

# The Relationship Between Financial Development and Economic Growth in The United Kingdom: A Granger Causality Approach

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## Abstract

This study aims to investigate the causal relationship between financial development and economic growth in the UK using quarterly data from 1963q1 to 2015q1. Three variables were used as proxies for financial sector development, namely, ratios of broad money supply to GDP, ratios of private sector credit to GDP and the ratios of stock market capitalization to GDP. Economic growth was measured using real GDP per capita. In order to achieve stated aim, the study employed the Johansen Cointegration test and the Granger causality test within a vector error correction framework (VEC) to test for the existence (or not) of a long run relationship as well as the direction of causality between financial development and economic growth. The result from the Cointegration test indicates that there is a stable long run equilibrium relationship between financial development and economic growth in the UK. The Granger causality test presents evidence of a bidirectional causality. This suggests that financial development and economic growth are mutually causal, that is, causality runs from both side which is in line with the feedback hypothesis in the literature which argue that financial development and economic growth exhibits a two-way causal relationship. In terms of each individual variable, the study finds that while bank credit to the private sector and stock market capitalisation Granger cause GDP per capita, GDP per capita on the other hand, Granger causes broad money supply.

*Keywords:* Granger Causality, Financial Development, Economic Growth, UK, Vector Error correction Model

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## 1. Introduction

### 1.1 Background to study

The link between financial development and economic growth has been a subject of sustained academic and policy debate for a long time now. A wealth of literature has addressed this issue by either cross country or time series analysis. However, until date, the causal relationship between financial development and economic growth has remained inconclusive in the empirical studies. While some studies have found the direction of causality running from financial developments to economic, some other studies have found the direction of causality running from economic growth to financial development. However, some other studies have also reported the existence of bidirectional causal relationship between financial development and economic growth. Till date, the finance-growth relationship has remained inconclusive in the empirical studies.

Against this background, this study attempts to shed further light on the causal relationship between financial developments and economic growth in the context of the UK economy. The motivation for this study lies in the fact that despite the significant amount of work done regarding this topic area, only very few time series studies have been conducted in the UK economy. Hence, this study attempts to fill that knowledge gap by investigating empirically whether financial development causes (in Granger causality sense) economic growth or vice versa. The recent global

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financial crisis of 2008/9 has shown how important the financial system is to the real economy. The UK economy was literally brought to a standstill in the aftermath of the credit crunch and until now, the economy is still struggling to fully recover from the shock. As one of the most highly developed financial system in the world, the UK's financial system plays a very important role in enhancing economic activities not only within the UK but also to the global economies. In 2014, the financial and insurance services accounted for 8.0% of the UK's total gross value added (GVA) and supports around 3.4% of total jobs created in the economy (Tyler, 2015). More also, trade in financial services makes up a substantial proportion of the UK's trade surplus in services. The growth of the UK's banking sector is evidenced by growth in private sector credit extension from 50% of GDP in 1975 to a peak of 229.2% in 2009 (World Bank, 2012).

### *1.2 Research Objectives*

There are two main objectives which this study intends to fulfil. They are as follow:

- To understand the long run and short run dynamic relationship between financial development and economic growth in the UK.
- To identify the direction of causation between financial development and economic growth in the UK.

### *1.3 Research questions*

Following the objectives, the following research questions have been posed:

- What is the nature of the long run relationship between financial development and economic growth in the UK?
- What is the direction of causality between financial development and economic growth in the UK?

### *1.3 Research Significance*

This piece of work is very significant to both policy makers and academic practitioners. To the policy makers, the findings from this study will offer some insight on the various channels through which financial development impacts on economic growth and vice versa. Such knowledge will be significant for an effective and efficient policy purposes. To the academic practitioners, this study can be a starting point for further research into the relationship between financial development and economic growth.

### *1.4 Statement of Problem*

The main issue which this piece of work seeks to address is the question of whether it is financial development that causes economic growth or whether it is the growth of the real sector of the economy that drives financial development in the UK. In order to tackle this question, this study will employ the Granger causality test which will be explain in detail in later chapters.

## **2. Literature Review**

### *2.1 Economic Growth*

Economic growth can be described as the positive and sustained increase in aggregate goods and services produced in an economy within a given time period (Uwakaeme, 2015). In the economic literature, there are many measures of economic growth, but for the sake of this study, economic growth will be measured by increase in the level of real gross domestic product (GDP) per capita. High per capita Growth rate is usually associated with increased standard of living in a country. (Tyavambiza & Nyangara, 2015).

## 2.2 Financial Development

The financial system comprises of banks, financial markets, market infrastructures, central bank, as well as regulatory and supervisory authorities. (www.imf.org, 2015). The Financial Development Report 2011, published by the World Economic Forum, defines financial development as the factors, policies, and institutions that lead to an effective financial intermediation and markets, as well as deep and broad access to capital and financial services (World Economic Forum, 2011). For the sake of this piece of work, financial development refers to the improvement and growth in the activities of financial institutions such as banks and the stock market. Banks are financial institutions that accept deposits and make loans (Mishkin, 2007). According to Abubakar and Gani (2013), the primary function of banks is financial intermediation. That is, accepting deposits from customers and loan the fund out to those who have investment need of them. Stock market, on the other hand, acts as a mechanism through which firms can raise long term funds to expand their productive base. Thus, banks and the stock market help to transfer financial resources from surplus units of the economy to deficit units. It is argued that a robust and efficient financial system promotes economic growth by channelling resources to their most productive uses and fostering a more efficient allocation of resources. A stronger and better financial system can also lift growth by boosting the aggregate savings rate and investment rate and speeding up the accumulation of physical capital (Kenourgios & Samitas, 2007). A strong financial system offers risk diversification and effective capital allocation (Habibullah & Eng, 2006).

## 2.3 Financial Development and Economic Growth Theory

The theoretical link between financial development and economic growth can be summarised into three different conflicting hypotheses. These are explained below.

