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Financial development and economic growth: Evidence from a panel of 16 African and non-African low-income countries

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Abstract: This paper aims to investigate the long-run relationship between financial development and economic growth using panel unit root and panel cointegration analysis in 16 selected low-income countries for the period of 20 years from 1995 to 2014. The long-run relationship has been estimated using fully modified and dynamic OLS techniques. The results show that there exists a cross-sectional dependence across the countries. The Pedroni's panel cointegration analysis provides clear support for the hypothesis that there exists a long-run cointegrating relationship between financial development and economic growth. The long-run panel estimates indicate that financial development has a positive and significant impact on economic growth. For the robustness of the results, this paper has also performed time-series analysis on a single country basis. The results also show the positive impact of financial development on economic growth in the majority of the countries. Likewise, it is found that flow of credit to the private sector is very low in this region of the world. Thus, one of the important policy implications of this study finding is that policy-makers should give more emphasis on the policies that provide a favourable environment for private sector to grow.



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Jagadish Prasad Bist has received a master's degree in Business Administration (MBA) with Finance as his specialization from the Pokhara University, Nepal. Mr Bist was also awarded a full scholarship for the degree of MBA from Pokhara University. His research interest lies in economics and finance. Currently, he is working at Uniglobe College affiliated to Pokhara University as a full-time faculty. Mr Bist has also published some of his research articles in peer-reviewed international Journals. He has also participated in some of the international conferences (like 4th Pan IIM World Management Conference organized by Indian Institute of Management Ahmedabad) as a presenter of the research paper. Mr Bist has also received a certificate of best research paper award at an international conference organized by Tribhuvan University, Nepal.

PUBLIC INTEREST STATEMENT

Although the development of financial system is important for economic growth, it is still underdeveloped in economically backward countries, the low-income countries (LICs). Low-income countries are characterized by poor financial policies in terms of both the formulation and implementation. Therefore, this study tries to analyse the relationship between financial development (in terms of banking sector development) and economic growth in 16 low-income countries. The study's findings indicate that there is a long-run positive relationship between financial development and economic growth. The results of panel causality also show that growth creates demand for financial development to be developed in short run. The data also show that flow of credit to the private sector is very low in LICs. Therefore, the policymakers should focus on formulating the policies that provide a favourable environment for private sector to grow.

Subjects: Economics and Development; International Economics; Banking

Keywords: financial development; economic growth; cross-sectional dependence; panel unit root; panel cointegration; low-income countries

JEL classifications: C23; O16; O40

1. Introduction

A well-functioning financial system is considered as one of the key foundations on which sustained economic development can be built (Demirguc-Kunt, 2006). However, there is no consensus on the relationship between financial development and economic growth. One of the highly debated issues in the literature of financial economics is the finance-growth nexus. Initially, there were two major schools of thoughts. The advocates of the first school of thoughts argued that financial development is indispensable for economic growth (Goldsmith, 1969; Levine, 1997; McKinnon, 1973; and Schumpeter, 1911). In fact, finance affects growth by influencing the saving, investment and technological innovations (Demirguc-Kunt, 2006). However, the advocates of the second school of thoughts, the Neoclassical theorists, argued that finance is not a primary source of growth (Lucas, 1988). According to Lucas (1988), the relationship between financial development and economic growth has long been overstressed in the literature (Christopoulos & Tsionas, 2004). In line with this, Singh (1997), Andersen and Tarp (2003), Ayadi, Arbak, Naceur, and De Groen (2015), and Ductor and Grechyna (2015) provided some arguments and evidence for an inverse relationship between financial sector development and the economic growth. Yet, in the recent past, a number of studies have agreed that financial sector development has positive effect on growth (Beck, Levine, & Loayza, 2000; Christopoulos & Tsionas, 2004; Durusu-Ciftci, Ispir, & Yetkiner, 2017; Herwartz & Walle, 2014; Jedidia, Boujelbène, & Helali, 2014; Khan & Senhadji, 2000; King & Levine, 1993a, 1993b; Levine, 1997; Levine, Loayza, & Beck, 2000; Muhammad, Islam, & Marashdeh, 2016; Pradhan, Arvin, Hall, & Nair, 2016; Samargandi, Fidrmuc, & Ghosh, 2014; Uddin, Sjö, & Shahbaz, 2013; Zhang, Wang, & Wang, 2012).

According to King and Levine (1993a), financial development stimulates economic growth by increasing the rate of capital accumulation. King and Levine (1993b) proposed four ways that development of financial sector affects growth. They are: financial system fosters productivity improvement by choosing higher quality entrepreneurs and projects, mobilizing external financing for these entrepreneurs, providing superior vehicles for diversifying the risk of innovative activities and revealing more accurately the potentially large profits associated with the uncertain business of innovation. Beck et al. (2000) concluded that financial intermediaries exert a large positive impact on the total factor productivity growth, which feeds through to overall GDP growth. The endogenous growth model also argued that financial intermediaries affect growth by altering the savings (Bencivenga & Smith, 1991; Levine, 1997; Pagano, 1993). However, Jayaratne and Strahan (1996) found no evidence to support the view that financial markets increase economic growth by increasing overall saving and investment.

In line with this, Gerschenkron (1962) forwarded the view that contribution of financial development on economic growth depends on the economic backwardness of an economy. He argued that economically backward countries need a more active financial system, whereas countries that are developed do not need an active financial system. Yet, despite the importance of a developed financial system for economic growth, economically backward countries, the low-income countries (LIC), remain financially underdeveloped.¹ Detragiache, Gupta, and Tressel (2005) argued that political instability and corruption are the major factors behind the poor financial system in LICs. Therefore, they further argued that efforts to strengthening the prudential regulation and supervision may not expect to yield an immediate benefit as LICs are characterised weak in policy implementation.

