2019; R. Levine, 1997; Odhiambo & Nyasha, 2022).

Based on the direction of the causality relationship, the approaches are categorized into four types namely, supply-leading, demand-following, feedback, and neutrality hypotheses. The supply-leading growth hypothesis is the first possibility, which states that an improved financial development policy can result in increased access to credit, investment opportunities, and financial services. These factors are considered to be the drivers of economic growth. This hypothesis proposes that modern financial systems can be the catalyst for economic growth, and the financial sector can become the main engine of growth. As a result of the expansion of the banking and financial services sector and the corresponding increase in capital inflows, the economic growth rate increased significantly. Durusu-Ciftci et al. (2017), Bist and Read (2018), Guru and Yadav (2019) and Taddese Bekele and Abebaw Degu (2021) found results that support the supply-leading hypothesis that financial development leads to economic growth, not the other way around.

However, there is also a clear argument for opposite causality, also known as the demand-following hypothesis, which stresses that financial development is a consequence, not a cause, of economic growth. According to this proposition, it is the economic growth that drives the need for financial institutions, assets, and services, which in turn promotes the development of the financial sector, instead of the reverse. For instance, Rajan and Zingales (1998) suggested that economic growth creates investment opportunities, stimulates credit demand, and thus has a positive impact on financial development. Omoke (2009) conducted an empirical analysis using Granger causality tests to investigate the relationship between financial development and economic growth in the case of Nigeria. Based on the Granger causality analysis, he found that there was no evidence to support the notion that financial development (measured by domestic credit, private credit, and broad money) causes economic growth. Instead, the results suggest that economic growth Granger-causes financial development, implying that growth-led financial development is the more likely scenario. Adeyeye et al. (2015), Akinci et al. (2014) and Haque et al. (2022) supported the demand-following hypothesis. In general, this causal relationship between growth and the level of financial development could reflect that countries with higher income consume more financial services.

The third possibility is the feedback hypothesis, which proposes that there is a two-way causal relationship between financial development and economic growth. Almassri et al. (2020), H. M. Nguyen et al. (2022), Abbas et al. (2022), Pradhan et al. (2017), Swamy and Dharani (2019) (Saqib, 2022; Vo et al., 2022), P. T. Nguyen and Pham (2021) (Manta et al., 2020), Jung (1986), (1999) and (Wolde Rufael, 2009) backed the idea that financial development and economic growth have a mutual cause-effect relationship. Proponents of this hypothesis emphasize the significance of a reliable and effective financial system in facilitating economic development. Simultaneously, economic growth can also drive the progress of finance by increasing the need for financial services and enhancing the profitability of financial intermediaries. The supporters of this approach also suggest that an efficient financial system can aid the economy in utilizing its trade openness effectively, leading to a rise in the country's economic growth. Consequently, an improvement in

the economic growth of the country can enhance the financial development, leading to an upsurge in the demand for financial services. Furthermore, the public will benefit from financial services due to their increasing demand, resulting in a positive effect on financial development (Faisal et al., 2019; Shahbaz et al., 2018).

The fourth possibility is the neutrality hypothesis, which stresses that no causal relationship exists in either of the flips (financial development-economic growth). Menyah et al. (2014), Nyasha et al. (2016), Opoku et al. (2019), Odhiambo and Nyasha (2022) and Okuyan (2022) support this hypothesis.

Based on different theoretical frameworks, Figure 1 illustrates the four possible hypotheses through which economic growth and financial development relate.

To sum up, it is clear from the available literature that the relationship between financial development and economic growth has been a topic of extensive research, yet the literature lacks a consensus on their causal link. Current studies suggest that this relationship is multi-faceted and context-dependent, with the influence of various internal and external dynamics of a nation shaping its outcome. Moreover, the particular model and dataset used may also impact the results (Samargandi et al., 2015). Research on this topic in Ethiopia is limited, and the existing literature uses a narrow measure of financial development, which may not provide a comprehensive understanding of the phenomenon or lead to specific policy implications. As a result, there is a research gap that needs to be filled by rigorous empirical methods to establish the causality between financial development and economic growth in Ethiopia. This study aims to address this gap by examining the validity of the four hypotheses in the Ethiopian context, providing a more comprehensive understanding of the relationship and potentially informing policies to promote financial development and economic growth in the country.

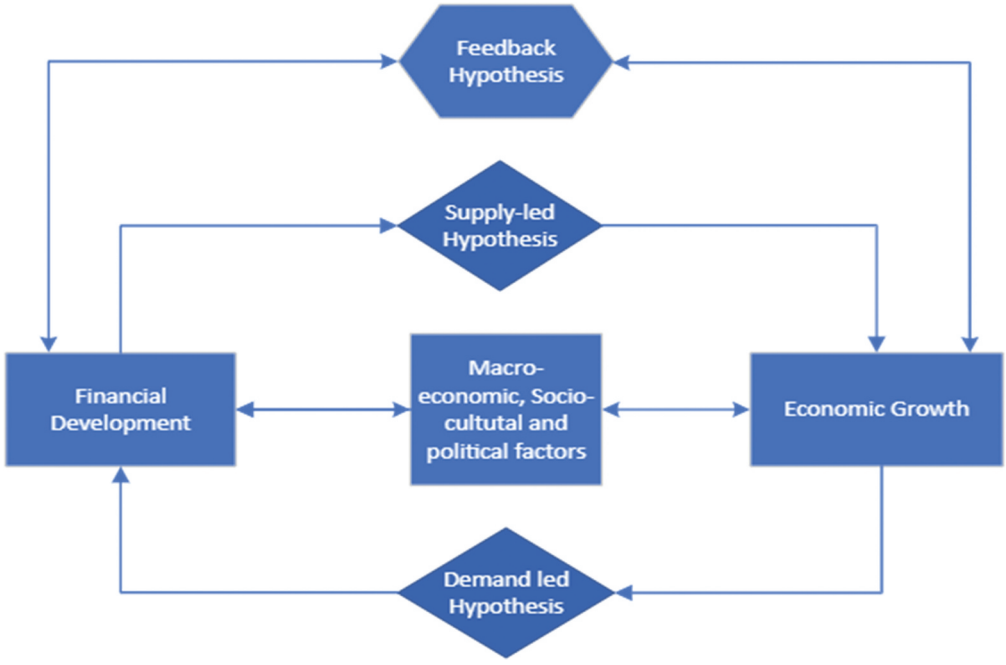

Figure 1. The possible causal relationship between Financial Development and Economic Growth.

Source: The Authors' own illustration.