### 2.3.1 The Supply-leading Hypothesis

The supply-leading hypothesis posits that it is the development of the financial sector that drives the real sector of the economy. Supporters of this view (McKinnon, 1973; Shaw, 1973 and Schumpeter, 1934) maintain that financial institutions and markets trigger economic growth through efficient allocation of financial resources to the most productive investment (Calderon & Liu, 2003). According to Levine (2005), financial institutions and market can foster economic growth via several channels: (1) by easing the exchange of goods and services through the provision of a payment system which enables economic agents to pay for goods and services, thereby facilitating trade in the economy. (2) Mobilising and pooling savings from savers and thus, make the proceeds from such fund available for firms with investment need of fund. This helps to boost aggregate investment and growth. (3) Acquiring and processing information about enterprises and possible investment projects, thus enhancing efficiency in the allocation of investment funds in the economy. (4) Monitoring investment and carrying out corporate governance, and (5) diversifying, increasing liquidity and reducing risk. According to Levine, each of these functions can influence aggregate savings and investment decisions and hence economic growth (Caporale, Rault, Sova, & Sova, 2009).

### 2.3.2 The Demand-following Hypothesis

In contrast to the supply-leading hypothesis, the demand-following hypothesis contends that it is growth of the real sector of the economy that accelerates financial development. Robinson (1952) attempted to challenge Schumpeter's view by arguing that it is the development of the real sector (economic growth) that drives financial development. According to this view, lack of financial growth is a manifestation of a lack of demand for financial services. Therefore, as the real side of the economy develops, its demands for various new financial services emerges, and these are met rather passively from the financial side. This view is also supported by Gurley and Shaw (1967), Goldsmith (1969) and Jung (1986) who argue that as countries rise along the scale of wealth and income, their financial structures usually become increasingly rich in financial assets, institutions, and markets. From this line of reasoning, the direction of causation runs from economic growth to financial development.

### 2.3.3 The Feedback Hypothesis

The feedback hypothesis argues that there is a bidirectional causal relationship between financial development and economic growth. Patrick, (1966) reconciled the two conflicting theories above by arguing that the direction of causality between financial development and economic growth changes over the course of a country's stage of development. In his view, financial development induces economic growth during the first phases of development. However, this effect gradually diminishes all along the development process till it reverses back. Thus, according to Patrick (1966), the supply-leading pattern dominates during the early stages of economic development, while the demand-following pattern dominates at later stages.

## 2.4 Empirical Studies

This section will examine some of the empirical studies that have been conducted in a bid to testing the three hypothesis explained above. Goldsmith, (1969) studies the relationship between financial development and economic growth in 35 countries from 1860 to 1963. Using the ratio of bank assets to GDP as a proxy for financial development, the result shows a strong evidence that financial development accelerates economic growth. Similarly, King and Levine (1993) study the relationship financial development and economic growth using endogenous growth model. The authors use three indicators of financial development namely – the ratio of liquid liabilities to GDP, the ratio of bank credit to the sum of bank and central bank credit and the ratio of private credit to GDP. In accordance with the findings of Goldsmith, the result confirms that financial development causes economic growth.

However, in a cross-country analysis, Jung (1986) investigates the finance-growth relationship for 56 countries, including 19 industrialised countries. The ratio of currency to narrow money supply (M1) and the ratio of broad money supply (M2) to GDP were used as proxies for financial development. The result of the study reveals that the direction of causality between financial development and economic growth differ between developed and developing countries. According to the study, in less developed countries, financial development causes economic growth, whereas in developed countries, economic growth causes financial development. Similarly, Odedokun (1996) in a time-series regression analysis for 71 countries for the periods 1960-80 finds further evidence that the impact of financial development is higher on low-income countries than in high-income countries. Based on the above assertion by Jung and Odedokun that the causal relationship between financial development and economic growth differ between developed and developing countries, the literature will be divided accordingly to see if this pattern is replicated in most of the papers that will be reviewed.

### 2.4.1 Empirical Studies for Developed Countries

Rousseau and Wachtel (1998) examine the links between the intensity of financial intermediation by banks and economic performance in five developed countries (USA, UK, Norway, Canada, and Sweden) over the period 1870-1929. Using Vector-error correction models, they find evidence that financial development causes economic growth in those countries which contradicts the earlier assertion by Jung (1986) and Odedokun (1996). In a different finding, Arestis and Demetriades (1997) use time series analysis and Johansen co-integration analysis to explore the direction of causality between financial development and economic growth in the USA and Germany. For Germany they found a positive effect of banking development on growth. However, in the USA, the result indicates that real GDP growth contributes to both the banking system and stock market development.

Shan, Moris and Sun (2001) use the Granger causality procedure within the framework of vector autoregressive (VAR) method to investigate the relationship between financial development and economic growth for nine OECD countries (Australia, Canada, Denmark, France, Japan, Italy, New Zealand, UK and USA) and China. They found that in the OECD countries (except the USA and Italy) there was no evidence of causality between financial development and economic growth. For the USA and Italy, it was found that economic growth granger causes financial development. In a subsequent research, Shan and Moris (2002) investigate the relationship between financial development and economic growth in 19 OECD countries and China using quarterly data. The result shows that in ten

countries (Canada, Finland, Greece, Ireland, Italy, the Netherlands, New Zealand, Norway, Spain and Sweden), there was no evidence of causality in either direction between financial development and economic growth in these countries. Whereas, in six countries (Australia, Denmark, France, Japan, Switzerland and the USA) they found evidence of a bidirectional causality. In other two countries (China and South Korea) there was evidence of one-way causality from economic growth to financial development while in Portugal and the UK, the causality runs from financial development to economic growth.

Apergis, Filippidis and Economidou (2007), examine whether a long-run relationship between financial development and economic growth exists in 15 OECD countries (Australia, Belgium, Canada, Denmark, Finland, Germany, Ireland, Italy, Japan, New Zealand, Norway, Sweden, Switzerland, United Kingdom and United States) and 50 non-OECD countries over the period 1975–2000. The findings from the Granger causality test presents evidence of a bidirectional causality between financial development and economic growth in those countries. In a study covering the period of 1970-91, Neusser and Kugler (1998) examine the relationship between financial development and manufacturing growth for 13 OECD countries. The result of the study showed that there is a positive relationship between financial development and manufacturing growth but that the underlying relationship varies widely across different countries. Petkovski and Kjosevski (2014) examine whether banking sector development promote economic growth for selected countries in Central and South Eastern Europe. Using a generalised method of moment's dynamic panel method, the results shows that credit to the private sector and interest margin are negatively related to the economic growth, while the ratio of quasi money is positively related to economic growth. In eighteen Latin America, Blanco (2009) analyses the relationship between financial development and economic growth, covering the period 1962 to 2005. Using Granger causality test in a VAR framework, the author found that economic growth causes financial development in those countries. However, Bittencourt (2012) investigates the role of financial development in generating economic growth in four Latin American countries between 1980 and 2007. The results, based on panel time-series data analysis, confirms that financial development promote economic growth.