The current study also shows that credit to the private sector in selected 16 low-income countries is considerably low. According to Papadavid, Rewilak, and Brighty (2017), “banks continue to lend little domestically and access to commercial finance, via bank deposits, remains low in the majority of low income sub-Saharan African countries”. Therefore, it needs to probe the effect of financial development, even if poor, on the economic growth in low-income countries. Some studies as such, by all means, have tried to analyze this relationship. However, there still exists a considerable amount of gap regarding finance-growth nexus in LICs in terms of econometric techniques, methodological issues or the data properties. The literature shows that studies on finance-growth nexus in LICs are based on the econometric techniques for time series data or the pooled cross-sectional data. The problem with the studies on times series techniques (Agbetsiafa, 2004; Atindéhou, Gueyie, & Amenounve, 2005; Ghirmay, 2004; Odhiambo, 2005, 2007) is the unavailability of large time series, which may distort the validity of the estimates (Christopoulos & Tsionas, 2004). It is also important to note that studies that have analyzed this relationship in a panel data setting (Abu-Bader & Abu-Qarn, 2006; Acaravci, Ozturk, & Acaravci, 2009; Ahmed & Wahid, 2011; Akinlo & Egbetunde, 2010; Demetriades & James, 2011; Fowowe, 2011; Hassan, Sanchez, & Yu, 2011; Jalilian & Kirkpatrick, 2002; Khalifa Al-Yousif, 2002; Menyah, Nazlioglu, & Wolde-Rufael, 2014; Rioja & Valev, 2004; Yu, Hassan, & Sanchez, 2012) are also subject to a number of concerns.

There are two groups of studies applying panel data analysis technique in LICs. The first group consists of studies pooling data from LICs, middle-income countries or high-income countries together. A large amount of heterogeneity amongst these countries may not provide a clear picture for LICs. Similarly, though another group of studies have analyzed this relationship by pooling data only from low-income countries, they make no attempt to address the issue of cross-sectional dependence. Pesaran (2007) argued that first generation unit root tests like Im, Pesaran, and Shin (1997) and Maddala and Wu (1999) (the highly used techniques in these studies) are sensitive to the power of test in the presence of cross-sectional dependence. One study as such by Menyah et al. (2014) on African countries has taken the issue of cross-sectional dependence to solve the causality nexus. However, their study was particularly limited to the causality nexus; they made no attempt to analyze the cointegrating long-run relationship between financial development and economic growth.

Similarly, another key issue with these studies is the estimation technique used for long-run cointegrating equations. Christopoulos and Tsionas (2004) interrogated the validity of estimates of Generalized Method of Moment (GMM) as GMM does not take integration and cointegration phenomenon into the account. Therefore, studies using estimation techniques like GMM, Fixed effect or Random effect methods are suspicious to generalize the estimated long-run relationship. Therefore, this study takes these issues to be of great importance and contributes to the literature by providing recent evidence on finance-growth nexus in LICs. More specifically, the contributions of this study are presented in following ways:

- (1) Unlike other studies, either grouping LICs along with developed or middle-income countries or analyzing a small sample of individual countries, this study pooled available data of 16 low-income countries for a quite long period, beginning from 1995 to 2014 to analyze the relationship between financial development and economic growth.
- (2) Current study tries to use obtained data in a most efficient way to produce valid results using second generation panel unit root test on the heterogeneous panels with cross-sectional dependence. To the best of author’s knowledge, there is no attempt to incorporate the hypothesis of cross-sectional dependence in the literature of finance-growth relationship in low-income countries while analysing the integration properties of the data. The use of second generation panel unit root test is necessary because one of the serious assumptions of first generation panel unit root tests is the assumption of cross-sectional independence.

- (3) The long-run panel cointegration test and short-run heterogeneous panel Granger causality test are performed in a sufficient panel of LICs, which is also absent in most of the earlier studies in LICs.
- (4) The cointegrating vectors are estimated using the fully modified OLS (FMOLS) and Dynamic OLS (DOLS) for heterogeneous cointegrated panels because these techniques deal with endogeneity and also take the time series property of the data in that integration and cointegration properties are explicitly taken into account (Christopoulos & Tsionas, 2004).

Therefore, one objective of this study is also to test whether the relationship between financial development and economic growth depends on the methodology applied.

The rest of the paper is organized as follows: Section two consists of a brief review of earlier studies on the finance-growth nexus. Section three describes data, model, variables and descriptive statistics. The data analysis techniques are discussed in the fourth section. The empirical results are presented in the fifth section and the conclusions and implications of the study findings are drawn in the final section.

2. Review of literature

Debate on finance-growth nexus has started since Schumpeter (1911) forwarded the view of the importance of financial sector development for economic growth. Schumpeter argued that development of the financial sector is essential for economic growth. It contributes to the economic growth through technological innovations. His argument is that financial development affects economic growth by providing sufficient fund to the firms that have a best productive use. Later on, Goldsmith (1969), McKinnon (1973) and Shaw (1973) supported this view. Gurley and Shaw (1955), refuting the argument of Neoclassical theorists that importance of financial sector is overstressed by the economists, highlighted the importance of finance for growth. Similarly, on the relationship between finance and growth, Patrick (1966) proposed two important hypotheses; (1) the supply leading hypothesis and (2) the demand following hypothesis. Patrick's argument is that in the early stage of the country's economic development, the financial system leads economic growth. Whereas, as the country advances toward becoming a developed nation, the growth creates demand for the financial sector to be developed. The theoretical debate on finance-growth nexus further been supported by Levine (1997) arguing finance as the lubricant of the main engine of economic growth.