3. Data sources, model specifications and estimation methods

3.1. Data sources

The availability of reliable and long-term macroeconomic data sets is one of the most pressing issues in Ethiopia, and most of the data sets are not long enough to allow reliable and long-term analysis. For data consistency, therefore, attempts have been made to rely on international sources. The study uses annual secondary data covering a period of 42 years (1980–2021) and was obtained from the World Bank open database (data.worldbank.org), the IMF's financial development index database (data.imf.org), the FRED economic data (fred.stlouisfed.org), the Bruegel dataset (www.bruegel.org) and the Penn World Table (Feenstra et al., 2015). This study used six variables to examine the relationship between financial development and annualized average growth rate of GDP per capita in Ethiopia. The variables are GDP per capita (Y), financial development (FD), capital (K), human capital (HC), trade openness (To) and real effective exchange rate (REER). A detailed description of the dependent variable, the independent variables, the measurement units, and the data sources is provided in Table 1.

3.2. Model specifications

Building upon the research referenced in the conceptual framework, the relationship between economic growth and financial development can be examined through the use of endogenous growth models (Bist & Read, 2018; Guru & Yadav, 2019; Haque et al., 2022; P. T. Nguyen & Pham, 2021). Several previous research works have shown that financial development, along with other economic, social, and political factors, affect economic growth. To examine the connection

Table 1. The variables used in the data analysis and their corresponding data source

Variable	Notation	Measure	Data source
National Output per capita	Y	GDP per capita, PPP (constant 2017 international $)	PWT 10.01 and WB, 2023
Financial Development Index	FD	The index summarizes how developed financial institutions (FI) and financial markets (FM) are in terms of depth, access, and efficiency. It ranges between 0 & 1.	IMF, 2023
Human Capital	HC	Human capital index per person based on years of schooling and returns to education.	PWT 10.01
Capital	K	Gross capital formation as % of GDP in current PPPs	PWT 10.01
Trade openness	TO	Trade Openness: Measures total trade (Import plus export) as a percentage of gross domestic product.	FRED, 2023 & WB, 2023
Real Effective Exchange rate	REER	The real effective exchange rate (REER) measures the changes in the value of a country's currency relative to a basket of currencies belonging to its trading partners (Darvas, 2012).	Bruegel dataset, 2023

Note: WDI indicates the world development indicators.

between financial development and economic growth in Ethiopia, this study established a simple empirical research model, represented by Equation 1.

$$Y = \alpha_0 + \beta FD + \delta X + \varepsilon \tag{1}$$

Where Y, FD and X, respectively, represent the national production measured by the Gross Domestic Product per capita of the country at time t, financial development (FD) and the set of macro-control variables, including physical capital, human capital, trade openness and real effective exchange rate, while ε is the error term.

In order to ensure accurate and reliable results, the variables utilized in the research were transformed into their logarithmic form using the natural log. This was done to simplify estimations, reduce issues of heteroskedasticity, and yield more accurate results compared to a basic linear approach. Based on the definitions mentioned above, the time series model was transformed into its log-log format as:

$$logY_t = \beta_0 + +\beta_1 lnFD_t + \beta_2 lnK_t + \beta_3 lnHC_t + \beta_4 lnTo_t + \beta_5 lnREER_t + \varepsilon_t \tag{2}$$

β_0 indicates the intercept of the model, β_1 is the coefficient of financial development (FD), and the coefficients β_2, β_3, β_4, and β_5 represent Capital (K), Human Capital *(HC)*, Trade Openness (To), and real effective Exchange Rate (REER), respectively. In the model, ε_t is the error term.

In this model, the dependent variable is economic growth, which is measured by the logarithmic value of the gross domestic product per capita of the country at time t. The most crucial economic gauge for measuring a country's level of development is Per Capita Income, which is computed by dividing a nation's gross domestic product by its population (Beylik et al., 2022). The degree of economic progress and advancement in any given nation is contingent upon a multitude of variables (Aye et al., 2017), however, we have exclusively considered variables for which empirical data is accessible. The main factor that is being investigated as a cause of economic growth is the level of financial development (FD). Since the variable could not be measured directly, we used a proxy variable. Unlike other studies conducted in Ethiopia that used only domestic credit to the private sector as percentage of GDP as a proxy for financial development, the one we conducted uses a comprehensive measure of financial development developed by Svirydzenka (2016). This broad-based index alternatively known as the IMF financial development index, which captures financial depth, access, and efficiency. Several empirical studies have shown that it is a better measure of financial development (Chen et al., 2020; T. A. N. Nguyen, 2022; Raifu & Afolabi, 2022).

The level of a country's trade openness, which reflects how much it relies on foreign trade and is calculated by taking the ratio of the total value of trade to its gross domestic product, could also boost the technology index and consequently, lead to economic growth (Jalil & Rauf, 2021). This could be because trade spurs the diffusion of technology and the transfer of skills and knowledge, resulting in a more efficient allocation of resources and higher factor productivity, ultimately contributing to a country's economic growth (Islam et al., 2022; Mtar & Belazreg, 2023). Furthermore, human capital accumulation improves a country's innovation capability and ultimately economic growth (Romer, 1990). There is evidence from various empirical studies indicating that human capital plays a significant role in raising the level of technology adoption, which, in turn, leads to an increase in production and overall productivity (Mtar & Belazreg, 2023; Papalia et al., 2011).

Finally, a number of studies have empirically confirmed that real effective exchange rates drive a country's economic growth trajectory and that its fluctuation or stability is the key factor that shapes the significance and behaviour of macroeconomic variables. Also, empirical research indicates that Real Effective Exchange Rates (REERs) can have a significant impact on the actual

economic growth of low-income countries (Giordano, 2023). However, the relationship between real effective exchange rates (REERs) and economic growth is a complex and varies across countries and time periods. While some studies show that REER depreciation has a positive impact on economic growth, others suggest no significant relationship or even an intended effect. Eliminating the institutional and market failures that cause the economic distortions would be the optimal solution. However, it goes without saying that proposing this strategy to developing nations would be equivalent to advising them to "get rich to become rich.". In light of these challenges, the impact of REER on economic growth remains indeterminate (Dani, 2009).

3.3. Estimation methods

In order to analyze time series data, different econometric techniques are used, including unit root tests, cointegration, estimation of long-run and short-run coefficients using the NARDL method, as well as the Toda-Yamamoto causality test (TY). We applied all these techniques in our analysis.

There is a tendency for time series data to be non-stationary or to change over time in terms of means, variances, and covariances. Therefore, it is essential to use unit root tests specifically designed to analyze and account for such non-stationarity (Hamilton, 1989). Based on the levels of integration of variables, unit root tests are an effective way to determine which co-integration method will be most appropriate for the specific data set. The concept of cointegration denotes that two or more time series variables are each non-stationary, yet their linear combination is stationary (Engle & Granger, 1987; Watson, 1994). There are several unit-root tests in the literature that can be used to check if a time series is stationary. In this study, the Augmented Dickey-Fuller (Dickey & Fuller, 1981), the Phillips-Perron (Peter & Perron, 1988), and the Dickey-Fuller Generalized Least Squares (Elliott et al., 1992) unit root tests were used to determine data stationarity. The Akaike information criterion (AIC) was used to examine the optimal lags for both the independent and dependent variables.