In a time-series analysis in the UK, Vazakidis and Adamopoulos (2011), examine the long-run relationship between financial development and economic growth for period of 1965-2007. The author used domestic bank credits to private sector as a % GDP and the general stock market index as measure of financial development. The result from the vector error correction model indicates that there is a bilateral causal relationship between economic growth and stock market index. In terms of the variables, the analysis shows that economic growth Granger causes credit market development while stock market index causes economic growth in the UK. This study suggest that stock market development has larger effect on economic growth than credit market development in UK. In contrast, Fethi & Katircioglu (2015) investigate the relationship between stock market/banking sector development and economic growth in the UK from the period 1965Q1 to 2011Q4. Using seasonal error correction modelling framework, the study finds a contrary evidence that the financial sector causes economic growth in the UK both in the short run and long run. In a different study, Nyasha and Odhiambo (2015) examine the dynamic impact of both bank and market-based financial development on economic growth in the UK during the period 1980 to 2012, using the autoregressive distributed lag bounds testing approach. The empirical results of this study show that while market-based financial development has a positive impact on economic growth in the UK, bank-based financial development has a distinct negative impact.

From all the papers reviewed above, it has been observed that there is no distinctive causal relationship between financial development and economic growth in the developed countries under study. What has been observed is a mixture of contradictory findings which to a greater extent reflects the differences in the country of study as well as according to the variables and the method of empirical analysis used. This goes to contradict the assertion that economic growth Granger causes financial development in developed countries.

#### 2.4.2 Empirical Studies for Less Developed Countries

Neimke (2004) found that in transitional economies, financial development had an impact on economic growth through improved investments and total factor productivity, which are two major channels of transmission. In a similar findings, Ahmed and Ansari (1998) investigate the relationship between financial sector development and economic growth for three major South-Asian economies, namely, India, Pakistan and Sri Lanka. Bank-based financial sector development was proxy by the ratio of money supply to nominal GDP, ratio of quasi-money to nominal GDP and the ratio of domestic credit to nominal GDP. The results from the causality analysis indicates that financial development Granger causes economic growth. Furthermore, Darrat (1999) examines the causal link between the degree of financial deepening and economic growth in three middle eastern countries (Saudi Arabia, Turkey, and the United Arab). Using the ratio of currency to money supply and the ratio of broad money to GDP as financial development indicators, the study generally supports the view that financial deepening is a necessary causal factor of economic growth but that the strength of the evidence varies across countries and across the proxies used to measure financial deepening. Similarly, Pradhan (2009) examines the relationship between banking sector development, stock market development, economic growth, and four other macroeconomic variables in ASEAN countries for the period 1961–2012. Using a panel vector auto-regressive model for testing the direction of causalities, the study finds the presence of both unidirectional and bidirectional causality links between these variables.

Fase and Abma (2003) use individual country time-series data to study the relationship between financial development and economic growth in eight Asian countries. The results were in support of the feedback hypothesis. Similarly, Shan and Jianhong (2006) use a vector autoregressive (VAR) approach to examine the impact of financial development (proxy by total credit) on economic growth in China. Variance decomposition and impulse-response function analysis was applied to examine the interrelationships between variables in the VAR system. The study supported the view that financial development and economic growth exhibit a two-way causality. Also, Sinha and Macri (2001) analyse the relationship between financial development and economic growth, using time-series data for eight Asian countries. Bank-based financial development was proxy by the growth of money supply (M1 and M2) and the growth rate of domestic credit as a ratio of GDP. The regression results show a positive and significant relationship between the economic growth variables and the financial development variables for India, Malaysia, Pakistan and Sri Lanka. The multivariate causality tests show a two-way causal relationship between the economic growth and the financial development variables for most of the countries.

In an empirical analysis, Ghali (1999) examines the question of whether financial development leads to economic growth in Tunisia. The author used the ratio of bank-deposit liabilities to nominal GDP and the ratio of bank claims on the private sector to nominal GDP as proxies for financial development. The results indicate the existence of a stable long-run relationship between the development of the financial sector and per capita real output. However, Boulila and Trabelsi (2002) found that financial reforms in Tunisia changed the pattern of causality from growth to finance in the pre-reform period to bi-directional causality in the post-reform period.

Using annual data from 1975-2005 for Turkey, Ozturk (2008) found that there is no long-run relationship between financial development and economic growth and the results show a one-way causality running from economic growth to financial development. However, in Morocco, Fatima (2004) explores the causality issue between financial development and economic growth for the period 1970-2000. The study employs three proxies for financial development namely - ratio of liquid liabilities (M3) to GDP, domestic credit provided by the banking sector as a percent of GDP and ratio of domestic credit to the private sector to GDP. They found unstable short-term, rather than long-term causality relationship between finance and growth. In a subsequent study, Fatima (2004) examines the causal relationship between bank-based financial development and economic growth in Morocco for the period 1970-2000. The ratio of liquid liabilities (M3) to GDP, the ratio of domestic credit provided by the banking sector to GDP and the domestic credit to the private sector to GDP were the financial depth indicators that were used in this study. Based on the Granger causality test, the study found an unstable short-run relationship between financial development and economic growth, with causality running from bank-based financial development to economic growth. Wood

(1993) investigates the causal relationship between financial development and economic growth in Barbados, using the ratio of money supply (M2) to GDP as a proxy for financial development. The results were in favour of the feedback response. That is, bank-based financial development and economic growth mutually cause each other. Similarly, Akinboade (1998) tested for causality between financial development and economic growth in Botswana, using the annual time-series data. The ratio of bank claims on the private sector to nominal non-mineral GDP and the ratio of bank-deposit liabilities to nominal non-mineral GDP were used to measure financial development. The results showed that financial development and economic growth in Botswana are mutually causal.