On the empirical side, the literature on finance-growth relationship could be divided into three categories, cross-sectional, panel and time series studies. Most of the studies on cross-sectional and panel data have accounted the positive relationship between financial development and economic growth. Goldsmith (1969) for the first time using an annual data-set of 35 countries over the period 1860 to 1963 documented a positive correlation between financial development and GDP per capita. De Gregorio and Guidotti (1995) using cross-country data found that financial development, proxied by bank credit to the private sector to GDP, is positively correlated to growth. However, they have found a negative relationship in a panel data for Latin America. They have argued that financial liberalization in a poor regulatory environment is the reason for this negative relationship. King and Levine (1993a) using a data-set of 80 countries over the period of 1960–1989 found that financial development is strongly associated with real per capita GDP growth, with the rate of physical capital accumulation, and with the improvements in efficiency with which economies employ physical capital. A similar result is also accounted by Rajan and Zingales (1996), who concluded that financial markets provide important services for growth. Similarly, Khan and Senhadji (2000) provided empirical evidence on the relationship between financial development and economic growth using a cross-section of 159 countries (comprising both industrial and developing countries) for the period of 1960 to 1999. The growth equation has been estimated using both pure cross-section sample (by averaging along the time dimension) and five-year average panels (obtained by taking a five-year average of the original data). They concluded that the effect of financial development on growth is

positive, the size of the effect varies with different indicators of financial development, estimation method, data frequency and the functional form of relationship.

A pioneer work on financial development and economic growth by Beck et al. (2000) concluded that there is an economically large and statistically significant relationship between financial intermediary development and both real per capita GDP growth and total factor productivity growth. They used cross-country data averaged over the period 1960 to 1995. Using GMM technique to account the problem of possible endogeneity of the regressors, they further concluded that better functioning financial intermediaries improve resource allocation and accelerate total factor productivity growth with positive repercussions for long-run economic growth. Likewise, using the same technique of data analysis, Levine et al. (2000) found that the exogenous component of financial intermediary development is positively associated with economic growth. They also concluded that cross-country differences in legal and accounting systems help account for differences in financial development. However, Christopoulos and Tsionas (2004) challenged the findings of Beck et al. (2000) and Levine et al. (2000) by raising the issue on used GMM technique. They stated that “in this approach, the integration and cointegration properties of the data are ignored. Thus, it is not clear that the estimated panel models represent a structural long-run equilibrium relationship instead of a spurious one” (p. 60).

Considering the integration and cointegration phenomenon, an inspiring paper by Christopoulos and Tsionas (2004) investigated long-run relationship between financial depth and economic growth, taking the data from 10 developing countries. They analyzed data using panel unit root and panel cointegration techniques. They have also taken threshold effects into the account. They concluded that there is a long-run relationship between financial development and economic growth in 10 developing countries. Similarly, Christopoulos and Tsionas (2004) found that there exists a unidirectional long-run causality between financial development and economic growth and that runs from finance to growth. However, they do not take the problem of cross-sectional dependency into the account. Similarly, Bojanic (2012), Uddin et al. (2013), Jedidia et al. (2014), and Samargandi et al. (2014) using time-series techniques for data analysis have also found a positive impact of financial development on economic growth.

Though there are some arguments on the relationship between financial development and economic growth, the majority of the recent studies have not ignored the importance of financial sector development on the growth of an economy. A study on the finance-growth relationship by Zhang et al. (2012) found that financial development is positively related to economic growth in China. Herwartz and Walle (2014), using annual data for 73 economies spanning the period 1975–2011, concluded that impact of finance on economic development is generally stronger in high-income economies than in low-income economies. In line with this, a more recent study by Pradhan, Arvin, Bahmani, Hall, and Norman (2017) used four different proxies of financial development (banking sector development, bond market development, stock market development, and insurance sector development) to examine the finance-growth relationships in ASEAN region for the period of 1991–2011. Their results show that banking sector development, stock market development, bond market development, insurance market development, and per capita economic growth shared a cointegrating relationship in long-run. However, in the case of causality, their results are sensitive to the use of financial development proxy. They accounted a unidirectional causality from banking sector development to economic growth and a bi-directional causality between stock market development and economic growth, and insurance sector development and economic growth.

In the context of low-income countries, using both simple and unidirectional concepts of causality, Jung (1986) found that supply leading causality is more frequent. Ghirmay (2004) analyzed the causal link between financial development and economic growth in 13 sub-Saharan African countries. Using Johansen’s cointegration test, they found a cointegrating relationship between financial development and economic growth. Regarding the causality, the study findings are sensitive to the individual country. However, Menyah et al. (2014) using a data-set of 21 African countries do not

find strong support for finance-led- growth evidence. Hassan et al. (2011) provided empirical results on the finance-growth relationship in Low and Middle-income countries. Their results show a positive relationship between financial development and economic growth in developing countries. The results show a two-way causality relationship between finance and growth for most of the regions and one-way causality from growth to finance for the two poorest regions. Andersen and Tarp (2003) using a data-set of least developed countries (LDCs) on financial liberalization, financial development and economic growth, concluded as “we agree that a well-functioning financial system can play a vital role in the process of economic growth; we fully recognize that government involvement in the financial sector has had huge negative implications; and we believe that deregulation of the financial sector should be approached somewhere down the line”.

There is another pool of studies that have either accounted negative or no relationship between financial development and economic growth. Singh (1997), Narayan and Narayan (2013) in 65 developing countries, Ayadi et al. (2015) in northern and southern Mediterranean countries, Ductor and Grechyna (2015) in 101 developed and developing countries, Grassa and Gazdar (2014) in five GCC countries, and Mhadhbi (2014) in the case of developed countries have found weak relationship between financial development and economic growth.

The extant literature also shows that some of the recent studies have raised the issue of threshold or non-linearity on the finance-growth nexus. This view argued that the level of financial development is beneficial for economic growth up to a certain threshold. Once the development of financial sector reaches that threshold, further development of finance leads to declining economic growth. Law and Singh (2014), using the data of 87 developed and developing countries, concluded that more finance is not necessarily good for economic growth. A similar study by Samargandi, Fidrmuc, and Ghosh (2015), using threshold effect, analyzed finance-growth nexus in a panel of 52 middle-income countries over the period 1980–2008. They found an inverted U-shaped relationship between finance and growth in the long run. In line with this, Arcand, Berkes, and Panizza (2015) and Rousseau and Wachtel (2011) found vanishing effect of financial development on economic growth. According to Arcand et al. (2015), finance starts having a negative effect on output growth when credit to the private sector reaches a threshold. Deidda and Fattouh (2002) using threshold regressions model found that financial development has a more significant effect on economic growth in high-income countries in comparison with low-income countries. A more recent study by Demetriades and Rousseau (2016) on the non-monotonic relationship between financial development and economic growth concluded that financial depth is no longer a significant determinant of long-run growth. They further argued that finance growth-nexus is influenced by bank regulation and supervision. To this end, it is important to note that higher level of development of financial sector may not always be beneficial for economic growth. However, one common issue with these papers on the non-monotonic relationship between financial development and economic growth is that they are conducted on highly heterogeneous panels (including higher, lower, middle or low-income countries). Similarly, the current study shows that development of the financial sector is very poor in selected low-income countries (i.e. average flow of credit to the private sector is only about 13.524% of the GDP). Arcand et al. (2015) found that there is a threshold once credit to the private sector reaches 80–100% of GDP. Therefore, the issue of the threshold is not considered as a critical issue in the current study.

