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THE DYNAMIC CAUSAL LINKAGE BETWEEN FINANCIAL DEVELOPMENT AND ECONOMIC GROWTH: EMPIRICAL EVIDENCE FROM ETHIOPIA

ABSTRACT

This paper investigates the dynamic causal linkage between bank-based financial development and economic growth in Ethiopia during the period from 1980 to 2014. The study includes savings and investment as intermittent variables in an attempt to address the omission of variable bias – thereby creating a multivariate Granger-causality model. Using the newly developed autoregressive distributed lag bounds testing approach to cointegration and the error-correction model-based causality model, the study finds that in the short run, both financial development and economic growth Granger-cause each other in Ethiopia. However, in the long run, there is unidirectional Granger-causality from bank-based financial development to economic growth. The study, therefore, recommends that policies aimed at enhancing both economic growth and financial development should be pursued in the short run. However, in the long run, policies that target the development of the banking sector should be prioritised in order to ensure a sustained growth path.

Keywords: Ethiopia, Bank-Based Financial Development, Economic Growth, Granger-Causality
JEL Classification: G20, O10

RIASSUNTO

La relazione causale dinamica tra sviluppo finanziario e crescita economica: evidenze empiriche dall'Etiopia

Questo studio esamina la relazione causale dinamica tra lo sviluppo finanziario basato sulle banche e la crescita economica in Etiopia durante il periodo 1980-2014. Lo studio include il

risparmio e gli investimenti come variabili intermittenti nel tentativo di neutralizzare il bias dovuto alle variabili omesse – creando così un modello di Granger-causalità multivariato. Utilizzando un approccio autoregressivo a ritardi distribuiti sviluppato recentemente e un modello di causalità *error-correction,* lo studio rileva che in Etiopia nel breve periodo tra sviluppo finanziario e crescita economica sussiste una relazione di Granger-causalità reciproca. Invece nel lungo periodo c'è Granger-causalità unidirezionale dallo sviluppo finanziario basato sulle banche alla crescita economica. Questo lavoro suggerisce che, nel breve periodo, si dovrebbero perseguire politiche tendenti a stimolare sia la crescita economica che lo sviluppo finanziario, mentre nel lungo periodo si dovrebbe dare priorità a politiche che mirano allo sviluppo del settore bancario al fine di assicurare una crescita sostenibile.

1. Introduction

The relationship between bank-based financial development and economic growth has generated a considerable amount of debate for many years among development economists, but with little consensus. Although extensive empirical work has been conducted on this subject in a number of countries, the results are conflicting. To date, the debate surrounding the causal relationship between bank-based financial development and economic growth is still raging.
Empirically, four views exist in the literature on the causal relationship between financial development and economic growth. The first view is the "supply-leading hypothesis", alternatively known as the "finance-led growth hypothesis", which postulates that bank-based financial development is important – and that it drives economic growth. This view finds extensive support in the work of McKinnon (1973), Shaw (1973), King and Levine (1993a), Beck and Levine (2002), Christopoulos and Tsionas (2004), Odhiambo (2009a) and Akinlo and Egbetunde (2010), among others. The supply-leading hypothesis attaches greater importance to the role played by banking sector development in the economic growth process.

The second view is the "demand-following hypothesis" – also known as the "growth-led finance hypothesis". This view argues that it is economic growth that causes bank-based financial development. Thus, bank-based financial development is considered to be demand-driven (see also Robinson, 1952; Gurley and Shaw, 1967; Goldsmith, 1969; Jung, 1986; Odhiambo, 2004; Ang and McKibbin, 2007; Odhiambo, 2009b). The third view is the "bidirectional-causality view",

alternatively called the "feedback hypothesis". It ascribes equal importance to both the financial and real sectors of the economy since it assumes a positive two-way causal relationship between bank-based financial development and economic growth (see also Patrick, 1966; Ang, 2008; Odhiambo, 2011).

Then there is the fourth view, commonly known as the "neutrality view", which ascribes no significant causal relationship at all between financial development and economic growth. According to this view, neither of these two sectors has any significant effect on the other (Lucas, 1988; Graff, 1999; Shan *et al*., 2001; Shan and Morris, 2002).

Although it is now well-known that a financial system is composed of bank-based and market-based segments, the majority of previous studies have concentrated on the relationship between economic growth and financial development in general. This generalisation, however, may not necessarily apply for a country like Ethiopia, whose financial sector is largely dominated by bank-based financial institutions. Moreover, some of these studies have mainly used a bivariate framework, which is now known to be unreliable due to the omission-of-variable bias (Loizides and Vamvoukas, 2005; Odhiambo, 2011). In addition, some of the previous studies over-relied on cross-sectional data analyis, which may not satisfactorily address country-specific issues (Casselli *et al.,* 1996; Ghirmay, 2004).

It is against this background that the current study empirically examines the causal linkage between bank-based financial development and economic growth in Ethiopia during the period from 1980 to 2014. The study employs the newly developed autoregressive distributed lag (ARDL) bounds testing approach, within an error-correction model (ECM)-based multivariate Granger-causality setting, to examine this linkage. This study might well be among the pioneer studies providing a detailed examination of the dynamic causal relationship between bank-based financial development and economic growth in Ethiopia using modern time-series techniques.

The rest of the paper is organised as follows: The second section provides an overview of the economic growth and the banking sector dynamics in Ethiopia. The third section reviews the finance-growth causality literature, while the fourth section covers the estimation techniques.

The fifth section dwells on econometric analysis and empirical findings; and the sixth section concludes the study.