Similarly, Al-Yousif (2002) also examines the nature and direction of the relationship between financial development and economic growth for 30 developing countries for the period 1970-1999. Using the ratio of currency to narrow money and the ratio of broad money to GDP as financial development indicators, the results strongly support the view that financial development and economic growth are mutually causal. That is, causality is bidirectional. Luintel and Khan (1999) use a multivariate vector auto-regressive framework to examine the relationship between bank-based financial development (proxy by the ratio of total deposit liabilities of deposit banks to one period-lagged GDP) and economic growth in a sample of ten less developing countries. The results showed a bidirectional causality between financial development and growth.

However, Calderon and Liu (2003) investigate the direction of causality between financial development and economic growth using decomposition test on pooled data of 109 developing and industrial countries from 1960 to 1994. Their empirical analysis adduce evidence that financial development generally leads to economic growth. In a similar result, Jalilian and Kirkpatrick (2002) explore the link between financial development and economic growth in 42 countries (26 developing and 16 developed countries) using bank-deposit money assets as a proxy for financial development. They utilised a pooled-panel data approach with both a time series and a cross-section dimension within the simple ordinary least squares (OLS), panel and two-stage least square frameworks. The results were consistent with the supply led hypothesis. In addition, Chistopoulos and Tsionas (2004) use dynamic panel and threshold co-integration tests to investigate the relationship between financial deepening and economic growth in ten developing countries. Modified Ordinary Least square regression was used to estimate the long run relationship among the variables. They found evidence that financial deepening Granger cause economic growth. Shabri and Majid (2008) examine the finance-growth nexus during the post-1997 financial crisis in Malaysia, using time-series data. The ratio of total bank-deposit liabilities to nominal GDP was used to proximate financial development. Granger causality tests revealed a unidirectional causality running from finance to growth, thus supporting the supply-leading view. Rachdi and Mbarek (2011) study the direction of causality between finance and growth based on a sample of ten countries, six from the OECD region and four from the Middle East and North Africa (MENA) region during 1990-2006. Panel data Cointegration analysis confirmed a long-term relationship between financial development and economic growth for the OECD and the MENA countries. The results further showed that causality is unidirectional for the MENA countries, from economic growth to financial development.

Samargandi, Fidrmuc and Ghosh (2013), investigate the relationship between financial development and economic growth in 52 middle income countries over the period of 1980–2008. Using pooled mean group estimations in a dynamic heterogeneous panel setting, the result indicates that there is an inverted U-shaped relationship between finance and growth in the long run. In the short run, the relationship is insignificant. This suggests that too much finance can exert a negative influence on growth in middle-income countries. However, Kar, Nazlıoğlu and Ağır (2011) investigate the direction of causality between financial development and economic growth in Fifteen Middle East and North African countries for the period 1980–2007. The study used six proxies for financial development namely - the ratio of narrow money to GDP, the ratio of quasi money to GDP, the ratio of M2 to GDP, the ratio of deposit money bank liabilities to GDP, the ratio of private sector credit to GDP and the ratio of domestic credit to GDP. The empirical result showed that there is no clear consensus on the direction of causality between financial development and economic growth for all measurements of financial development and it is also observed that the findings are country specific.

Ang (2008) estimate 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 leads to higher output growth via promoting both private savings and private investment. In addition, Chang & Caudill (2005) examine the relationship between financial development and economic growth in Taiwan between the periods 1962 to 1998. Using Granger causality tests based on vector error-correction models (VECM), the result suggests a unidirectional causality running from financial development to economic growth. This result supports the supply leading hypothesis for Taiwan. Habibullah & Eng (2007) examine the causal relationship between financial development and economic growth of the Asian developing countries for the periods 1990–1998. The result shows that financial development promotes growth, thus supporting the old Schumpeterian hypothesis and Patrick's 'supply-leading' hypothesis. Similar findings was achieved by Lean and Song (2009) who examined the relationship between the growth of domestic savings and economic growth in China for the Period of 1955-2004. The result indicate that China's economic growth is found to have a long-running relationship with household savings and enterprise savings. However, the author found that while bilateral causality exists between the domestic savings growth and economic growth in the short-run, in the long-run, a unidirectional causality exists running from the domestic savings growth to the economic growth.

From all the paper examined above, it has been observed that there is no overriding consensus in findings regarding the causal relationship between financial development and economic growth. Another observation made is that each paper tended to use different time period, statistical methods and proxies use as financial development. This might explain the observed differences in findings. It is however, worthy to state here that researchers in this field are yet to reach a common agreement on the best proxy for measuring financial development as well as the best statistical method to employ.

### **3. Material and Methods**

#### *3.1 Data Source and Variables Measurement*

This study employs quarterly time series data covering a 52-year period from 1963q1–2015q1, making a total of 209 observations for each variable. The choice of a time series analysis (as against the use of a cross country analysis as it appear to be the case in most of the empirical literature) is based on the findings by Arestis and Demetriades (1997); Demetriades and Hussein (1996); Ghirmay, (2004) and Odhiambo (2009) who argue that the relationship between financial development and economic growth may be country-specific, and thus, the use of time series data as opposed to cross sectional data is more revealing. For the purpose of estimation, economic growth is measured using GDP per head at constant prices (GDPPC). This is a commonly measure of economic growth in the literature. This data is sourced from the website of the UK office for National Statistics (Office for National Statistics, 2016).

In terms of measuring financial development, the literature has identified several proxies of financial development. In this study, the author intends to use three measures of financial development that are popularly used. The first measure of financial development is bank credit to the private sector as a proportion of GDP (PSC). This measure captures the financial intermediation role played by banks in financing the private sector (King & Levine, 1993a; Demetriades & Hussein, 1996; Luintel & Khan, 1999). This proxy represents the banking sector side of the financial system. This data is sourced from BIS website (Bank of International Settlement, 2015).

Another measure of financial development used in this study is the ratio of broad money supply to GDP (BMS). This variable is traditionally used as a measure of size of the financial sector. All things been equal, an increase in this variable is an indication of growth in the size of the financial system in the economy. The M4 money supply is sourced from DataStream. In order to derive a ratio of M4 money supply to GDP, the author divided the M4 data by the UK gross domestic product (GDP) as it is commonly used in the literature.