3. Data, model, variables and descriptive statistics

The primary focus of this study is to provide evidence for the relationship between the development of the financial sector and economic growth in low-income countries. For which, this study purposed a simple linear regression model. On the basis of an extensive review of the literature, this study further used capital formation, trade openness, inflation, and the labour force as the control variables. Therefore, the model takes the following form:

$$\text{LGDP}_{it} = \beta_{0i} + \beta_{1i}\text{PRVT}_{it} + \beta_{2i}\text{GFC}_{it} + \beta_{3i}\text{OPE}_{it} + \beta_{4i}\text{CPI}_{it} + \beta_{5i}\text{LF}_{it} + \mu_{it}$$

where subscripts i and t are the representatives of country and time period, respectively. LGDP is the economic growth defined as log of real gross domestic product (GDP) in 2010 constant US dollar. Credit to the private sector (PRVT) is the proxy for development of the financial sector and measured as the ratio of GDP. GFC is the ratio of the gross fixed capital formation to GDP, OPE represents trade openness and defined as imports plus exports to GDP ratio, CPI is the consumer price index used to account for the inflation, and LF is the labour force. The model assumes heterogeneity amongst the countries. Thus, this study allowed individual intercepts and slope coefficients across countries. β_{0i} is the country-specific fixed effect and β_{1i} , β_{2i} , β_{3i} , β_{4i} and β_{5i} are the country-specific long-run coefficients of private credit, gross fixed capital formation, trade openness, consumer price index, and labour force, respectively. The μ_{it} is the error term.

This study includes a group of 16 low-income countries (15 low-income African countries and one non-African low-income country) classified by the World Bank. The data have been extracted from the World Development Indicators of the World Bank for the period of 20 years beginning from 1995 to 2014. The selection of the countries and the study time period is restricted to the availability of the data. The countries that are selected in this study are Benin, Burkina Faso, Burundi, Central African Republic, Chad, Guinea-Bissau, Madagascar, Malawi, Mali, Mozambique, Nepal, Niger, Senegal, Tanzania, Togo and Uganda.

To measure the development of the financial sector in an economy, a number of indicators have been proposed in the literature.² Initially, the measures were limited to the monetary aggregates like M1 and M2. However, these measures are more related to the ability of the financial system to provide transaction services than its ability to channel the fund from savers to borrowers (Khan & Senhadji, 2000). Similarly, other variables that are most frequently used in the literature are deposit liabilities (Christopoulos & Tsionas, 2004), liquid liabilities (King & Levine, 1993a) and credit to private sector (Beck et al., 2000 and Levine et al., 2000). Likewise, studies have also used stock market development as the indicator of financial sector development. Thus, the selection of variables is related to the countries financial system, depending on whether the country features a financial system oriented on banks or on the stock market. Since the stock market in low-income countries is underdeveloped, an indicator of stock market development for financial development is not used in this study. Following Beck et al. (2000), this study used credit issued by banking and financial institutions to the private sector as the proxy for financial development. The private credit stands for the value of credits by banks to the private sector divided by GDP. Beck et al. (2000) argued that credit to the private sector is the most appropriate measure of financial development amongst the used variables in the literature. They argued that private credit isolates credit issued to the private sector, as opposed to credit issued to governments, government agencies and public enterprises. Credit to the private sector has also been used by a number of studies as a proxy for financial development (Beck et al., 2000; Khan & Senhadji, 2000; King & Levine, 1993a, 1993b; and Levine et al., 2000).

This study has further used macroeconomic variables: trade openness as import plus export to GDP, gross fixed capital formation as a percentage of GDP, labour force defined as the percentage of the economically active population (ages 15 and older) to the total population, and inflation in terms of consumer price index to control the finance-growth relationship. The trade openness measured by imports plus exports to GDP presents the actual status of economic activities within a country. Trade grants a country access to the advancements in technological knowledge of its trade partners. Yanikkaya (2003) argued that trade grants developing countries access to investment and intermediate goods that are vital to their development processes. Similarly, inflation, on the other hand, does not only affect growth, but it also affects the financial activities of the country by affecting the interest rates, which has a direct effect on deposit collection and mobilization activities of banking and financial institutions. Likewise, capital and labour are the two important pillars of every theory of economic development. Capital stock has a positive effect on economic growth, both in Cobb-Douglas production function and in other various models (Narayan & Narayan, 2013). Likewise, a country's overall development depends on its labour force. These variables have also been used extensively in the literature to control the finance-growth relationship [see: inflation (Beck et al.,

2000; Christopoulos & Tsionas, 2004; and Levine et al., 2000), trade openness (Menyah et al., 2014; Salahuddin & Gow, 2016; and Samargandi et al., 2014), and gross capital formation (Narayan & Narayan, 2013)].

Table 1 presents the descriptive statistics of the variables used in this study.