To examine the causal relationship between economic growth and financial development, we employ Toda and Yamamoto (1995) Granger causality technique. This technique is notable because it doesn't need to assess the cointegrating properties of the system beforehand, which helps to prevent any bias that might occur with unit root and cointegration tests. By doing so, the approach overcomes the problem of the traditional Granger causality analysis and is robust in accounting for the unit root and cointegration characteristics of the VAR system.

The test assumes that financial development (FD) and economic growth (EG) are two separate variables that may be related to each other. The method relies on the estimation of a VAR model with lag length p and maximum integration order d. This means that the VAR model, denoted as VAR (p + d), can be expressed in the following manner:

$$y_t = \beta_0 + \beta_1 y_{t-1} + \ldots + \beta_{p+d} y_{t-(p+d)} + \varepsilon_t \tag{3}$$

Where the vector y_t consists of K endogenous variables, the intercept terms represented by the vector β_0, coefficient matrices are denoted by β_{p+d} and white noise residuals are represented by ε_t. To test for Granger non-causality, the null hypothesis is that the first p parameters of the k^{th} element of y_t are zero, indicated by the notation: H_0: $\beta_0 = \ldots = \beta_p = 0$.

Toda and Yamamoto (1995) presented a Wald test statistic that has the property of asymptotically following the chi-square distribution with p degrees of freedom. This holds true regardless of the variables' order of integration or cointegration properties. Wald statistics can therefore be used to test the null hypothesis of Granger non-causality in Equation 3.

Using the Toda-Yamamoto approach, one can formulate the following causality analysis equation for economic growth.

$$\begin{aligned} lnY_t = {} & \phi + \sum_{i=1}^{k} \alpha_{1i} lnY_{t-i} + \sum_{j=k+1}^{d_{max}} \alpha_{2j} lnY_{t-j} + \sum_{i=1}^{k} \beta_{1i} lnFD_{t-i} \\ & + \sum_{j=k+1}^{d_{max}} \beta_{2j} lnFD_{t-j} + \sum_{i=1}^{k} \gamma_{1i} lnHc_{t-i} + \sum_{j=k+1}^{d_{max}} \gamma_{2j} lnHc_{t-j} \\ & + \sum_{i=1}^{k} \eta_{1i} lnK_{t-i} + \sum_{j=k+1}^{d_{max}} \eta_{2j} lnK_{t-j} + \sum_{i=1}^{k} \vartheta_{1i} lnTo_{t-i} + \sum_{j=k+1}^{d_{max}} \vartheta_{2j} lnTo_{t-j} \\ & + \sum_{i=1}^{k} \rho_{1i} lnREER_{t-i} + \sum_{j=k+1}^{d_{max}} \rho_{2j} lnREER_{t-j} + \varepsilon_t \end{aligned} \tag{4}$$

It is possible to construct equations for other series in a similar manner.

The relationship between financial development and economic growth in Ethiopia can also be investigated using the standard ARDL specification without asymmetry in short- and long-run dynamics, as described by Pesaran et al. (2001) as follows.

$$\begin{aligned} dlnY_t = {} & \alpha + \rho lnY_{t-1} + \pi lnFD_{t-1} + \alpha_1 lnK_{t-1} + \alpha_2 lnHc_{t-1} + \alpha_3 lnTo_{t-1} + \alpha_4 lnEr_{t-1} \\ & + \textstyle\sum_{i=0}^{p-1} \gamma_i dlnY_{t-1} + \sum_{i=0}^{q-1} \beta_i dlnFD_{t-1} + \sum_{i=0}^{q-1} \alpha_i dlnK_{t-1} + \sum_{i=0}^{q-1} \alpha_i dlnHc_{t-1} \\ & + \textstyle\sum_{i=0}^{q-1} \alpha_i dlnTo_{t-1} + \sum_{i=0}^{q-1} \alpha_i dlnEr_{t-1} + \varepsilon_t \end{aligned} \tag{5}$$

where d denotes the first difference operator and $\varepsilon_t \sim iid(0, \sigma^2)$ represents the white noise term.

However, in several recent studies it has been shown that most economic fundamentals have nonlinear (asymmetric) dynamics (Kassi et al., 2023), and that the relationship between financial development and economic growth is not different (H. M. Nguyen et al., 2022; Odhiambo & Nyasha, 2022; Tinta, 2022). For instance, a negative shock might have a greater short run effect, while a positive shock might have a larger long run effect (or vice versa) (Udeagha & Breitenbach, 2023). Thus, the ARDL method may produce inaccurate results and unreliable conclusions. In order to address this issue, the research has adopted the nonlinear autoregressive distributed lags (NARDL) modeling technique proposed by Shin et al. (2014) to capture the nonlinearity, asymmetries, as well as long- and short-term dynamics (Faisal et al., 2019), making it well suited for the investigation of the financial development-economic growth nexus in Ethiopia. The NARDL model computation is applied by many empirical researchers (Chen et al., 2020; Raifu & Afolabi, 2022; Uche & Effiom, 2021; Udeagha & Breitenbach, 2023).

The NARDL model is a generalization of the ARDL model that can accommodate departures from linearity in a way that is relevant to many integrated economic time series. It can also nest the linear ARDL model as a special case, which provides a means to test the hypothesis of linearity. The NARDL model uses partial sum decompositions of the explanatory variables to accommodate asymmetry (Cho et al., 2021).

The NARDL model differs from other nonlinear frameworks, like the smooth transition regression and the Markov-switching model, by utilizing partial sum decompositions to incorporate both nonlinear long-run relationship and nonlinear error correction (Udeagha & Breitenbach, 2023). So, following Shin et al. (2014), to incorporate both short-run and long-run dynamics, the ARDL approach in Equation 5 can be extended by replacing the variable $lnFi_t$ with $lnFi_t^+$ and $lnFi_t^-$ as follows:

$$dlnY_t = \alpha_0 + \rho lnY_{t-1} + \pi^+ lnFD^+_{t-1} + \pi^- lnFD^-_{t-1} + \alpha_1 lnK_{t-1} + \alpha_2 lnHc_{t-1} + \alpha_3 lnTo_{t-1} + \alpha_4 lnEr_{t-1} + \sum_{i=1}^{p-1} \gamma_i dlnY_{t-i} + \sum_{i=0}^{q-1} (\beta_i^+ dlnFD^+_{t-1} + \beta_i^- dlnFD^-_{t-1}) + + \sum_{i=0}^{q-1} \varphi_i dlnK_{t-1} + \sum_{i=0}^{q-1} \omega_i dlnHc_{t-1} + \sum_{i=0}^{q-1} \tau_i dlnTo_{t-1} + \sum_{i=0}^{q-1} \lambda_i dlnREER_{t-1} + \varepsilon_t \quad (6)$$

where $p-1$ *and* $q-1$ are the optimal lags derived from the Akaike information criterion (AIC). ρ, π^+ *and* π^- represent the long-run coefficient and the positive and negative partial sums of financial development respectively. The intercept and coefficients of the control variables are represented by $\alpha_0, \alpha_1, \alpha_2, \alpha_3,$ *and* α_4 respectively. Each variable has its own short-run coefficients represented by γ_i, β_i^+, β_i^-, $\varphi_i, \omega_i, \tau_i$ and λ_i.