The third proxy of financial development is the ratio of UK FTSE All-Share Price Index to GDP (FTSE). This is the stock market capitalization of about 98 percent listed companies in the London Stock Exchange. This Index is used to

measure the UK stock market development. The data is sourced from DataStream. To derive the ratio of FTSE All Share index to GDP, the author divided the FTSE data by the GDP data.

### *3.2 Econometric Techniques*

The objective of this study is to identify the short run and long run causal relationship between financial development and economic growth in the UK. To this end, this study proposes to use the Johansens Cointegration test to determine whether a long run relationship exist between financial development and economic. Johansen's (1988) multivariate maximum likelihood approach to co-integration is the most popular approach in estimating long-run economic relationship in the literature. This method is preferred over other alternative procedures because it allows for the possibility of more than one cointegrating relationship in a multivariate time series modelling. Also, in a Monte Carlo study it has been found that the Johansen's method perform best than other approaches of estimating a long-run equilibrium relationship if the sample size is fairly large, about 100 observations or more (Hargreaves, 1994). In this study, there are 209 observations for each variable and as a result, it is believed that the Johansen approach will be more appropriate.

To identify the direction of causality between financial development and economic growth, this study proposes to undertake the Granger causality test to test whether it is financial development that causes economic growth or vice versa. There are many alternative econometric models for testing Granger causality test. However, this study intends to use the two most used time series models in the literature. These are the vector error correction model (VEC) and the vector autoregressive model (VAR). The VEC model is used if the variables are found to be cointegrated. That is, when it has been established that the variables have a long run relationship. However, if there is no evidence of Cointegration among the variables, then the VAR model will be used to test for granger causality. Therefore, the choice of the econometric model to test for Granger causality test will be dependent on the outcome of the Johansen Cointegration test.

In this study, all the econometric regression and test will be carried out using Eview software. This software works great for analysing complex economic data analysis.

## **4. Results and Discussion**

The empirical analyses are presented in steps. The first step begins with an examination of descriptive statistics for all the variables. This will be followed by a unit root test which typically examines the stationary properties of the series and their order of integration. Subsequently, a Cointegration tests will be applied to determine the existence (or not) of a long run equilibrium relationship among the variables. The last step is the determination of causality between the financial development variables and economic growth.

### *4.1 Descriptive Statistics*

The main reason for the descriptive statistics is to examine whether the series follow a normal distribution or not. In econometrics, most of the statistical analysis and hypothesis testing procedures rely on the assumption that the variables follow the Gaussian normal distribution. A normal distribution has a symmetrical bell-shaped curve when represented diagrammatically. Also, a normal distribution has no skewness (i.e., the value of the skewness equals zero) and the value of the kurtosis equals three. If the variables are not normally distributed, then any hypothesis test carried out on them will be inaccurate and unreliable. However, the only exception to this rule is if the sample size is sufficiently large (usually more than 30 observations). This rule is called the central limit theorem. The implication of this rule is that even if the sample observations do not resemble a normal distribution, one can still obtain a good result provided the sample size is large.

The commonly used statistical test for determining the normality of a distribution is the Jarque-Bera test. The null hypothesis of the test is that the series are normally distributed while the alternative hypothesis is that the series are

not normally distributed. The decision rule is that if the probability value of the Jarque-Bera test is greater than 0.05 significance level, we accept the null hypothesis and infer that the series are normally distributed. On the other hand, if the probability values of the Jarque-Bera test is less than 0.05 significance level, we reject null hypothesis in favour of alternative hypothesis, meaning that the series do not follow a normal distribution. The table 1 contain the summary statistics for each of the variables after log transformation.

**Table 1.** Descriptive statistics for all the variables

	<b>LGDPPC</b>	<b>LBMS</b>	<b>LPSC</b>	<b>LFTSE</b>
Mean	8.387462	-0.021703	4.089239	-5.891377
Median	8.443762	0.328247	4.289089	-5.550061
Maximum	8.831420	1.710709	4.765587	-4.692081
Minimum	7.774015	-2.242431	3.310543	-7.932647
Std. Dev.	0.317777	1.265144	0.442302	0.941093
Skewness	-0.143115	-0.387504	-0.208204	-0.329651
Kurtosis	1.699087	1.775866	1.465822	1.519354
Jarque-Bera	15.45121	18.28002	22.00679	22.87671
Probability	0.000441	0.000107	0.000017	0.000011
Sum	1752.980	-4.535834	854.6510	-1231.298
Sum Sq. Dev.	21.00426	332.9226	40.69117	184.2163

#### **Variables description:**

LGDPPC = log of real GDP per capita

LBMS = log of broad money supply as a proportion of GDP

LPSC = log of bank credit to the private sector as a proportion of GDP

LFTSE = log of FTSE all share index as a proportion of GDP

In table 1, it appears that the four variables are not normally distributed since the probability value of the Jarque-Bera test for each variable is far less than 0.05 significance level. This conclusion is supported by the values of the skewness and kurtosis. The table shows that the value of skewness for each variable is less than zero, indicating that the series are negatively skewed. Also, the kurtosis value is less than three imply that the distribution of the series is flatter than a normal distribution. However, even though the variables are found to be statistically different from a normal distribution, we can rely on the central limit theorem and carry on with the assumption of normality since the sample size is sufficiently large (209 observations).

#### *4.2 Unit Root Test*

A unit root test is examined in this section to test for the stationary properties of the variables. Strictly speaking, a time series is said to be stationary if its mean and variance are constant over time (Banerjee, Dolado, Galbraith, & Hendry, 1993). When represented graphically, a stationary time series does not have a trend and/or does not wander too far without returning to its mean value. If a series is non-stationary then it can be pronounced as containing a stochastic trend or a unit root, or integrated. Stationarity checks are necessary because if two or more variables that are nonstationary are regressed against each other, the estimates from such regression may lead to spurious results. Spurious result occurs when the estimated coefficients from regressing nonstationary time series appear to be significant when in fact there is no true relationship between the variables (Hill, Griffiths, & Lim, 2012). This means

that we may achieve a result that looks good, but the least-squares estimates are not consistent, and the conventional tests of statistical inference will not hold.