Table 1 shows that variation does not exist on a large scale amongst the sample countries. However, it is enough to differentiate one country’s development process with another in a considerable manner. It is observed that when average real GDP is only about USD 0.762 billion for Guinea-Bissau, the average real GDP is about USD 22.512 billion for Tanzania. It indicates that Tanzania has the largest economy amongst sample countries. However, in the case of development of the banking sector in terms of the flow of credit to the private sector, Nepal stands significantly at the top. Data show that average flow of credit to the private sector is about 37% of GDP for **Nepal** followed by **Senegal** with about 22% of GDP. The table shows that average credit to the private sector is about 13% of GDP for selected 16 low-income countries. This indicates that flow of credit as a percentage of GDP is very low in LICs. It is also important to note that, out of the 16 selected low-income countries, average credit to the private sector is below the sample average for 8 countries (50% of the total sample). The countries below the average are Madagascar (10.17%), Uganda (9.297%), Tanzania (8.393%), Niger (8.040%), Central African Republic (7.36%), Malawi (7.294%), Guinea-Bissau (5.541%) and Chad (3.986%). It shows that **Chad** has the lowest average credit to the private sector as a ratio of GDP with 3.986%. This indicates the urgency in the formulation of policies that enhance the flow of credit to the private sector.

In the case of trade openness, data show that Togo, which has the real GDP (USD 2.804 billion) below the sample average, has the highest volume of international trade amongst the sample

Table 1. Descriptive statistics

Countries	LGDP	PRVT	OPE	GFC	LF	CPI
Benin	5.663	14.825	57.503	21.717	73.390	85.291
Burkina Faso	6.443	15.342	41.950	22.470	85.140	87.278
Burundi	1.729	15.626	36.014	16.193	84.545	68.397
Central African Republic	1.667	7.364	39.327	10.789	78.700	87.004
Chad	6.563	3.986	74.620	26.741	72.045	86.750
Guinea-Bissau	0.762	5.541	49.258	9.074	73.050	83.994
Madagascar	7.481	10.166	65.363	19.771	88.665	66.822
Malawi	5.211	7.294	60.522	14.179	80.750	70.246
Mali	6.789	15.337	56.107	19.210	58.165	88.248
Mozambique	6.676	15.380	72.930	19.320	85.045	66.444
Nepal	12.765	37.487	49.922	21.015	86.945	75.105
Niger	4.575	8.040	50.431	21.715	64.230	87.751
Senegal	10.324	21.891	68.270	23.279	77.405	90.806
Tanzania	22.512	8.393	45.525	24.029	90.510	75.495
Togo	2.804	20.414	89.796	16.667	80.825	85.913
Uganda	13.733	9.297	41.347	21.612	80.480	78.127
Average	7.231	13.524	56.180	19.236	78.743	80.230
Standard deviation	5.501	8.266	14.941	4.786	8.838	8.585

Notes: This table presents a 20-year average of all the variables used in this study. GDP is the real GDP measured in 2010 with the US dollar in billion, OPE is traded openness defined as import plus export to GDP ratio, PRVT is the credit to private sector by banks to GDP ratio, GFC is the gross fixed capital formation as percentage of GDP, LF is the labour force defined as percentage of economically active population (ages 15 and older) to the total population, and CPI is the consumer price index to account the inflation.

countries. It indicates that economy of Togo is not benefited from international trade. However, Burundi has the smallest volume of international trade throughout the study period. Similarly, data show that average gross capital formation as a percentage of GDP is lowest for Guinea-Bissau (9.07%), which also has the smallest volume of GDP amongst the sample countries. The gross fixed capital formation is highest for Tanzania (24.029%). The labour force defined as the percentage of the economically active population (ages 15 and older) to the total population is also highest for Tanzania. On an average, 90% of the total population of Tanzania is actively participating in the labour force. However, Mali has the least percentage of the economically active population (58%). This shows that, though the development of banking sector is below the industry average in Tanzania, the capital formation and over 90% of the economically active population is a significant part of economic growth. It is observed that, on an average, 79% of the total population is actively participating in economic activities in low-income countries.

4. Data analysis techniques

The data analysis procedures involve a total of following four steps: checking the level of integration of the variables, testing for the long-run cointegrating relationship amongst the variables, estimating long-run cointegrating parameters and finally testing for the short run causality between financial development and economic growth.

4.1. Testing for integration

Since this study seeks to analyze the long-run cointegrating relationship between financial development and economic growth, it is important to verify that all the variables are integrated at least of order one in level. It is because most of the cointegration techniques in panel data require variables to be integrated at least of order one³ i.e. $I(1)$. Therefore, it is required to apply panel unit root test on the variables before going for further analysis. The literature shows that Im et al. (1997) and Maddala and Wu (1999) panel unit root tests are the majorly used unit root tests in a set of heterogeneous panels. However, these tests for a unit root in panel data do not address the issue of cross-sectional dependence, though they allow for individual unit root process in a panel (Pesaran, 2007). So, it is important to test for cross-sectional dependence before performing the first-generation unit root tests like Im et al. (1997) and Maddala and Wu (1999). To this end, this study used a second-generation panel unit root test, cross-sectional augmented IPS (CIPS) test, by Pesaran (2007) to address the cross-sectional dependence.

4.2. Testing for cointegration and estimating the long-run relationship

Once the order of integration is determined within the variables, the next step is to perform the cointegration test amongst financial development, economic growth, and control variables. Taking into consideration the panel data and the time period of the study, this study used panel cointegration test by Pedroni (2004). This test provides seven test statistics; first four are known as panel cointegration statistics and that are within-dimension statistics: the panel v -statistic, panel rho-statistic, panel PP-statistic (nonparametric), panel ADF-statistic (parametric); and the last three are known as group mean panel cointegrating statistics and that are between-dimension statistics: group rho-statistic, group PP-statistic (nonparametric) and group ADF-statistic (parametric). This test tests the null hypothesis of no cointegration.