2. Bank-based financial development and economic growth in Ethiopia: an overview

The National Bank of Ethiopia (NBE) was created in 1963 and began operating in January 1964 through a proclamation which entrusted it with a number of responsibilities. Among other responsibilities were: to regulate the supply, availability and cost of money and credit; to manage and administer the country's international reserves; to license and supervise banks and hold commercial banks reserves and lend money to them; to supervise loans of commercial banks and regulate interest rates; to issue paper money and coins; to act as an agent of the Government; and to fix and control the foreign exchange rates (NBE, 2016a). Following the adoption of a new proclamation in 1976, the central bank's supervisory area increased to include other financial institutions such as insurance institutions, credit cooperatives and investment-oriented banks (NBE, 2016a). In addition, a new currency was introduced as legal tender known as the Birr (NBE, 2016a).

Ethiopia's financial system is dominated largely by banks, followed by insurers and microfinance institutions. Nineteen banks, seventeen insurance companies and thirty-five microfinance institutes operate in the economy, with the majority of the banks and insurance companies being owned privately (NBE, 2015). The financial sector has four main public banks, namely the Commercial Bank of Ethiopia; the Construction and Business Bank of Ethiopia; the Development Bank of Ethiopia; and the Ethiopian Insurance Corporation.

In 1994, a new proclamation was issued to direct the bank towards a free market economic environment, which allowed new reforms to be adopted. These included the restructuring and recapitalisation of credit supplied to cooperatives and state farms in the agricultural sector and to public and private enterprises in other sectors (NBE, 2016a). Another reform was the adoption of new legislation around monetary and banking policy. Accordingly, this new legislation redefined the status, functions and authority of the NBE under a market-based economic environment so as to provide for a stronger and more autonomous role for the NBE (NBE, 2016a). The legislation stipulated the NBE's relation to Government and other financial

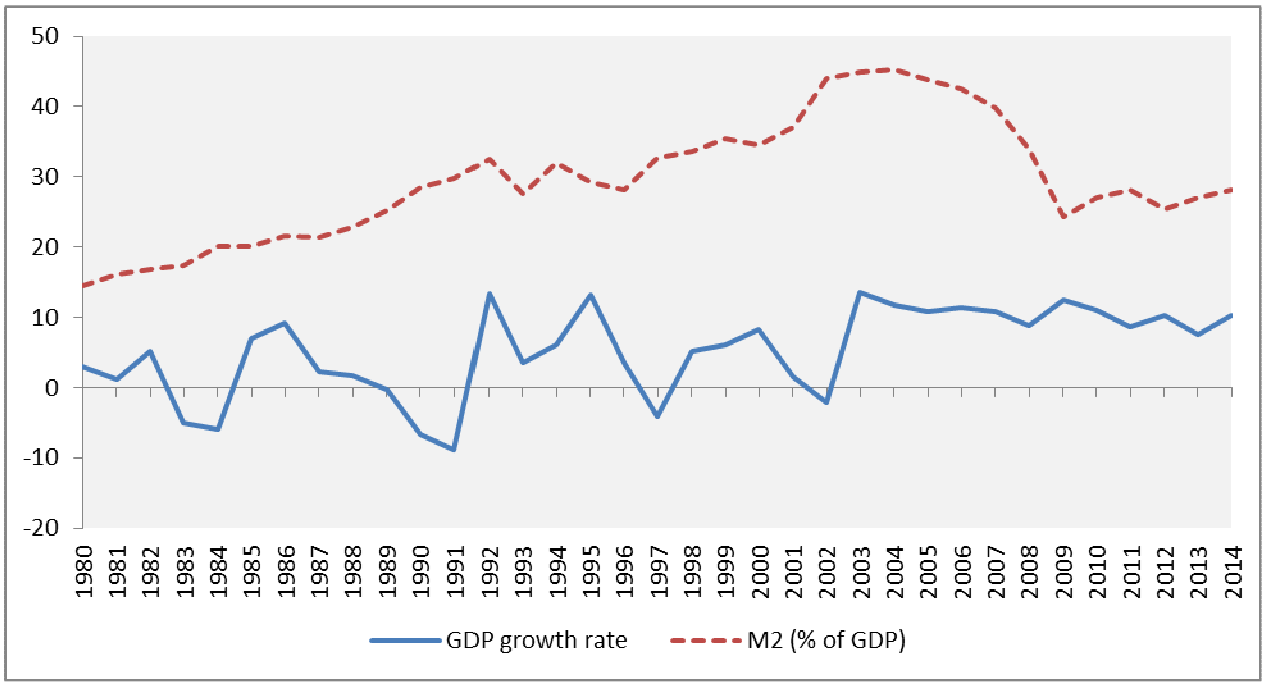
institutions through its supervision of credit, the setting of foreign exchange rates and the framework of interest rate policy (International Monetary Fund, 1994).

Government dominates lending, controls interest rates, and owns the country's largest bank, the Commercial Bank of Ethiopia (CBE), which accounts for 34% of the total capital in the banking system (NBE, 2015). The total capital of the insurance industry increased by 40.8 percent on an annual basis in the 2014/15 period and reached Birr 2.8 billion, of which 77.6 percent was owned by private insurance companies (NBE, 2015). According to the NBE (2015), the top five largest microfinance institutions accounted for 84.2 percent of the total capital, while the total number of microfinance institutions operating in the country mobilised a total saving deposit of around Birr 14.8 billion. This was 25.9 percent higher than the previous period, 2013/14, with outstanding credit of the micro-finance institutions (MFIs) scaled up by 29.5% and reaching Birr 21.8 billion (NBE, 2015).