If a series is not stationary, the number of times required to transform such a nonstationary series into a stationary one through differencing is known as the order of integration. For example, if all variables in this study are nonstationary at level but becomes stationary after first differencing, then the series will be said to be integrated of order one, often denoted as  $I(1)$ . The first step in checking whether a particular time series is stationary or not is to visually inspect the line graph of the series plotted over time. As earlier explained, if the graph of the series appears to have a trend or wander about, this might suggest that the series are nonstationary.

The line plots of the four variables used in this study are presented in figure 5. The graph shows that each one of the variables appear to be trending upward. That is, the variables are growing over time which also means that their mean value will differ from time to time. Hence, this visual inspection indicates that the variables are nonstationary. Having observed this, a formal test will be carried out to ascertain the validity of this claim. In this study, the unit root test will be carried out using the Augmented Dickey-Fuller unit root framework.

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Since the variables appear to be trending, the unit root test will be performed by specifying an autoregressive equation with both trend and intercept. The regression equation is presented below:

$$\Delta Y_t = c + \gamma Y_{t-1} + a_2 t + \varepsilon_t$$

where:

- $\Delta Y_t$  = the change in the variable (which in this case, represents any of the four variables)
- $C$  = the intercept parameter,
- $\gamma$  = the autoregressive parameter
- $a_2$  = the linear trend parameter.
- $\varepsilon_t$  = the white noise disturbance term.

The parameter of interest in the equation above is  $\gamma$  whereby if  $\gamma = 0$ , then the variable  $Y_t$  contains a unit root (not stationary). To generate the value of the parameter  $\gamma$  as well as its associated standard error, an ordinary least square will be applied to the regression equation. This will necessitate the desire to perform the following hypothesis.

Ho:  $\gamma = 0$  (Non-stationary time series)

Ha:  $\gamma < 0$  (Stationary time series)

Test statistic:

$$\frac{\hat{\gamma}}{s.e.(\hat{\gamma})}$$

Where  $\hat{\gamma}$  denotes the estimate of  $\gamma$  and  $s.e.(\hat{\gamma})$  is the standard error of  $\hat{\gamma}$  from the OLS regression output. The decision is based on comparing the computed value from the test statistics above with the appropriate critical value reported in the Dickey-Fuller tables. If the value of the computed test statistic is less than the associated critical value, then we reject Ho in favour of Ha. The inference will be that the series is stationary. However, if the value of the computed test statistic is greater or equal to the critical value then we do not reject Ho. Thus, the inference will be that the variable is not stationary.