This section also provides an overview of the econometric techniques used in this study to analyze the finance-growth relationship in a dynamic panel of 16 low-income countries. The extant literature shows that there are a number of techniques that can be used to estimate the relationship between variables in a dynamic panel. Raising the issue of simultaneity and endogeneity, Beck et al. (2000) proposed a generalized method of moment (GMM) approach to estimate the structural long-run association amongst variables in a dynamic panel. However, Christopoulos and Tsionas (2004) argued that it is doubtful whether the GMM system generates a structural long-run relationship or a spurious one, since this technique does not take integration and cointegration phenomenon into the account. Similarly, another technique of panel data analysis includes Instrumental Variables (IV) approach, especially to account endogeneity and serial correlation in the error term. The fixed effect

and random effect on an OLS setting are also highly used estimation techniques in a panel data-set. However, these estimation techniques do not also take integration and cointegration phenomenon into the account, which is critical issues in a time series panel. The literature also argued that endogeneity and heterogeneity are the major issues that should be taken care of while estimating the long-run coefficients in a dynamic panel (see Beck et al., 2000; Levine et al., 2000).

Therefore, it is important to apply panel data analysis techniques that address the issues of integration and cointegration properties of the data along with endogeneity and heterogeneity amongst the variables and countries, respectively. Therefore, considering these issues, this study used Fully Modified Ordinary Least Square (FMOLS) and Dynamic Least Square (DOLS) to estimate the long-run association amongst the variables in a cointegrated panel. Christopoulos and Tsionas (2004) forwarded three reasons why FMOLS is better to apply in a cointegrated panel. They stated that “it allows consistency of the long-run relation with the short run adjustments, deals with the endogeneity of regressors problem, and respects the time-series properties of the data in that integration and cointegration properties are explicitly taken into account”. Similarly, DOLS adjusts the errors by augmenting the static regression with leads, lags and contemporaneous values of the regressor in first differences (Kao & Chiang, 2001). Therefore, for the robustness of the results, this study applied both the FMOLS and the DOLS techniques to estimate the long-run parameters. Once the panel estimates of long-run parameters are calculated, this study further applied FMOLS to estimate the long-run estimates across the countries for the robustness of the result.

4.3. Estimating panel causality

Having estimated the long-run parameters, the direction of causality between variables is further tested. Taking into account the panel of 16 low-income countries and presence of cross-sectional dependence, this study used a pairwise panel causality test by Dumitrescu and Hurlin (2012) to analyze the causality nexus. This test provides consistent standardized panel statistics for a small sample, even in the presence of cross-sectional dependence (see: Dumitrescu & Hurlin, 2012). The test statistic is based on the individual Wald statistics of Granger non-causality averaged across the cross-section units, and hence assumes all the coefficients to be different across the cross-sections. It is also important to note that this test requires variables to be stationary at level. Therefore, the test was applied on first difference of the series, and hence, the results are considered as the short run causalities.

5. Empirical results and discussions

The empirical investigation begins with a test of cross-sectional dependence (Pesaran CD) and second-generation panel unit root test (CIPS). The results of these tests are presented in Table 2.

The result shows that all the variables used in this study have rejected the null hypothesis of no cross-sectional dependence (correlation) at 1% level of significance except for LF. The result shows that labour force does not have any cross-sectional dependence. Given the presence of

Table 2. Results of cross-sectional dependence and panel unit root test

Tests/Variables	LGDP	PRVT	GFC	OPE	LF (IPS)	CPI
Pesaran CD	42.077*	33.903*	11.414*	6.575*	1.021	46.838*
CIPS (level)	-2.529	-2.324	-2.137	-2.114	0.989	-1.524
CIPS (first difference)	-4.252*	-4.000*	-4.601*	-4.499*	-5.883*	-2.971*

Notes: Pesaran CD denotes cross-sectional dependence test statistics. The model used to test the unit root hypothesis is the one with intercept and trend. CIPS is the panel unit-root statistics developed by Pesaran (2007). LGDP is the log of real GDP measured in 2010 with the US dollar in billion, PRVT is the credit to private sector by banks to GDP ratio, OPE is trade openness defined as import plus export to GDP ratio, GFC is the gross fixed capital formation as percentage of GDP, LF is the labour force defined as percentage of economically active population (ages 15 and older) to the total population, and CPI is the consumer price index to account the inflation.

*Indicate significance at the 1%, respectively.

cross-sectional dependence in the variables, this study used the second-generation panel unit root test by Pesaran (2007). However, for LF, the study used Im et al. (1997) panel unit root test. The second row of the Table 2 shows that all the variables accepted the null hypothesis of homogeneous non-stationary at level. However, the CIPS results of first difference show that variables are stationary at first difference. Therefore, these results support the contention that variables under investigation are all I (1) variables.

Having indicated the order of integration I(d), co-integration testing has been performed to determine the presence or absence of a long-run equilibrium relationship amongst the variables. The null hypothesis of no cointegration is examined using seven different cointegration test statistics, and the results are presented in Table 3.

The result shows that out of the seven statistics, five are statistically significant. Hence, the null hypothesis of no cointegration can be rejected. Thus, it can be concluded that variables under consideration are cointegrated, indicating that economic growth, financial development, trade openness, gross fixed capital formation, consumer price index and labour force shared a long-run equilibrium relationship.

After the establishment of unit root and cointegration, the next step is to estimate the associated long-run cointegration parameters. The estimated results of Fully Modified OLS and the Dynamic OLS are reported in Table 4. The findings show that both the FMOLS and DOLS produce similar results for each variable in terms of sign, significance, and magnitude. The result shows that financial development has a positive and statistically significant impact on economic growth at 1% level of significance. All else is same, 1 percentage point increase in credit to the private sector as the ratio of GDP causes 0.015% increase in the real gross domestic product in the long-run. This finding is similar to the findings of Khan and Senhadji (2000), King and Levine (1993a, 1993b), Beck et al. (2000), Levine et al. (2000), and Christopoulos and Tsionas (2004). The result also shows that gross fixed capital formation has exerted a positive impact on real GDP. However, gross capital formation does not seem to be statistically significant for growth in low-income countries.