Financial development in Ethiopia over the years, as measured by M2/GDP, followed an upward trend from 1980 to 2006, with fluctuations between 1992 and 1997 (NBE, 2016b). In 1992, M2/GDP was 33%. It moderated to 28% in 1993, before increasing to 32% in 1994 (NBE, 2016b). The M2/GDP ratio went down from 40.0% in 2002 to 25.6% in 2011, reflecting a contraction in financial deepening in the country (NBE, 2016b). The M2/GDP ratio peaked at about 45% in 2004; but following a tight monetary policy stance by the government of Ethiopia over the preceding years to combat inflation, there was a declining trend in the M2/GDP ratio from 2005 to 2009 (NBE, 2016b). Since 2007, the NBE has been using different monetary policy instruments such as reserve requirement, liquidity requirement and credit capital on banks to reduce the banks' credit capacity (NBE, 2015). This has subsequently led to a reduction in the growth of the broad money supply relative to GDP (Zwedu, 2014).

On the real sector front, Ethiopia's GDP growth rate followed a volatile fluctuating trend between 1980 and 2003 before the fluctuations stabilised (United Nations Conference on Trade and Development [UNCTAD], 2016). According to UNCTAD (2016), the lowest growth rate of -11% was recorded in 1991, while the highest of 14% was in 2003. Thereafter, the trend has remained positive to date. Figure 1 illustrates the trends in M2/GDP and GDP growth rate over the years.

FIGURE 1 - *Trend in M2/GDP and GDP Growth Rate in Ethiopia (1980 -2014)*



Source: NBE (2016b); UNCTAD (2016).

3. LITERATURE REVIEW

Theoretically, the financial development and economic growth nexus can be traced back to Schumpeter (1911), whose notion was that financial development leads to economic growth. He emphasised that financial institutions and entrepreneurship were necessary and sufficient conditions for economic growth and concluded that, to the extent that the financial structure of an economy facilitates the migration of funds to the best user, it leads to the accelerated growth and performance of the country. McKinnon (1973) and Shaw (1973) later supported this view by arguing that government quantitative restrictions on the banking system restrain the volume and the productivity of investments, which impedes economic growth. In their view therefore, financial sector development – through the development of financial markets and high interest rates, and therefore investment – has a positive effect on economic growth.

A challenge to Schumpeter's view by Robinson (1952) argued that it was the development of the real sector that led to the development of the financial sector. Patrick (1966), however, put forward the hypothesis that the relationship between financial development and economic growth changes over the course of development. He argued that financial development induces

real investment innovation before sustained modern economic growth gets underway, in such a way that as modern economic growth occurs, the supply-leading impetus gradually becomes less and less important as the demand following response becomes dominant. King and Levine (1993b) argued that the efficient allocation of funds from financial intermediaries to entrepreneurs would be able to lower the cost of investing in productivity, leading to economic growth stimulation.

Empirically, four main variants exist in the literature on the causal relationship between financial development and economic growth (Odhiambo, 2004). The first of these views purports that financial development leads to economic growth. This is supported by various studies (such as Jung, 1986; Graff, 2002; Chistopoulos and Tsionas, 2004; Shabri and Majid, 2008; Ahmed and Wahid, 2011; Nwosa *et al.*, 2011; Hussain and Chakraborty, 2012; Hsueh *et al.*, 2013; Gokmenoglu *et al.*, 2015).

Jung (1986) investigated the finance-growth nexus using cross-sectional data for 56 countries, including 19 industrialised countries, between 1950 and 1981. Using the ratio of currency to M1 and the ratio of M2 to nominal gross national product (GDP) as proxies for financial development, Jung concluded that the supply-leading pattern occurs more frequently than the demand-following pattern in the less-developed countries (LDCs). Graff (2002) used a cross-country analysis for 93 countries to study the causal links between financial activity and economic growth from 1970 to 1990. Evidence of finance-led growth was found, although it was concluded that such a relationship was not stable.

Christopoulos and Tsionas (2004) used the ratio of total bank deposit liabilities to nominal GDP as a measure of bank-based financial depth in a study on ten developing countries to examine the causal relationship between financial development and economic growth over the period 1970 to 2000. Based on panel unit-root tests and panel cointegration analysis, it was concluded that a fairly strong and significant long-run causality relationship runs from financial development to economic growth.

Shabri and Majid (2008) employed time-series data to empirically examine the finance-growth nexus during the post-1997 financial crisis in Malaysia using the ratio of total bank deposit

liabilities to nominal GDP as a proxy for financial development. Granger-causality tests revealed a unidirectional causality running from finance to growth, thus supporting the finance-led growth hypothesis or the supply-leading view. For Zambia, Odhiambo (2009a) examined the dynamic impact of interest rate reforms on economic growth for the period from 1969 to 2006 using a trivariate Granger-causality model in which savings was the intermittent variable. The ratio of M2 to GDP and the nominal deposit rate were used to proximate financial development. The results revealed that financial deepening, which results from interest rate liberalisation, Granger-causes economic growth, regardless of whether the causality is estimated in the short run or in the long run.

Ahmed and Wahid (2011) used panel data cointegration analysis and dynamic time-series modelling to examine the linkages between financial structure and economic growth in a group of seven African countries over the period from 1986 to 2007. They found evidence of unidirectional causality running from bank-based financial systems to economic growth. Nwosa *et al.* (2011) employed a trivariate vector error-correction model (VECM) to test the causal relationships between financial development, foreign investment and economic growth in Nigeria from 1970 to 2009. The study used the ratio of saving deposits to GDP and the ratio of total credits to GDP as measures of banking sector size. The causality results showed that financial development Granger-caused economic growth.