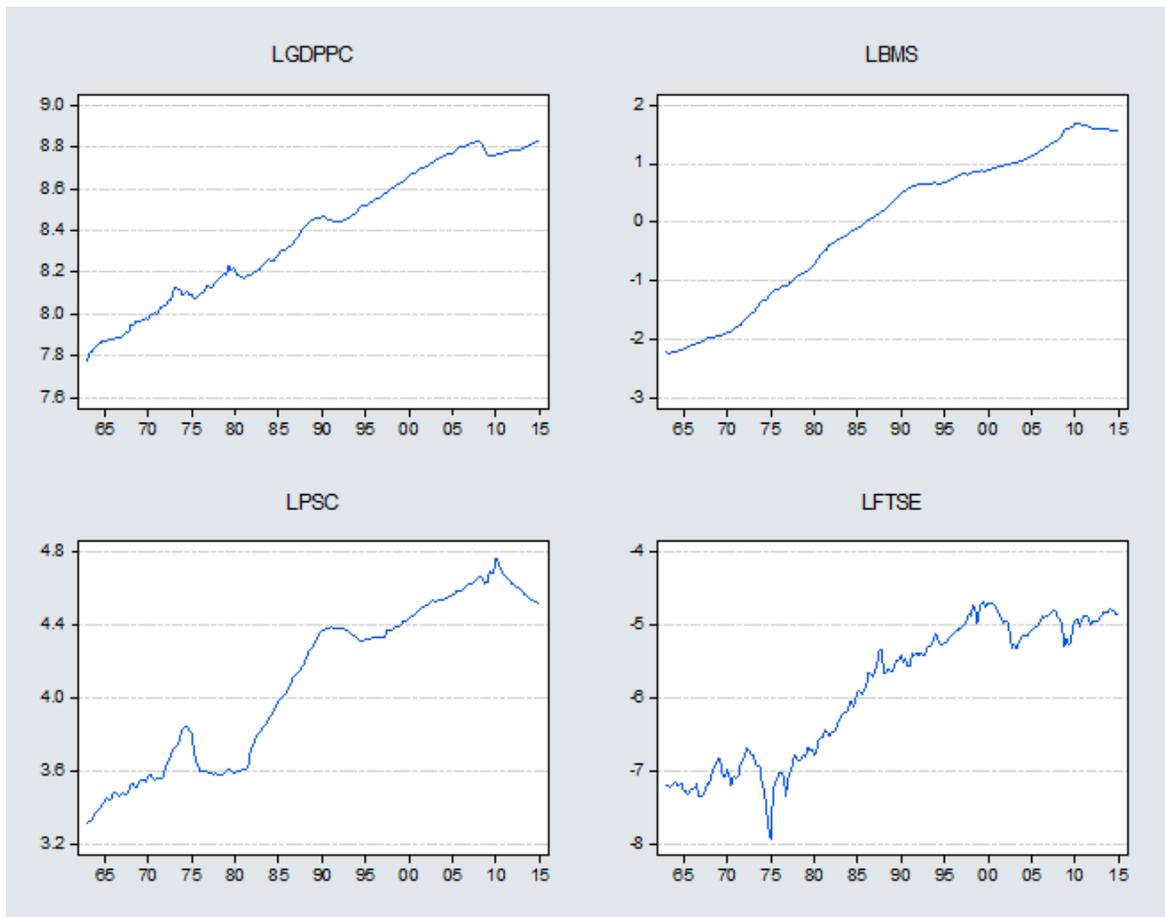
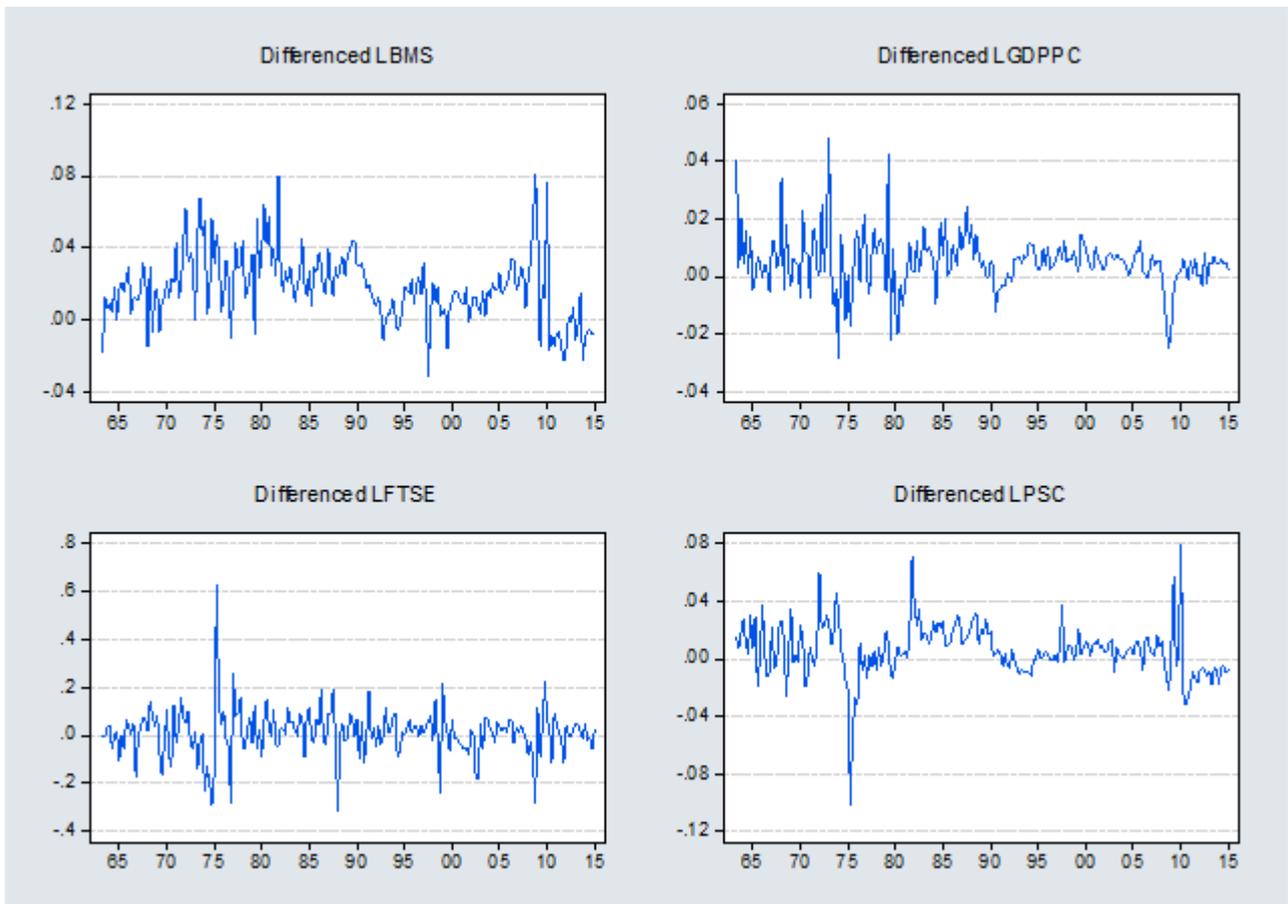


Fig. 1. Line Plots of the Variables in their log Form

The output in table 2 displays the summary result from the Dickey-Fuller unit root test at both level and first difference. The unit root test at level shows that all the variables are nonstationary at level since the value of the computed ADF test statistic for each variable is greater than their corresponding 5% critical value. On the other hand, the unit root test for the variables at first difference shows that all the variables are stationary at first difference. This confirms that the series are integrated of order one 1(1) since they become stationary by differencing them once.

**Table 2.** Augmented Dickey-Fuller unit root test at both level and first difference

Variables	Unit root test at Level			Unit root test at First difference		
	ADF t Value	Critical value 5 %	Decision	ADF t Value	Critical value 5 %	Decision
LGDPCC	-1.934151	-3.431896	Non-stationary	-13.24689	-3.431682	1(1)
LPSC	-1.665600	-3.431896	Non-stationary	-4.898183	-3.431896	1(1)
LBMS	0.899743	-3.431682	Non-stationary	-9.619267	-3.431682	1(1)
LFTSE	-1.972293	-3.431576	Nonstationary	-13.28706	-3.431682	1(1)



**Fig. 2.** Line Plots of the Variables in their First Difference

In figure 2, after taking the first difference, each one of the variables appears to oscillate around zero without drifting or trending. This confirms that the variables are integrated of order one  $I(1)$ .

#### 4.3 Cointegration test

Having found evidence that the variables are integrated of order one, the next step is to test whether they are cointegrated. If two or more series are themselves nonstationary, but a linear combination of them is stationary, then they are said to be cointegrated (Harris, 1995) Cointegration is a statistical term use to determine whether there is the existence of a long run relationship between nonstationary variables. When two or more variables are cointegrated, it means that the variables have a long run relationship. The Cointegration test will be undertaken using the Johansens Cointegration test. However, before carrying on with the actual Johansen Cointegration test, it is necessary to first determine the optimal lag length since the outcome of the test is very sensitive to the number of lags included.

##### 4.3.1 Lag Selection Criteria

There are various information criteria for determining the optimal lag length of any econometric time series models. Surprisingly, none of the information criteria is arguably superior to the others. However, one of the most used information criteria is the Akaike information criterion (AIC). AIC is a measure of the relative quality of statistical models for a given set of data. Given a collection of models for the data, AIC estimates the quality of each model, relative to each of the other models. AIC is sometimes preferred over other information criteria because of its asymptotic characteristic. That is, in large sample, AIC is relatively efficient. The table 3 presents the optimal lag for this study as indicated by the Akaike information criterion.