It is also important to note that trade openness has a positive and statistically significant impact on economic growth at 1% level of significance. The result shows that in the long-run, keeping other

Table 3. Results of Pedroni panel cointegration test

	Statistics	Prob.	Weighted statistic	Prob.
<i>Alternative hypothesis: common AR coefficients (within-dimension)</i>				
Panel v-Statistic	8.262*	0.000	8.831*	0.000
Panel rho-Statistic	2.675	0.996	2.370	0.991
Panel PP-Statistic	-6.480*	0.000	-7.490*	0.000
Panel ADF-Statistic	-5.702*	0.000	-6.708*	0.000
	Statistic			Prob.
<i>Alternative hypothesis: individual AR coefficients (between-dimension)</i>				
Group rho-Statistic	4.329			1.000
Group PP-Statistic	-12.112*			0.000
Group ADF-Statistic	-5.779*			0.000

Notes: Series: LGDP PRVT OPE GFC LF, and CPI. Trend assumption: Deterministic intercept and trend. Automatic lag length selection based on SIC with a max lag of 2. LGDP is the log of real GDP measured in 2010 with the US dollar in billion, PRVT is the credit to private sector by banks to GDP ratio, OPE is trade openness defined as import plus export to GDP ratio, GFC is the gross fixed capital formation as percentage of GDP, LF is the labour force defined as percentage of economically active population (ages 15 and older) to the total population, and CPI is the consumer price index to account the inflation.

*Denotes the significance level at 1%.

Table 4. Results of fully modified OLS and dynamic OLS techniques

Variable	FMOLS		DOLS	
	Coefficient	t-Statistic	Coefficient	t-Statistic
PRVT	0.015*	4.421	0.015*	4.300
GFC	0.001	0.448	0.002	0.667
OPE	0.007*	4.160	0.005*	2.877
LF	0.033*	4.366	0.033*	4.243
CPI	0.005*	6.429	0.005*	7.116
R-squared	0.970		0.967	

Notes: This table presents the results of long-run estimates of DOLS and FMOLS, dynamic and fully modified ordinary least square methods, respectively. PRVT is the credit to private sector by banks to GDP ratio, OPE is trade openness defined as import plus export to GDP ratio, GFC is the gross fixed capital formation as percentage of GDP, LF is the labour force defined as percentage of economically active population (ages 15 and older) to the total population, and CPI is the consumer price index to account the inflation. The dependent variable is LGDP, the log of real GDP measured in 2010 with the US dollar in billion.

*Denotes the significance level at 1%.

things constant, 1 percentage point increase in trade openness as imports plus exports to the GDP ratio leads to increase in GDP by 0.007%. Another important determinant of economic growth is the labour force. The long-run estimates indicate that labour force is positively related to economic growth at 1% level of significance. If all other things remain the same, the result indicates that 1 percentage point increase in the labour force as a percentage of the economically active labour force to total population is associated with 0.033% increase in gross domestic product.

Once the long-run panel coefficients are estimated, this study, further estimated the long-run estimates of cointegrating relationship for each individual country. This is important to understand the dynamic impact of financial development on growth across the sample countries. The long-run coefficients are estimated using the FMOLS and results are presented in Table 5.

The results show that long-run estimates of private credit are positive in the majority of the countries. The estimates revealed that out of 16 countries, 9 (Benin, Burkina Faso, Chad, Malawi, Mali, Niger, Senegal, Tanzania and Uganda) have a positive and significant impact of private credit on economic growth at 1% level of significance. These findings suggest that flow of credit to the private sector in these countries is related to the higher gross domestic product. Likewise, for 4 countries (Burundi, Guinea-Bissau, Nepal and Togo), there is no significant impact of private credit on economic growth. However, in the case of the **Central African Republic, Madagascar and Mozambique**, credit to the private sector has a negative impact on the GDP. Yet, it is statistically significant at 1% level of significance. This result is similar to that of Narayan and Narayan (2013), Ayadi et al. (2015), Ductor and Grechyna (2015), Grassa and Gazdar (2014), and Mhadhbi (2014). However, it is important at this point to note that this negative effect cannot be forwarded to support the view that finance has a negative effect on growth because these are the financially least developed countries within the selected sample countries. For example, the average flow of credit to the private sector throughout the study period is only about 5.541% of the GDP in Madagascar. Now, policy implication of this finding is the urgency in the formulation and proper implementation of the policies that create a favourable environment for private sector to grow with the availability of required finance. The results also show that gross capital formation has a positive impact on economic growth in the majority of the countries. It indicates that the public and private investment in the productive sector is essential for the economic growth. However, some of the countries were unable to exploit the importance of capital formation for economic growth. For example, estimates show that capital

Table 5. Results of long-run output coefficients using FMOLS Models for individual countries (dependent variable: LGDP)

Country	PRVT	GFC	OPE	LF	CPI	C	Adj_R ²
Benin	0.0129***	-0.0061*	0.0041**	-0.2022**	0.0109**	36.0659**	0.987
Burkina Faso	0.0198***	-0.0124*	0.0018	0.0985	0.0198**	12.3608	0.979
Burundi	0.0027	0.0011	0.0032*	0.0181*	0.0038**	19.2934**	0.978
Central African Republic	-0.0312**	0.0246**	-0.0152**	0.4473**	-0.0075**	-12.7569	0.617
Chad	0.0577*	-0.0175**	0.0076**	-1.4106**	0.0148**	122.6137	0.965
Guinea-Bissau	8.47E-05	0.0213**	-0.0046**	0.0347	0.0064*	17.4098**	0.594
Madagascar	-0.0279**	0.0028**	0.0032**	0.0134	0.0043**	21.2735**	0.979
Malawi	0.0273**	0.004	-0.002	0.002	0.0029**	21.8845**	0.983
Mali	0.0479**	0.0332**	-0.0078	-0.0537**	0.0015	26.7090**	0.982
Mozambique	-0.0032	0.0046	-0.0038**	0.1665**	0.0158**	7.6492**	0.991
Nepal	0.0001	-0.0364**	-0.0013	-0.0982**	0.0049**	32.2615**	0.988
Niger	0.0328**	0.0008	-0.0079*	-0.0095	0.0169**	21.4939**	0.961
Senegal	0.0261*	0.0119	-0.0059	-0.3534	0.0219*	47.9798**	0.957
Tanzania	0.0442**	0.003	-0.0043**	0.1433*	0.0049**	10.257	0.992
Togo	0.0045	0.0066	-0.0019	0.0258	0.0072*	19.0167**	0.945
Uganda	0.0479**	0.0332**	-0.0078	-0.0537**	0.0014	26.7091**	0.982

Notes: This table presents the results of long-run estimates of fully modified ordinary least square (FMOLS) for individual sample country. PRVT is the credit to private sector by banks to GDP ratio, OPE is trade openness defined as import plus export to GDP ratio, GFC is the gross fixed capital formation as percentage of GDP, LF is the labour force defined as percentage of economically active population (ages 15 and older) to the total population, and CPI is the consumer price index to account the inflation.