Kar *et al.* (2011) examined the financial development and economic growth nexus in fifteen MENA countries using the bootstrap panel Granger-causality between 1980 and 2007. The study used monetary aggregates, domestic and private credit values and banking variables as indicators of financial development. The results from the study confirmed the finance-led growth hypothesis in Bahrain, Israel, Kuwait, Libya, Morocco, Qatar, Saudi Arabia, Syria, Tunisia and Turkey.

Hussain and Chakraborty (2012) also found that bank-based financial development Granger-causes economic growth after empirically examining the relationship between financial development and economic growth in Assam, a state in India, between 1985 and 2009. Hsueh *et al.* (2013) used a method of bootstrap panel Granger-causality analysis to analyse the causality between financial development and economic growth among ten Asian countries during the

period 1980 to 2007. The study supported the supply-leading hypothesis for Malaysia, Indonesia, Korea, Singapore, Thailand, Taiwan and China.

Gokmenoglu *et al.* (2015) investigated the relationship between international trade, financial development and economic growth in Pakistan. The direction of causality between the variables was tested using the Granger-causality test and the results indicated that financial development drives economic growth in Pakistan. Omri *et al.* (2015) examined the relationship between financial development and economic growth using simultaneous equation panel data models for a panel of 12 Middle East and North Africa (MENA) countries over the period from 1990 to 2011. The study confirmed the finance-led growth hypothesis.

The second group argues the opposite – that economic growth leads to financial development (see Shan *et al.,* 2001; Shan and Morris, 2002; Agbetsiafa, 2003; Odhiambo, 2004; Zang and Kim, 2007; Odhiambo, 2008: Akinlo and Egbetunde, 2010; Rachdi and Mbarek, 2011; Simwaka *et al.,* 2012). Shan *et al.* (2001), while examining the relationship between financial development and economic growth in nine OECD countries and China, using the Granger-causality framework, they found one-way causality from economic growth to financial development in Canada, China and Italy.

Shan and Morris (2002) used the Toda and Yamamoto (1995) causality-testing procedure to investigate the relationship, if any, between financial development and economic growth, using quarterly data from 19 Organisation for Economic Co-operation and Development (OECD) countries and China. Using total credit and interest spread as indicators of financial development, they found evidence that economic growth leads financial development for five countries. Agbetsiafa (2003), while examining the causal relationship between financial development and economic growth in a sample of eight emerging economies in sub-Saharan Africa (SSA), found that unidirectional causality from growth to finance dominates in Ivory Coast and Kenya.

Odhiambo (2004) investigated whether financial development was still a spur to economic growth in South Africa between 1968 and 2000. He used the ratio of M2 to GDP, the currency ratio and the ratio of bank claims on the private sector to nominal GDP as proxies of bank-based

financial development. Based on the Granger-causality test in the context of the Johansen-Juselius cointegration technique and the VECM, the study revealed that there was an overwhelming demand-following response between financial development and economic growth in South Africa, regardless of the measurement for financial development.

Zang and Kim (2007) examined the causal link between financial development and economic growth in East Asian countries. By applying the Sims-Geweke causality technique, the authors found substantial evidence that economic growth precedes financial development. Odhiambo (2008) investigated the relationship between financial development and economic growth for Kenya. Using the dynamic Granger-causality model and three main proxies for financial development, namely the ratio of M2 to GDP, the currency ratio and domestic credit to the private sector across, the study found that the demand-following response tended to predominate. Akinlo and Egbetunde (2010) examined the long-run causal relationship between financial development – proxied by the ratio of M2 to GDP – and economic growth for ten countries in SSA. Using the VECM, the study found that economic growth Granger-causes financial development in Zambia.

Rachdi and Mbarek (2011) empirically investigated the direction of causality between finance and growth based on a sample of ten countries, six from the OECD region and four from the MENA region during the 1990 - 2006 period. Causality tests revealed unidirectional causal flow from economic growth to financial development for the MENA countries. Simwaka *et al.* (2012) examined the causal relationship between financial development and economic growth in Malawi using the autoregressive distributed lag (ARDL) approach. Granger-causality tests showed that economic growth drives financial development with no feedback effects. Ho and Odhiambo (2013) conducted an empirical investigation on banking sector development and economic growth in Hong Kong over the period 1980 to 2011. The results of the study showed that when bank deposits are used as a proxy for bank development, a demand-following response predominates.

Despite the overwhelming arguments in favour of supply-leading and demand-following hypotheses, a number of studies have found that the third view holds – that financial development and economic growth can Granger-cause one another (see Wood, 1993; Akinboade,

1998; Calderon and Liu, 2003; Odhiambo, 2005; Shan and Jianhong, 2006; Ang, 2008; Acaravci *et al.*, 2009; Odhiambo, 2011). Wood (1993) examined the causal relationship between financial development and economic growth in Barbados during the 1946-1990 period. Using Hsiao's (1979) test procedure, the study found a bidirectional causal relationship between financial development and economic growth.

Akinboade (1998), while examining the direction of causality between financial development and related growth in Botswana during the period from 1972 to 1995, found evidence of bidirectional causality between financial development and economic growth. Calderon and Liu (2003), while using the Geweke decomposition test on pooled data for 109 countries from 1960 to 1994, found evidence of bidirectional Granger-causality when the sample was split into developing and industrial countries.

Odhiambo (2005) found a bidirectional causal relationship in Tanzania between economic growth and financial development, proxied by the ratio of currency to narrow definition of money and the ratio of bank claims on the private sector to GDP. The study employed the Johansen-Juselius cointegration method and VECM. Shan and Jianhong (2006) examined the causal relationship between financial development, proxied by total credit, and economic growth in China using a VAR approach. The study supported the view in the literature that financial development and economic growth exhibit a two-way causality.