We examine the potential long-run asymmetric relationship (cointegration) between the series using the t_{BDM} test of Banerjee et al. (1998) for testing $\rho = 0$, against $\rho < 0$ and the F_{PSS} test of Pesaran et al. (2001) for testing the joint null hypothesis $(H_0 : \rho = \pi^+ = \pi^- = 0)$ against the alternative hypothesis $(H_0 : \rho \neq \pi^+ \neq \pi^- \neq 0)$ as suggested by Shin et al. (2014). The Wald test is used to determine whether there is asymmetry by testing the null hypothesis that $\theta^+ = \theta^-$, where $\theta^+ = \frac{\pi^+}{-\rho}$, and $\theta^+ = \frac{\pi^-}{-\rho}$. If the null hypothesis is accepted (i.e., there is a symmetry between financial development and economic growth), Equation 6 will be transformed into Equation 5; if the null hypothesis is rejected, Equation 6 will become a co-integration NARDL with short- and long-run asymmetry.

The asymmetric dynamic multipliers can be used to quantify the asymmetric adjustment processes (responses) of economic growth to changes in financial development, as shown in Eq. (7) below:

$$m_h^+ = \sum_{j=0}^{h} \frac{\partial lnY_{t+j}}{\partial lnFD_t^+}, \qquad and \qquad m_h^- = \sum_{j=0}^{h} \frac{\partial lnY_{t+j}}{\partial lnFD_t^-}, h = 0, 1, 2, \quad (7)$$

Note that as $h \to \infty$, $m_h^+ \to \theta^+$ and $m_h^- \to \theta^-$, where θ^+ and θ^- are the asymmetric long-run coefficients. On the basis of the estimated multipliers, we are able to see the direction of change from the old to the new equilibrium following a negative or positive shock, as well as the short-term disequilibria.

Finally, the present study also performs sensitivity analysis to check consistency and validity of long run dynamics using fully modified ordinary least squares (FMOLS) developed by Phillips and Hansen (1990), canonical cointegrating regression (CCR) developed by Park (1992) and dynamic ordinary least squares (DOLS) developed by Stock and Watson (1993) econometric techniques to confirm the outcome from NARDL cointegration approach. We use the FMOLS and DOLS methods to correct for small-sample bias and take into account the possibility of serial correlation and endogeneity (Djeunankan et al., 2023).

4. Empirical results

4.1. Descriptive analysis of national output and financial development trends

Figure 2 shows a graphical representation of the main research variables, GDP and financial development. Despite the positive role of financial development in promoting economic growth, the level and growth rate of financial development remained very low in Ethiopia, as is clear from Figure 2b. The country's average financial development index is 0.116, making it one of the lowest in the world. As Figure 3c clearly shows, economic growth has gone through upward and downward movements over time and has been strongly affected by political instability and civil war

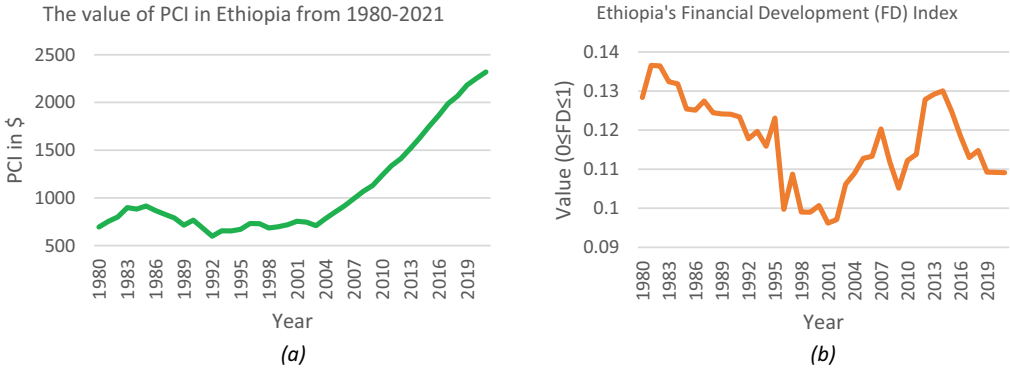

Figure 2. Trend Analysis of GDP per capita and Financial Development Index in Ethiopia (1980–2021).

Source: Researchers' own illustrations.

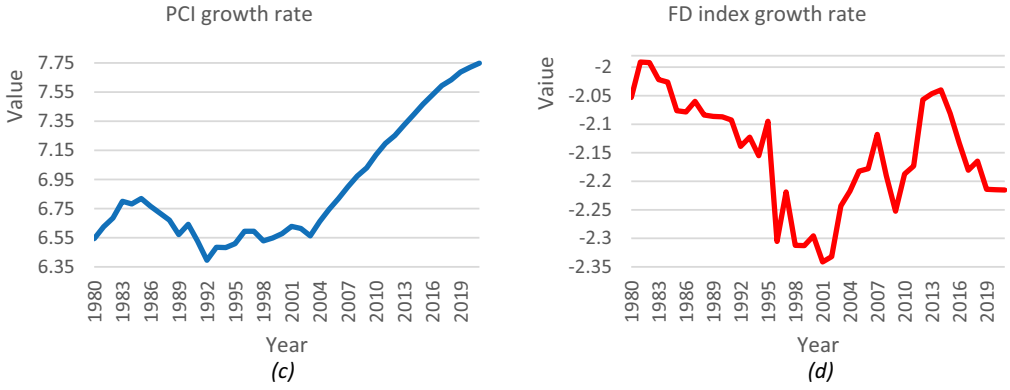

Figure 3. Trend Analysis of Financial Development Growth and Economic Growth in Ethiopia (1980–2021).

Source: Researchers' own illustrations.

from 1980 to 1991 (Collier, 1999) and the Ethiopia-Eritrea war between 1998 and 2000 (Lata, 2003). In addition, Figure 3c presents GDP trends that consistently increased from 2003 to 2021, albeit not at the same rate. This shows a country's resilience in absorbing the shocks of global and domestic crises, as the economy's performance is not severely affected.

Moreover, a stable negative rate of financial development (varying around −2.2%) was observed in Ethiopia during the study period as clearly shown in Figure 3d, indicating that the global economic situation did not significantly affect the sector. The reason for this might be that the financial system in Ethiopia is dominated by state-owned banks and relatively less integrated into the global economy, which might make it somewhat immune to some of the shocks and volatility experienced in other parts of the global financial system (Beck et al., 2014).