*Indicate the significance level at 5%, respectively.

**Indicate the significance level at 1%, respectively.

formation is negatively related to the gross domestic product in the case of **Benin, Burkina Faso, Chad and Nepal** at 1% level of significance.

Similarly, Table 5 shows that, unlike the results of panel estimate, the majority of the low-income countries (11 out of 16) have a negative impact of trade openness on the growth. This indicates that low-income countries are unable to use their resources to produce the goods and services within the country and export it to the foreign counterparts. Likewise, the labour is positively related to the growth for the majority of the countries (9 out of 16).

Having indicated the long-run cointegrating relationship, the study further conducts a pairwise panel causality test and the results are presented in Table 6. The result shows that short-run causality is unidirectional from GDP to private credit in low-income countries. This is not consistent with the findings of Christopoulos and Tsionas (2004). The study also found bi-directional causality between CPI and GDP. However, the study does not find any unidirectional or bidirectional causality between OPE and GDP, and GFC and GDP.

Table 6. Results of heterogeneous panel causality test

Null hypothesis	Zbar-Stat.	Prob.
PRVT does not homogeneously cause LGDP	1.557	0.119
LGDP does not homogeneously cause PRVT	1.844*	0.065
OPE does not homogeneously cause LGDP	-0.127	0.899
LGDP does not homogeneously cause OPE	-0.447	0.655
GFC does not homogeneously cause LGDP	-0.890	0.373
LGDP does not homogeneously cause GFC	-1.143	0.253
CPI does not homogeneously cause LGDP	3.817***	0.000
LGDP does not homogeneously cause CPI	2.937***	0.003
LF does not homogeneously cause LGDP	1.209	0.227
LGDP does not homogeneously cause LF	2.074**	0.038

Notes: This table presents the results of pairwise panel causality test of Dumitrescu and Hurlin (2012). LGDP is the log of real GDP measured in 2010 with the US dollar in billion, PRVT is the credit to private sector by banks to GDP ratio, OPE is trade openness defined as import plus export to GDP ratio, GFC is the gross fixed capital formation as percentage of GDP, LF is the labour force defined as percentage of economically active population (ages 15 and older) to the total population, and CPI is the consumer price index to account the inflation.

*Indicate the significance level at 10%, respectively.

**Indicate the significance level at 5%, respectively.

***Indicate the significance level at 1%, respectively.

6. Summary and conclusions

This study has been conducted to analyze the long-run relationship between financial development and economic growth in 16 low-income countries, combining the cross-sectional and time series data for the period of 1995–2014. The cross-sectional dependence, which is not considered as seriously in previous studies, has been taken into account. This study has made the use of second-generation panel unit root test in the presence of cross-sectional dependence. The panel short-run causality test has further been used to analyze the direction of causality between financial development and economic growth. The long-run parameters were estimated with the use of Fully Modified OLS (FMOLS) and Dynamic OLS (DOLS).

The study revealed that there exists a long-run cointegrating relationship between financial development and economic growth in low-income countries. The results of Pedroni cointegration test indicate that financial development, economic growth, trade openness, capital formation, consumer price index and labour force shared a long-run cointegrating relationship over the study period. More importantly, results of this study reveal that financial development proxied by credit to private sector has long-run positive and significant impact on growth. The long estimates of individual country-wise FMOLS show that majority of the countries (9 out of 16) have a significant positive relationship between financial development and economic growth. However, some countries (3 out of 16)—**Central African Republic, Madagascar and Mozambique**—provided the significant and negative impact of finance on growth. The poor development system and a higher level of non-performing assets could be the causes of such relationship in these countries. For example, in the context of Central African Republic, one-third of loans extended by banks are nonperforming and the business climate, marked by socioeconomic problems and weaknesses of the judicial system, prevents the enforcement of guarantees, thus contributing to private sector defaults (IMF, 2009). Likewise, this study reveals unidirectional causality from economic growth to financial development in the short run, supporting the demand following hypothesis.

On the aggregate, though time series analysis produces some mixed results, this study argues that financial sector development in terms of the flow of credit to the private sector has a positive impact on economic growth. This is because this study is more focused on the results of panel data

analysis. Therefore, it can be concluded that there is sufficient evidence to support the view that financial development is essential for economic growth.

The most important policy implication of this study finding is that policy-makers should be focused on long-run policies to enhance the financial sector in low-income countries. The negative effect of credit to private sector in few countries further increases the urgency for the policies that reduce the non-performing assets and strengthen the credit guarantees. The policy-makers should also focus on formulating the policies that provide a favourable environment for private sector to grow. These data show that flow of credit to the private sector is very low in this region of the world. Another important policy implication of the study findings is that policy-makers should give more emphasis on growth-related activities or fiscal policy in the short run as short-run causality is found to be demand following. However, more focus should be given to the financial sector or the monetary policy in the long-run.

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Notes

1. See: Demircuc-Kunt (2006) for a comprehensive review on policy choices for developing Countries.
2. For more comprehensive literature on measures of financial development, See: von Furstenberg and Fratianni (1996) and Valickova, Havranek, and Horvath (2015).
3. Except for the Auto Regressive Distributed Lag (ARDL) approach to cointegration, which could be performed in the data having mixed orders of integration in a single equation, other techniques of cointegration analysis require data to be integrated at least of order one in level.

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