Ang (2008) estimated a six-equation model of financial development and economic growth for Malaysia to shed light on the mechanisms linking these two variables. The results indicated that financial development and economic growth in Malaysia show a bidirectional causality pattern. Acaravci *et al.* (2009) investigated the causality between financial development and economic growth for the panels of 24 SSA countries for the period from 1975 to 2005. The empirical findings in the paper showed a bidirectional causal relationship between the growth of real GDP *per capita* and the domestic credit provided by the banking sector. Odhiambo (2011) examined a dynamic causal relationship between bank-based financial development and economic growth in South Africa during the 1980-2007 period, using a trivariate Granger-causality model. The results indicated that there is a bidirectional causal relationship between bank-based financial development and economic growth.

Jedidia *et al.* (2014) conducted an empirical investigation into whether financial development can boost economic growth in Tunisia by employing an ARDL method to assess the finance-growth relation. The study confirmed the view that there is a bidirectional relationship between financial development and economic growth. Peia and Roszbach (2015) examined the empirical relationship between financial and economic development using time series analysis in 22 advanced economies. The results of the study revealed that causality patterns depend on whether countries' financial development stems from the stock market or the banking sector development and that bidirectional causality is mainly found between banking sector development and output growth.

Lastly, the fourth variant in the literature on the causal relationship between financial development and economic growth is of the view that there is no causal relationship between the variables. Shan *et al.* (2001) found no Granger-causality in either direction in France and New Zealand after employing Granger-causality tests on nine OECD countries. Ibrahim (2007) examined the causal linkage between financial development and economic growth in Malaysia during the period from 1985 to 2003, using time series methods. The results found the neutrality hypothesis to hold between development of financial intermediaries and GDP. Kumar *et al.* (2015) employed Toda and Yamamoto Granger-causality tests for South Africa over the period 1971 to 2011 and confirmed the absence (neutrality) of causality between financial development and economic growth, thus indicating that these two variables evolve independently of each other.

4. Estimation techniques

The vast research available on finance-growth causality is based on a bivariate framework, yet it is now known that results from such a model suffer from the omission of variable bias (among others, see Pradhan, 2011; Odhiambo, 2011; Loizides and Vamvoukas, 2005). To address the weakness of bivariate Granger-causality, this study utilises a multivariate Granger-causality model, based on the autoregressive distributed lag (ARDL) bounds-testing approach developed by Pesaran and Shin (1999) and later extended by Pesaran *et al.* (2001), to examine the dynamic causal relationship between bank-based financial development and economic growth in Ethiopia.

Savings and investment are the intermittent variables in the multivariate model. The choice of these variables as intermittent variables is underpinned in the theoretical and empirical links between each one of them and economic growth; and between each one of them and financial development. Traditional theories underscore the role of savings and investment in the economic growth process (Solow, 1956; Romer, 1986; Lucas, 1988). Solow (1956), in his exogenous growth model, argued that an increase in savings leads to higher growth in the short run, during the transition between steady states. According to endogenous growth models developed by Romer (1986) and Lucas (1988), a permanent increase in growth can be determined by higher savings and capital accumulation.

The theoretical link between financial development, savings and investment is also, to a large extent, influenced by the work of McKinnon (1973) and Shaw (1973), which emphasised that a well-developed financial sector is expected to increase savings and create a pool of resources for investment through efficiency improvement during the intermediation process (see also Odhiambo, 2008). Based on this argument, savings and investment variables are therefore chosen to be the intermitting variables.

In this study, annual growth rate of real GDP is used as a proxy for economic growth (GDP). This proxy has been used extensively in the literature (see, among others, Wood, 1993; Odedokun, 1996; Shan and Jianhong, 2006; and Majid, 2008).

Bank-based financial development, on the other hand, is proxied by the ratio of quasi-liquid liabilities (M2) as a percentage of GDP (BFD). Bank-based financial development is proxied by various indicators in modern literature – including M2 to nominal GDP, M3 to nominal GDP, domestic credit to private sector divided by nominal GDP and claims on the private sector divided by GDP, among others. However, due to the unavailability of sufficient time-series data for Ethiopia on most of these indicators, this study utilises the ratio of M2 to nominal GDP (BFD) as a proxy of bank-based financial development. This indicator shows the overall size of the financial intermediary in a country (Levine, 1997; Calderon and Liu, 2003). A higher ratio of M2 to GDP shows a larger financial sector and consequently, a larger financial intermediation. The opposite also holds.

The causality model used in this study originates from Granger's definition of causality, based on the notion that the future cannot cause the past but the past can cause the future. The definition is that X causes Y, given U_t, if Y_{t+1} can be better predicted by past values of X (Xs, S ≤ t) than by not using it – where U_t is the universe of information up to and including period (t). Thus, comparing the forecasting ability of U_t with and without X: if past values of X contribute to forecasting Y_{t+1} significantly, then X is said to Granger-cause Y. Causality from Y to X can be defined in the same way.

The study utilises the newly proposed autoregressive distributed lag bounds testing approach to examine the causal relationship between bank-based financial development and economic growth in Ethiopia. The choice of this test is based on the numerous advantages it has over conventional estimation techniques such as the residual-based technique by Engle and Granger (1987) and the Full-Maximum Likelihood (FML) test based on Johansen (1988; 1991) and Johansen and Juselius (1990) – see, among others, Pesaran and Shin (1999), Duasa (2007), Odhiambo (2008) and Majid (2008). The ARDL bounds testing approach does not impose the restrictive assumption that all the variables must be integrated of the same order. The approach can be applied to test the existence of a relationship between variables, even if the underlying regressors are integrated of order zero [I(0)] or order one [I(1)]. While conventional cointegration methods estimate the long-run relationship within the context of a system of equations, the ARDL method is based on only a single reduced form equation (Pesaran and Shin, 1999). Furthermore, the ARDL approach provides unbiased long-run estimates and valid t-statistics, even when some of the regressors are endogenous (Odhiambo, 2008). The ARDL test also considers a sufficient number of lags to capture the data-generating process in a general-to-specific modelling framework to obtain optimal lag length per variable. To top it all, the technique has superior small sample properties, making it suitable even when the sample size is small. Therefore, the ARDL approach is considered to be suitable for the analysis of the underlying relationship. Of late, the approach has also been increasingly used in empirical research.