It can be seen from the graph that the trends in the growth of the financial development index and the economic growth curves do not show a positive correlation. However, correlation does not necessarily imply causation (Brooks, 2019), and we hypothesize that economic growth is influenced by financial development or vice versa.

4.2. Econometric analysis

4.2.1. Unit test results

In order to fully investigate the stationarity property of each variable and to identify the integration order, we first apply three conventional unit root tests. In this regard, the Augmented Dickey-Fuller test (Dickey & Fuller, 1981), the Philips-Perron test (Peter & Perron, 1988) and the Dickey-Fuller Generalized Least Squares (Elliott et al., 1992) were applied to all the variables of the study. As displayed in Tables 2-4, all the ADF, PP and ADF-GLS tests fail to reject the null hypothesis that all variables are nonstationary at level, with the exception of GDP growth, which is stationary at

Table 2. Augmented Dickey-Fuller (ADF) unit root tests

Variables	*Variables at their level form*				*Variables at their first difference*			
	IC (t-stat)	***P-value***	**IC + TD (t-stat)**	***P-value***	**IC (t-stat)**	***P-value***	**IC + TD (t-stat)**	***P-value***
GDP per capita	−2.032	0.273	−5.671	0.000***	−9.719	0.000***	−9.577	0.000***
Financial Development	−2.113	0.241	−2.151	0.502	−8.233	0.000***	−8.150	0.000***
Trade Openness	−1.266	0.636	−1.126	0.913	−7.328	0.000***	−7.295	0.000***
Human Capital	1.619	0.999	−2.096	0.532	−2.803	0.067*	−3.478	0.056*
Physical Capital	0.369	0.979	−2.559	0.299	−9.263	0.000***	−9.342	0.000***
Real Effective Exchange Rate	−1.217	0.658	−0.829	0.954	−4.949	0.000***	−5.016	0.001***

Source: Researchers' own computations.

Note: All the variables are expressed in growth terms.

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Table 3. Philips-Perron (PP) unit root test

Variables	*Variables at their level form*				*Variables at their first difference*			
	IC (t-stat)	***P-value***	**IC + TD (t-stat)**	***P-value***	**IC (t-stat)**	***P-value***	**IC + TD (t-stat)**	***P-value***
GDP per capita	−4.459	0.001***	−5.280	0.001***	−14.442	0.000***	−16.378	0.000***
Financial Development	−1.963	0.301	−2.124	0.517	−8.042	0.000***	−8.082	0.000***
Trade Openness	−1.257	0.639	−1.103	0.916	−7.263	0.000***	−7.233	0.000***
Human Capital	2.704	0.999	−1.989	0.589	−2.659	0.089*	−3.477	0.056*
Physical Capital	0.259	0.973	−2.973	0.152	−9.046	0.000***	−9.250	0.000***
Real Effective Exchange Rate	−1.316	0.613	−0.989	0.934	−4.959	0.000***	−4.925	0.002***

Source: Researchers' own computations.

Note: All the variables are expressed in growth terms.

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Table 4. ADF—GLS unit root tests

Variables	*Variables at their level form*				*Variables at their first difference*			
	IC (t-stat)	***P-value***	**IC + TD (t-stat)**	***P-value***	**IC (t-stat)**	***P-value***	**IC + TD (t-stat)**	***P-value***
GDP per capita	−1.792		−5.746		−9.859		−9.846	
Financial Development	−1.427		−2.0493		−8.339		−8.245	
Trade Openness	−1.267		−1.301		−7.296		−7.486	
Human Capital	−0.117		−1.361		−2.838		−3.559	
Physical Capital	0.876		−1.815		−9.340		−9.579	
Real Effective Exchange Rate	−1.055		−0.985		−4.878		−4.995	

Source: Researchers' own computations.

Note: 1. IC and TD represent intercept and trend, respectively.

2. ***, **, * show the significance at the 1%, 5%, and 10% levels, respectively.

3. All the variables are expressed in growth terms.

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level. However, once the first difference is taken, all variables become stationary, indicating that the integration order of the variables is unique, and this excludes any time series spurious relationships of unit root property.

We next use stationary variables to construct the Toda Yamamoto model to test causality and the NARDL model to examine asymmetric cointegration, non-linear relationships, and long- and short-run dynamics (Faisal et al., 2019).

4.2.2. The Toda-Yamamoto approach for causality analysis result

Once the cointegration relationship among the variables has been identified, the next step is to estimate the Toda and Yamamoto (1995) Granger noncausality test using the Wald test statistic, and the results are shown in Table 5. Based on the findings, the growth of financial development does not appear to be a Granger cause of economic growth, but the growth of human capital and trade openness are. Ethiopia has experienced significant economic growth in recent years, and human capital and trade openness are some of the factors that have contributed to this growth. The results also showed that the growth of GDP per capita, human capital and real effective exchange rate Granger cause of the growth of financial development in Ethiopia. Therefore, we conclude from the Toda-Yamamoto non-causality test results that economic growth is unidirectionally causal to financial development in Ethiopia in the sample period.

Table 5. Wald test statistic result

Dependent variable: Per capita GDP			**Dependent variable: financial development**		
Null hypothesis	$\chi^2(3)$	**Probability**	**Null hypothesis**	$\chi^2(3)$	**Probability**
Financial Development	1.784	0.618	GDP per capita	2.143	0.064*
Human Capital	10.650	0.014**	Human Capital	7.678	0.008*
Physical Capital	0.631	0.889	Physical Capital	4.056	0.256
Trade Openness	10.910	0.012**	Trade Openness	2.014	0.569
Real Effective Exchange Rate	0.406	0.939	Real Effective Exchange Rate	12.131	0.007***
Dependent variable: human capital			**Dependent variable: physical capital**		
GDP per capita	1.721	0.632	GDP per capita	9.456	0.023**
Financial Development	2.805	0.422	Financial Development	8.033	0.045**
Physical Capital	2.512	0.473	Human Capital	9.106	0.028**
Trade Openness	4.535	0.209	Trade Openness	7.283	0.063*
Real effective exchange rate	7.132	0.068*	Real effective exchange rate	12.58	0.006***
Dependent variable: trade openness			**Dependent variable: real effective exchange rate**		
GDP per capita	1.074	0.783	GDP per capita	13.606	0.004**
Financial Development	22.042	0.0001***	Financial Development	6.170	0.104
Human Capital	5.886	0.117	Human Capital	22.059	0.0001***
Physical Capital	9.538	0.023**	Physical Capital	13.067	0.005**
Real effective exchange rate	5.022	0.170**	Trade Openness	14.851	0.002**

Note: ***, **, * show the significance at the 1%, 5% and 10% levels, respectively.