The long-run equilibrium relationship among the variables – economic growth, bank-based financial development, savings and investment – is first established using the cointegration test before causality is tested. The cointegration test utilised in this study is ARDL-based and is

conducted by making each variable a dependent variable, one at a time. A system of ECM-based cointegration equations associated with the multivariate Granger-causality model is expressed as follows:

4.1 Cointegration Model

$$\Delta GDP_t = \alpha_0 + \sum_{i=1}^{n} \alpha_{1i} \Delta GDP_{t-1} + \sum_{1=0}^{n} \alpha_{2i} \Delta BFD_{t-1} + \sum_{i=0}^{n} \alpha_{3i} \Delta SAV_{t-1} + \sum_{1=0}^{n} \alpha_{4i} \Delta INV_{t-1}$$

$$+ \alpha_5 GDP_{t-1} + \alpha_6 BFD_{t-1} + \alpha_7 SAV_{t-1} + \alpha_8 INV_{t-1} + \mu_{1t} \ldots \ldots \ldots \quad (1)$$

$$\Delta BDF_t = \beta_0 + \sum_{i=0}^{n} \beta_{1i} \Delta GDP_{t-1} + \sum_{i=1}^{n} \beta_{2i} \Delta BFD_{t-1} + \sum_{i=0}^{n} \beta_{3i} \Delta SAV_{t-1} + \sum_{i=0}^{n} \beta_{4i} \Delta INV_{t-1}$$

$$+ \beta_5 GDP_{t-1} + \beta_6 BFD_{t-1} + \beta_7 SAV_{t-1} + \beta_8 INV_{t-1} + \mu_{2t} \ldots \ldots \ldots \quad (2)$$

$$\Delta SAV_t = \delta_0 + \sum_{i=0}^{n} \delta_{1i} \Delta GDP_{t-1} + \sum_{i=0}^{n} \delta_{2i} \Delta BFD_{t-1} + \sum_{i=1}^{n} \delta_{3i} \Delta SAV_{t-1} + \sum_{i=0}^{n} \delta_{4i} \Delta INV_{t-1}$$

$$+ \delta_5 GDP_{t-1} + \delta_6 BFD_{t-1} + \delta_7 SAV_{t-1} + \delta_8 INV_{t-1} + \mu_{3t} \ldots \ldots \ldots \quad (3)$$

$$\Delta INV_t = \vartheta_0 + \sum_{i=0}^{n} \vartheta_{1i} \Delta GDP_{t-1} + \sum_{i=0}^{n} \vartheta_{2i} \Delta BFD_{t-1} + \sum_{i=0}^{n} \vartheta_{3i} \Delta SAV_{t-1} + \sum_{i=1}^{n} \vartheta_{4i} \Delta INV_{t-1}$$

$$+ \vartheta_5 GDP_{t-1} + \vartheta_6 BFD_{t-1} + \vartheta_7 SAV_{t-1} + \vartheta_8 INV_{t-1} + \mu_{4t} \ldots \ldots \ldots \quad (4)$$

Where:

GDP = growth rate of real gross domestic product (a proxy for economic growth)

BFD = share of M2 in GDP (a proxy for bank-based financial development)

SAV = share of gross savings in GDP (a proxy for savings investment)

INV = share of gross fixed capital formation in GDP (a proxy for investment)

$\alpha_0, \beta_0, \delta_0,$ and ϑ_0 = respective constants; $\alpha_1 - \beta_8, \beta_1 - \beta_8, \delta_1 - \delta_8,$ and $\vartheta_1 - \vartheta_8 =$ respective coefficients; Δ = difference operator; n = lag length; t = time period; and $\mu_{it} =$ white-noise error terms.

4.2 Granger-Causality Model

The ECM-based multivariate Granger-causality model adopted in this study follows Hamdi *et al*. (2013), Odhiambo (2011), Narayan and Smyth (2008) and Ang and McKibbin (2007) and is expressed as follows:

$$\Delta GDP_t = \alpha_0 + \sum_{i=1}^{n} \alpha_{1i} \Delta GDP_{t-1} + \sum_{i=1}^{n} \alpha_{2i} \Delta BFD_{t-1} + \sum_{i=1}^{n} \alpha_{3i} \Delta SAV_{t-1} + \sum_{i=1}^{n} \alpha_{4i} \Delta INV_{t-1} + \alpha_5 ECM_{t-1} + \mu_{1t} \quad (5)$$

$$\Delta BFD_t = \beta_0 + \sum_{i=1}^{n} \beta_{1i} \Delta GDP_{t-1} + \sum_{i=1}^{n} \beta_{2i} \Delta BFD_{t-1} + \sum_{i=1}^{n} \beta_{3i} \Delta SAV_{t-1} + \sum_{i=1}^{n} \beta_{4i} \Delta INV_{t-1} + \beta_5 ECM_{t-1} + \mu_{2t} \quad (6)$$

$$\Delta SAV_t = \delta_0 + \sum_{i-1}^{n} \delta_{1t} \Delta GDP_{t-1} + \sum_{i=1}^{n} \delta_{2i} \Delta BFD_{t-1} + \sum_{i=1}^{n} \delta_{3i} \Delta SAV_{t-1} + \sum_{i=1}^{n} \delta_{4i} \Delta INV_{t-1} + \delta_5 ECM_{t-1} + \mu_{3t} \quad (7)$$

$$\Delta INV_t = \vartheta_0 + \sum_{i=1}^{n} \vartheta_{1i} \Delta GDP_{t-1} + \sum_{i=1}^{n} \vartheta_{2i} \Delta BFD_{t-1} + \sum_{i=1}^{n} \vartheta_{3i} \Delta SAV_{t-1} + \sum_{i=1}^{n} \vartheta_{4i} \Delta INV_{t-1} + \vartheta_5 \Delta ECM_{t-1} + \mu_{4t} \quad (8)$$

Where:

GDP = growth rate of real gross domestic product (a proxy for economic growth)

BFD =share of M2 in GDP (a proxy for bank-based financial development)

SAV = share of gross savings in GDP (a proxy for savings investment)

INV = share of gross fixed capital formation in GDP (a proxy for investment)

ECM = Error-correction term

$\alpha_0, \beta_0, \delta_0,$ and $\vartheta_0 =$ respective constants; $\alpha_1 - \alpha_5, \beta_1 - \beta_5, \delta_1 - \delta_5$ and $\vartheta_1 - \vartheta_5 =$ respective coefficients; $\Delta =$ difference operator; n = lag length; t = time period; and $\mu_{it} =$ mutually uncorrelated white noise residuals.

4.3 Data Sources

This study is based on annual time-series data from 1980 to 2014. The data sources for this study are the United Nations Conference on Trade and Development (UNCTAD), the National Bank of Ethiopia and the International Monetary Fund (IMF). Growth rate of real GDP, nominal GDP and real gross fixed capital formation data was obtained from UNCTAD (UNCTAD, 2016), while M2 data was sourced from the National Bank of Ethiopia (NBE 2016b). Savings data was collected from the IMF (IMF, 2016).

5. ECONOMETRIC ANALYSIS AND EMPIRICAL FINDINGS

5.1 Stationarity Tests

The ARDL procedure does not require pre-testing the variable for unit-root. However, the stationarity test provides guidance as to whether ARDL is applicable or not, since it is only appropriate for the analysis of variables that are integrated of order one [I(1)] and below. Therefore, before any analysis is done, the variables are first tested for stationarity using the Dickey-Fuller generalised least squares (DF-GLS) and Perron (1997) (PPURoot) unit-root tests. The PPURoot test was employed to cater for possible structural breaks within the data set. The results of stationarity tests for all the variables are presented in Table 1.

TABLE 1 - *Stationarity Tests of all Variables*

Panel A: Dickey-Fuller generalised least squares (DF-GLS)				
Variable	**Stationarity of all Variables in Levels**		**Stationarity of all Variables in First Difference**	
	Without Trend	With Trend	Without Trend	With Trend
GDP	-3.76***	-5.05***	-	-
BFD	-1.14	-1.09	-4.92***	-5.36***
SAV	0.59	-1.85	-7.80***	-7.86***
INV	0.49	-2.17	-7.09***	-7.22***
Panel B: Perron, 1997 (PPURoot)				
Variable	**Stationarity of all Variables in Levels**		**Stationarity of all Variables in First Difference**	
	Without Trend	With Trend	Without Trend	With Trend
GDP	-4.61	-4.56	-8.11***	-8.12***
BFD	-4.91	-4.11	-6.01***	-7.06***
SAV	-5.01	-5.12	-7.14***	-7.18***
INV	-3.05	-3.18	-7.68***	-7.94***

Note: *** denotes stationarity at 1% significance level.
See the appendix for the PPURoot break dates.

The results of the stationarity tests reported in Table 1 confirm that all the variables are integrated of order one, except GDP, which is integrated of order zero, but only when DF-GLS test is employed – as shown in Panel A of the table. This confirmation implies that the ARDL approach to cointegration can be applied.

5.2 Cointegration

This section examines the long-run relationship between the variables in the specified model – in equations (1-4) – using the ARDL bounds-testing approach. First, the order of lags on the first differenced variables in the equations is determined. This is followed by the application of bounds F-test to equations (1-4), in order to establish whether a long-run relationship between the variables under study exists or not. Taking equation 1 as an example, the null hypothesis of no cointegration, expressed as H_0: $\alpha_5 = \alpha_6 = \alpha_7 = \alpha_8 = 0$, is tested against the alternative hypothesis of cointegration, expressed as H_1: $\alpha_5 \neq \alpha_6 \neq \alpha_7 \neq \alpha_8 \neq 0$.

In the stage that follows, the calculated F-statistic is compared with the critical values provided by Pesaran *et al.* (2001). If the calculated F-statistic is above the upper bound level, the null hypothesis of no cointegration is rejected and it is concluded that the variables in question are cointegrated. In the event that the calculated F-statistic is below the lower bound level, the null hypothesis of no cointegration is accepted and it follows that the variables are not cointegrated. However, if the calculated F-statistic falls within the upper and the lower bound levels, the results are inconclusive. The results of the bounds F-test for cointegration are displayed in Table 2.

TABLE 2 - *Bounds F-Test for Cointegration*

Dependent Variable	**Function**		**F-statistic**		**Cointegration Status**	
GDP	F(GDP|BFD, SAV, INV)		6.97***		Cointegrated	
BFD	F(BFD| GDP, SAV, INV)		2.70		Not cointegrated	
SAV	F(SAV| GDP, BFD, INV)		2.28		Not cointegrated	
INV	F(INV| GDP, BFD, SAV)		2.20		Not cointegrated	
Asymptotic Critical Values						
Pesaran *et al.* (2001), p.300 Table CI(iii) Case III	1%		5%		10%	
	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
	4.29	5.61	3.23	4.35	2.72	3.77

Note: *** denotes statistical significance at 1% level.