All the variables are expressed in growth terms.

$$\begin{aligned} lnY = {} & c(1)*lnY_{t-1} + c(2)*lnY_{t-2} + c(3)*lnY_{t-3} + c(4)*lnFD_{t-1} + c(5)*lnFD_{t-2} \\ & + c(6)*lnFD_{t-3} + c(7)*lnHC_{t-1} + c(8)*lnHC_{t-2} + c(9)*lnHC_{t-3} + c(10)*lnK_{t-1} \\ & + c(11)*lnK_{t-2} + c(12)*lnK_{t-3} + c(13)*lnTO_{t-1} + c(14)*lnTO_{t-2} \\ & + c(15)*lnTO_{t-3} + c(16)*lnREER_{t-1} + c(17)*lnREER_{t-2} + c(18)*lnREER_{t-3} \end{aligned} \quad (8)$$

$$\begin{aligned} lnFD = {} & c(20)*lnY_{t-1} + c(21)*lnY_{t-2} + c(22)*lnY_{t-3} + c(23)*lnFD_{t-1} + c(24)*lnFD_{t-2} \\ & + c(25)*lnFD_{t-3} + c(26)*lnHC_{t-1} + c(27)*lnHC_{t-2} + c(28)*lnHC_{t-3} \\ & + c(29)*lnK_{t-1} + c(30)*lnK_{t-2} + c(31)*lnK_{t-3} + c(32)*lnTO_{t-1} \\ & + c(33)*lnTO_{t-2} + c(34)*lnTO_{t-3} + c(35)*lnREER_{t-1} + c(36)*lnREER_{t-2} \\ & + c(37)*lnREER_{t-3} + c(38) \end{aligned} \quad (9)$$

Overall, considering the findings of the study as shown in Table (5), unidirectional causality was observed from economic growth to physical capital, economic growth to real effective exchange rate, trade openness to economic growth, financial development to capital, financial development to trade openness, real effective exchange rate to financial development, human capital to economic growth and human capital to capital. On the other hand, capital and financial development, human capital and real effective exchange rate, capital and trade openness, real effective exchange rate and capital, and real effective exchange rate and trade openness showed bidirectional causality. Finally, no causality was observed between human capital and trade openness in Ethiopia during the sample period considered.

4.2.3. NARDL cointegration analysis test results

To estimate how changes in economic growth and other independent variables asymmetrically affect the growth of financial development in both the short and long run, the NARDL framework was used. The results of the NARDL model have been reported only for financial development as a dependent variable. This is because, as shown previously in the Toda Yamamoto model, unidirectional causality runs from economic growth to financial development and also to preserve space. The values of other variables can be obtained from the authors upon request. The NARDL model findings indicate that the variables have a long-run relationship in the presence of asymmetry, which reinforces the reliability of our estimations.

Table 6 shows how economic growth affects financial development in non-linear ways. Specifically, using the NARDL framework, we have identified both positive and negative long-term effects of economic growth on financial development. It can be seen from the table that economic growth has a significant effect on financial development in the long-run positive and negative effects, which is 1.113 and −1.386 respectively. The long run positive and negative effects of a 1% rise in the economy or a 1% drop will be 1.113% and rise or 1.386% drop in financial development, respectively. These effects have also been observed when both positive and negative shocks affect the variable simultaneously. In long-run asymmetric impacts, we read that both the one period lagged positive partial sum ($L_{lnYg^{+}_{t-1}}$) and the one period lagged negative partial sum ($L_{lnYg^{-}_{t-1}}$) changes in economic growth asymmetrically affect financial development. Therefore, the significant long-run coefficient by positive shock of economic growth ($L_{lnYg^{+}_{t-1}}$) which is 0.808 demonstrates that increasing economic growth by 1% increases financial development by 0.804%. In the same fashion, in the long run, negative partial shocks of economic growth are seen to decrease financial development by 1.241%. Exploring short-run results, an increase or a decrease in economic growth doesn't significantly influence financial development. In the short run, therefore, we observe no trade-off between economic growth and financial development.

Turning to specific insights in Table 7, we reject the null hypothesis of long-run symmetry for GDP per capita growth rate at 5% significance levels, and we also reject the joint symmetry test for GDP per capita growth rate at all reasonable significance levels, but we fail to reject the null hypothesis of short-run symmetry for GDP per capita growth rate at all reasonable significance levels.

Table 6. Full information estimates of the asymmetric effects of economic growth on financial development in Ethiopia with the NARDL approach

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
co-integrating (long-run) dynamics				
$lnFD_{t-1}$	0.137	0.288	0.475	.641
$lnHC_{t-1}$	−3.367	2.007	−1.678	.112
lnK_{t-1}	0.981	0.293	3.342	.004**
$lnTO_{t-1}$	−0.289	0.147	−1.970	.065*
LREER	−0.290	0.115	−2.515	.022**
$dlnY^{+}_{t-1}$	1.113	0.371	−2.998	.008***
$dlnY^{-}_{t-1}$	−1.386	0.374	3.703	.002***
C	−6.527	2.176	−3.000	.008***
Adjusting (short run) dynamics				
$dlnFD_{t-1}$	−0.708	0.252	−2.814	.012**
$dlnHC_{t}$	15.825	8.038	1.969	.066*
$dlnHC_{t-1}$	14.728	9.459	1.557	.138
$dlnK_{t}$	−0.008	0.304	−0.027	.979
$dlnK_{t-1}$	−0.364	0.216	−1.685	.110
$dlnTO_{t}$	−0.078	0.105	−0.739	.470
Asymmetric Long-Run Coefficients				
$L_{lnY^{+}_{t}}$	−0.053	0.412	−0.128	.890
$L_{lnY^{-}_{t}}$	−0.640	0.413	−1.550	.140
$L_{lnY^{+}_{t-1}}$	0.804	0.385	2.088	.052*
$L_{lnY^{-}_{t-1}}$	−1.241	0.392	−3.166	.006***
R-squared	0.756			
F-statistic	2.639			
Prob(F-statistic)	0.024**			

Note: ***, **, * show the significance at the 1%, 5%, and 10% levels, respectively.

The results of the Conditional Error Correction model summarized in Table 8 and the dynamic multiplier graph in Figure 4 confirm the existence of a co-integrating relationship between the growth of GDP per capita and financial development growth. In fact, this co-integrating relationship is itself significant as the *cointeq* coefficient in the error-correction regression is highly significant.

Cumulative dynamic multipliers allow us to study the evolution of adjustment patterns following negative and positive shocks to asymmetric regressors and quantify the path of asymmetry as they evolve towards their respective (cointegrating) equilibrium states. As shown by the asymmetry curve and its associated 95% confidence interval, as the zero line is not located between the lower and upper bands in Figure 4, the asymmetric effects of GDP per capita growth is significant. The graph validates the significant asymmetric response of the financial development to shocks in GDP per capita. These findings reveal that there is an overall positive relationship between financial development and GDP per capita in Ethiopia since the cumulative effects of a positive change in GDP dominate the cumulative effects of a negative change in GDP per capita.