The ECM-based cointegration results, displayed in Table 2, reveal the presence of a unique cointegrating vector. The existence of cointegration between the variables suggests that there must be Granger-causality in at least one direction. However, it does not indicate the direction of causality between these variables (see Narayan and Smyth, 2004; Odhiambo, 2009b, among others). While the short-run causality is dictated by the F-statistics on the explanatory variables, the long-run causality is determined by the error-correction term. It should also be noted that even though the error-correction term has been included in all the Granger-causality equations [equations (5) to (8)], only equations where the null hypothesis of no cointegration is rejected

will be estimated with an error-correction term (see also Narayan and Smyth, 2004; Odhiambo, 2009b).

There are four *a priori* possibilities regarding the causality between bank-based financial development and economic growth. There can be unidirectional causality flowing from bank-based financial development to economic growth or unidirectional causality flowing from economic growth to bank-based financial development. Alternatively, there can be bidirectional causality between bank-based financial development and economic growth. There is also a possibility of finding no causality at all between the two.

5.3 Granger-Causality Results

The cointegration results have revealed that there is a long-run relationship between variables in the specified Granger-causality model. What follows is the testing of ECM-based Granger-causality using the ARDL approach, including the lagged error-correction term in the relevant regression equation (equation 5). The results of the causality test based on the error-correction mechanism are presented in Table 3.

TABLE 3 - *Results of Granger-Causality Tests*

Dependent Variable	**F-statistics [probability]**				ECT_{t-1} **[t-statistics]**
	ΔGDP_t	ΔBFD_t	ΔSAV_t	ΔINV_t	
ΔGDP_t	-	5.140** [0.032]	4.710** [0.039]	0.172 [0.682]	-0.811*** [-4.150]
ΔBFD_t	3.878* [0.059]	-	0.803 [0.378]	0.004 [0.951]	-
ΔSAV_t	0.028 [0.868]	0.285 [0.599]	-	1.686 [0.207]	-
ΔINV_t	0.115 [0.738]	3.831* [0.061]	0.463 [0.502]	-	-

Note: *, ** and *** denote statistical significance at 10%, 5% and 1% levels respectively .

As reported in Table 3, the empirical results show that while there is bidirectional causality between economic growth and bank-based financial development in the short run in Ethiopia, in the long run there is unidirectional causality from bank-based financial development to economic growth. The short-run results are confirmed by the F-statistics of ∆GDP and ∆BFD in the bank-based financial development function and the economic growth function respectively, and are statistically significant. The long-run results, on the other hand, are confirmed by the error-correction term (ECM_{t-1}) in the economic growth function, which is negative and statistically significant. These results are consistent with empirical literature on the subject. For bidirectional causality between bank-based financial development and economic growth, see Sinha and Macri (2001), Shan and Jianhong (2006) and Abu-Bader and Abu-Qarn (2008), among others. For finance-led growth, see Christopoulos and Tsionas (2004), Majid (2008) and Odhiambo (2009a), among others.

The results also reveal the presence of a distinct unidirectional Granger-causal flow from savings to economic growth in the study country. These results are supported by the F-statistic of ∆SAV in the economic growth function that is statistically significant, as well as the error-correction term in the same function that is both negative and statistically significant.

The results further reveal that in Ethiopia, there is unidirectional Granger-causality from bank-based financial development to investment. These results apply only in the short run, as there is no causal relationship established between the two in the long run. However, no causality was found between economic growth and investment; bank-based financial development and savings; and between savings and investment. Although these results were largely unexpected, they are not unusual. They find support in earlier work by Mandishekwa (2014), Gungor *et al.* (2014) and Esso (2010), respectively.

From a policy perspective, both pro-growth and pro-banking sector policies are recommended in the short run, since bank-based financial development and economic growth are mutually causal in the short run. However, in the long run, banking sector enhancing policies are recommended because it is the banking sector that propels the real sector in Ethiopia in the long run.

6. Conclusion

In this study, the causal relationship between bank-based financial development and economic growth in Ethiopia has been examined for the period from 1980 to 2014. Unlike the majority of previous studies on the subject, this study has used savings and investment as intermittent variables to address the omission of variable bias, thereby creating a multivariate Granger-causality model. Although it is now well known that a financial system is composed of bank-based and market-based segments, the majority of previous studies concentrated on the relationship between economic growth and financial development in general. This generalisation, however, may not necessarily apply for a country like Ethiopia, whose financial sector is largely dominated by bank-based financial institutions. Using the ARDL bounds testing approach to cointegration and the ECM-based Granger-causality tests, the study finds that in the short run, both financial development and economic growth Granger-cause each other in Ethiopia. However, in the long run, there is unidirectional Granger-causality from bank-based financial development to economic growth. The study, therefore, recommends that policies aimed at enhancing both economic growth and financial development should be pursued in the short run. However, in the long run, policies that target the development of the banking sector should be prioritised in order to ensure a sustained growth path.

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APPENDIX

PPUROOT BREAK DATES

Perron, 1997 (PPURoot) break dates				
Variable	Stationarity of all Variables in Levels		Stationarity of all Variables in First Difference	
	Without Trend	With Trend	Without Trend	With Trend
GDP	2002	1993	1992	1992
BFD	2007	2001	2004	2007
SAV	2009	2004	2006	2006
INV	1989	1997	1992	1992