Table 7. Coefficient-Symmetry Tests

Variable	GDP per capita growth rate					
	Long-run		Short run		Joint (Long-Run and Short-Run)	
Statistic	$F(1,17)$	$\chi^2(1)$	$F(1,22)$	$\chi^2(1)$	$F(1,17)$	$\chi^2(1)$
Value	6.605	6.605	0.856	0.856	6.648	6.296
Probability	0.017**	0.000**	0.368	0.355	0.007***	0.001***

Note: ***, **, * show the significance at the 1%, 5%, and 10% levels, respectively.

Table 8. Conditional Error Correction Results

Dependent Variable: First difference in the growth of financial development

Variable	Coefficient	Std. Error	t-Statistic	Prob.
cointeq*	−0.133	0.021	−6.283	.000***
$dlnFD_{t-1}$	−0.519	0.121	−4.278	.000***
$dlnHC_t$	7.305	4.494	1.626	.114
$dlnHC_{t-1}$	14.928	5.642	2.646	.013**
$dlnK_t$	−0.124	0.156	−0.793	.434
$dlnK_{t-1}$	−0.407	0.176	−2.310	.028**
$dlnTO_t$	0.006	0.061	0.103	.918
$dlnREER_t$	−0.040	0.060	−0.664	.512
$dlnREER_{t-1}$	−0.197	0.062	−3.158	.004**
R-squared	0.638			
F-statistic	6.841			
Prob(F-statistic)	0.000***			

Note: ***,**,* show the significance at the 1%, 5% and 10% levels, respectively.

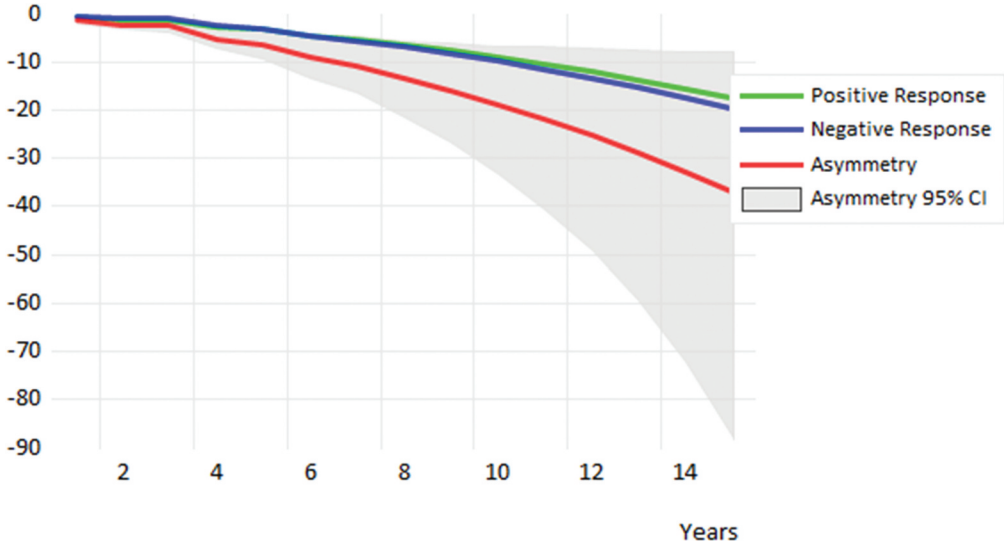

Figure 4. Cumulative Dynamic Multiplier Graph: The effect of GDP per capita growth on the growth of financial development index shock evolution.

Note: The horizontal axis shows years, and the vertical axis shows the magnitude of both kinds of shocks.

Table 9. FMOLS, DOLS, and CCR analysis

	Dependent variable: Economic Growth					
Explanatory Variables	**Fully Modified Least Squares (FMOLS)**		**Dynamic least squares (DOLS)**		**Canonical Cointegration Regression (CCR)**	
	t-statistics	p-value	t-statistics	p-value	t-statistics	p-value
Financial development	1.161	0.254	0.355	0.727	0.943	0.352
Human Capital	2.744	0.009***	1.584	0.131	2.676	0.011**
Physical Capital	−1.218	0.231	−0.908	0.376	−1.204	0.237
Trade Openness	1.661	0.106	2.169	0.044**	1.638	0.110
Real Effective Exchange Rate	5.539	0.000***	2.740	0.013**	5.210	0.000***
	Dependent variable: financial development					
Explanatory Variables	**Fully Modified Least Squares (FMOLS)**		**Dynamic least squares (DOLS)**		**Canonical Cointegration Regression (CCR)**	
	t-statistics	p-value	t-statistics	p-value	t-statistics	p-value
GDP per capita	2.657	0.045**	2.923	0.039**	2.483	0.032**
Human Capital	0.552	0.584	0.338	0.739	0.495	0.623
Physical Capital	0.698	0.490	0.853	0.406	0.431	0.668
Trade Openness	3.131	0.004***	2.695	0.015*	2.929	0.006
Real Effective Exchange Rate	2.045	0.045**	4.292	0.000***	1.757819	0.0875

Note: ***, **, * show the significance at the 1%, 5%, and 10% levels, respectively.

All the variables are expressed in growth terms.

In order to ensure the validity and robustness of the results produced through NARDL testing approach, three different techniques were used: FMOLS, DOLS, and CCR. As seen in Table 9, the results of FMOLS indicate that GDP growth has a positive and significant impact on financial development growth. The results of DOLS and CCR are not significantly different from those of FMOLS, supporting each other. Consequently, the results of three alternative approaches support the results obtained from the Toda Yamamoto and NARDL testing approaches.

Thus, regardless of estimation methods, economic growth leads to financial development, not the other way around. This could be attributed to a variety of factors, including the fact that the financial sector is still not fully integrated into the Ethiopian economy to the point where it can influence economic growth.

5. Discussion

For many years, the financial development—economic growth hypothesis has been a topic of sustained interest and controversy in the economic development literature. This study improves upon previous studies by proposing a theoretically reasonable multivariate time series approach to investigate the financial development—economic growth causal relationship in the Ethiopian context using annual time-series data from 1980 to 2021.

The research utilizes Toda-Yamamoto and Nonlinear Autoregressive Distributed Lag (NARDL) models to explore the cause-and-effect connections between financial development and economic growth in Ethiopia. According to the Toda-Yamamoto causality tests, there is noteworthy one-way causation from economic growth to financial development. To put it differently, the findings of the present study reinforce the proposition that economic growth drives financial development (demand-following hypothesis).

The findings of this study are in line with some previous studies while contradicting others. Our results are largely consistent with previous research, which has generally found a causal relationship that runs from economic growth to financial development not the other way around. For instance, our findings are consistent with the observation of Adeyeye et al. (2015), Akinci et al. (2014) and Haque et al. (2022) which predicted unidirectional causality running from economic growth to financial development. Additionally, our results are similar to Omoke (2009) who used data from Nigeria to demonstrate that economic growth precedes the development of the financial system.

However, the findings of this study contradict the findings of some other studies such Teklu and Jemal (2019), Durusu-Ciftci et al. (2017), Taddese Bekele and Abebaw Degu (2021), Bist and Read (2018), and Guru and Yadav (2019) which predict unidirectional causality running from financial development to economic growth. The results of this study also contradict the findings of Nyasha et al. (2016), Almassri et al. (2020), H. M. Nguyen et al. (2022), Abbas et al. (2022), Pradhan et al. (2017), Swamy and Dharani (2019), Vo et al. (2022), Saqib (2022), P. T. Nguyen and Pham (2021) and Manta et al. (2020) who found bidirectional causality between economic growth and financial sector development. The study also differed from Menyah et al. (2014), Nyasha et al. (2016), Opoku et al. (2019), Odhiambo and Nyasha (2022) and Okuyan (2022), who reported no causal relationship between financial development and economic growth.

Our study results are also in contrast with the research conducted by Moyo et al. (2018) in Brazil. They employed the Nonlinear Autoregressive Distributed Lag (NARDL) model to investigate the association between financial development and economic growth and reported that financial development had a significant and positive effect on economic growth, but the linkage between the two was nonlinear, which is similar to our findings. However, our findings do not support their claim of a significant positive impact of financial development on economic growth. The results of this study also somehow contradict those of Nyasha et al. (2016) who found that both financial development and economic growth Granger cause each other in the short run and that a one-way causal relationship from financial development to economic growth in the long run in Ethiopia from 1980 to 2014.

The findings from the nonlinear autoregressive distributive lag (NARDL) model reinforce the proposition that economic growth drives financial development. However, our findings also offer some unique insights into this relationship. Specifically, we find that the relationship between financial development and economic growth is not linear (asymmetrical) in the context of Ethiopia. The results of the model further indicate that economic growth had non-linear (asymmetrical) impacts on financial development in Ethiopia. The model suggests that positive changes in economic growth had more favourable effects on financial development, especially in the long run, as opposed to their negative effects in Ethiopia.

Joint positive shocks to economic growth also had a positive impact on financial development. Our findings partially support the idea put forth by the NARDL model that a negative shock will probably have a greater short run impact, while a positive shock is more likely to have a greater long-run effect (Udeagha & Breitenbach, 2023). These asymmetrical effects might be caused by the macroeconomic environment and inefficient financial management.

The study findings differ from those of Teklu and Jemal (2019), who used annual data from 1975 to 2016 to assess the nexus between financial development and economic growth in Ethiopia using multiple econometric regression protocols. According to their study, financial development leads to economic growth unidirectionally in both the short and long runs, leaving the issue unresolved. Various factors may have contributed to the variation in the results, such as the inclusion of additional macroeconomic variables; the use of a relatively recent sample period; and a different methodology.

Overall, our study adds to the ongoing debate on the relationship between financial development and economic growth in developing countries. Our findings confirm some previous research but contradict others, indicating that the relationship between economic growth and financial development may not be universal and may depend on various contextual factors. Although economic growth can have a positive impact on financial development, policymakers in developing countries should consider the specific context of their country when formulating policies to promote economic growth as a means of stimulating financial development.

6. Conclusions and policy implications

Based on the results of our study, one may conclude that financial development does not matter for economic growth. However, it may be more reasonable to conclude that financial development will not guarantee economic growth without building better institutions and following sound and stable fiscal policies (R. Levine, 1997). The implications of these findings for government policymakers in Ethiopia revolve around the necessity of constructing an effective economic growth strategy that maintains financial development. Besides, contrary to the primary drivers of financial development in developed countries, which are often technological innovation and market competition, the situation in developing countries like Ethiopia requires a different approach. Researchers suggest that policymakers in Ethiopia should initiate specific projects that have a direct impact on and facilitate the advancement of the economy, thus expediting the progress of financial development (Song et al., 2021).

Therefore, the study's results emphasize the need for policymakers in Ethiopia to prioritize policies aimed at promoting economic growth. By prioritizing economic growth, policymakers can stimulate financial development, indicating the importance of creating an environment that fosters economic growth as a means of promoting financial development.

7. Limitations and future research directions

Although this study is the first study to use asymmetric cointegration to examine the nexus between broad-based financial development and economic growth in Ethiopia, it has some limitations that need to be considered. First, the study focuses solely on investigating the causal link between economic growth and financial development in Ethiopia, which makes it difficult to generalize the results to other developing countries. As such, future studies should extend the analysis to other developing countries to provide insights into whether the findings in Ethiopia are generalizable to other countries and to highlight any differences or similarities in the relationship between economic growth and financial development across diverse contexts. Second, the study has a small sample size of around 40 data points in total, which may not be adequate for conducting rigorous time series econometric analyses. In addition, the short period data used in the study may not allow for a thorough investigation of the potential long lags in financial development that may have a significant impact on PCI growth. While the small sample size is an understandable limitation given the specific context of the research, future researchers in similar situations may consider using cross-country time series panel datasets or large cross-sectional datasets to enhance the reliability and robustness of their findings.

Third, the association between economic growth and financial development is intricate and influenced by a range of factors (Nyasha & Odhiambo, 2018). However, the study does not consider additional drivers of PCI growth such as innovation intensity, product and labor market regulations,

and institutions due to the unavailability of reliable data in Ethiopia. Future research on this topic could consider examining these and related issues thoroughly to gain a deeper understanding of the relationship between economic growth and financial development in developing countries and to enhance the reliability and robustness of the findings. Future research should also focus on investigating the specific channels through which economic growth affects financial development in Ethiopia, to provide a more comprehensive understanding of the relationship between the two variables and identify areas for further policy intervention.

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Disclosure statement
No potential conflict of interest was reported by the author(s).

Data availability statement
The data sets used in this study can be found in the World Bank open database (data.worldbank.org), the IMF's financial development index database (data.imf.org), the FRED economic data (fred.stlouisfed.org), the Bruegel dataset (www.bruegel.org), and the Penn World Table (Feenstra et al., 2015).

Ethical Considerations
The ethical responsibility for the data lies with the institutions that conducted the surveys in Ethiopia, and we did not need ethics approval for our study.

Correction
This article has been corrected with minor changes. These changes do not impact the academic content of the article.

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Appendix

Table A1. The expanded versions of the acronyms used in the paper

Acronyms	Expanded form
ARDL	Autoregressive Distributed Lag
CCR	Canonical Cointegration Regression
DOLS	Dynamic least squares
FMOLS	Fully Modified Least Squares
FRED	Federal Reserve Economic Data
GDP	Gross Domestic Product
IMF	International Monetary Fund
NARDL	Nonlinear Autoregressive Distributed Lag
PCI	Per Capita Income
PPP	Purchasing power parity
PWT	Penn World Table
SDGs	Sustainable Development Goals
TY	Toda-Yamamoto
WB	World Bank
UN	United Nations