**Table 3.** Lag order selection criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	115.5942	NA	3.87e-06	-1.110390	-1.044653	-1.083790
1	1951.801	3581.059	5.27e-14	-19.22190	-18.89321	-19.08890
2	2003.533	98.83123	3.70e-14	-19.57744	-18.98580*	-19.33804*
3	2021.671	33.93124	3.62e-14	-19.59872	-18.74413	-19.25292
4	2038.481	30.77549	3.59e-14*	-19.60677	-18.48924	-19.15457
5	2054.496	28.68303	3.60e-14	-19.60692*	-18.22644	-19.04832
6	2068.115	23.85153	3.69e-14	-19.58324	-17.93980	-18.91823
7	2081.886	23.56706	3.79e-14	-19.56105	-17.65467	-18.78964
8	2101.391	32.60584*	3.67e-14	-19.59593	-17.42659	-18.71812

\* indicates lag order selected by the criterion

From the table 3, both the Schwartz information criterion (SC) and the Hannan-Quinn information criterion (HQ) chose lag two as the optimal lag order. Base on this, the Cointegration test will be carried out using two lags.

The output of the Johansens Cointegration test is presented in table 4. The left-hand column contains the four hypotheses of the test. ‘None’ indicates absence of a cointegrating relationship among the variables. ‘At most 1, 2 and 3’ indicate presence of at least one, two and three cointegrating relationship, respectively. For both the Trace test and the Max-Eigen value test, the decision rule is that if the probability value associated with the first hypothesis (none) is less than 0.05 significance level, we reject the hypothesis that there is no Cointegration among variables and infer that there is at least one cointegrating equations.

**Table 4.** Johansen and Juselius Cointegration Tests

Hypothesized No of Cointegrations	Trace Cointegration Test			Max-Eigen Cointegration Test		
	Trace Statistic	5 % Critical Value	Probability value	Max-Eigen Statistic	5 % Critical Value	Probability value
None *	54.94610	47.85613	0.0094**	31.55671	27.58434	0.0146**
At most 1	23.38940	29.79707	0.2275	12.29433	21.13162	0.5189
At most 2	11.09506	15.49471	0.2057	9.025823	14.26460	0.2840
At most 3	2.069238	3.841466	0.1503	2.069238	3.841466	0.1503

\* denotes rejection of the hypothesis at the 0.05 level

\*\*Both Trace and Max-Eigen Test indicate the existence of one cointegrating equations at 0.05 level

From the output in the tables 4, the hypothesis that there is no Cointegration among the variables is rejected since the probability values for the Trace and Max-Eigen tests are less than 0.05 significance level. Hence, both the maximum eigenvalue and trace tests confirm the existence of one Cointegrating equation. This result indicates that there exists a long run equilibrium relationship between economic growth and financial development in the UK for the period under study. This, however, does not imply any causality, it merely identifies that GDP growth and the financial development variables tend to be moving together in the same pattern over time.

**Table 5.** Normalised long run Cointegrating coefficients (LGDPPC)

	Coefficients	Standard error
LPSC	2.463854	0.90062
LBMS	0.513157	0.32240
LFTSE	-2.296430	0.40723

The output in table 5 is the normalised long run Cointegrating coefficients derived from the Johansens Cointegration test. It shows the long run effect of financial development proxies on economic growth. Since both the depended variable (LGDPPC) and the explanatory variables are in log form, the result can be interpreted in terms of elasticity. Thus, the output shows the responsiveness of economic growth to changes in the growth of the financial development proxies. Private sector credit (LPSC) and money supply (LBMS) have a positive relationship with economic growth as indicated by the sign of their coefficients. The value of their coefficients indicates that, holding other factors constant, a one percent increase in LPSC and LBMS will lead to a rise in GDP per capita growth by 2.46% and 0.51% respectively. This shows that both LPSC and LBMS have a strong positive impact on UK long run economic growth with LPSC having the greatest impact.

On the other hand, stock market index is shown to have a negative relationship with economic growth. The coefficient shows that, holding other factors constant, a one percent increase in the stock market index will lead to a decline in economic growth by -2.29 percent in the long run. This estimate does not seem to conform to priori expectation: conventional economic theory postulates a positive relationship between stock market and economic growth.

#### 4.4 Vector Error Correction Model

Since the variables under consideration are cointegrated, a Vector Error Correction Model (VEC) will be specified in order to investigate their short run dynamics in a condition of disequilibrium as well as the Granger causality test between economic growth and financial development. According to Engle and Granger (1987), if there is evidence of Cointegration between two or more variables, then a valid error correction model should exist between the variables. A vector error correction model is a restricted VAR designed for use with nonstationary series that are known to be cointegrated. The VEC has Cointegration relations built into the specification so that it restricts the long-run behaviour of the endogenous variables to converge to their cointegrating relationships while allowing for short-run adjustment dynamics (Hill, Griffiths, & Lim, 2012). The error correction model, as the name implies, test for the stability of the long run equilibrium relationship among the variables following a shock to the system in the short run. That is, it shows how fast the variables will achieve convergence to their long run equilibrium following a temporary disequilibrium condition. A multivariate vector error correction model is specified below:

$$\begin{aligned} \Delta LGDPPC_t &= \beta_0 - \pi ECT_{-1} + \sum_{i=1}^{n=2} \beta_{1i} \Delta LGDPPC_{t-i} + \sum_{i=1}^{n=2} \beta_{2i} \Delta LPSC_{t-i} + \sum_{i=1}^{n=2} \beta_{3i} \Delta LBMS_{t-i} + \sum_{i=1}^{n=2} \beta_{4i} \Delta LFTSE_{t-i} \\ &+ \epsilon_t \dots \dots \dots 1 \\ \Delta LPSC_t &= \alpha_0 - \pi ECT_{-1} + \sum_{i=1}^{n=2} \alpha_{1i} \Delta LPSC_{t-i} + \sum_{i=1}^{n=2} \alpha_{2i} \Delta LGDPPC_{t-i} + \sum_{i=1}^{n=2} \alpha_{3i} \Delta LBMS_{t-i} + \sum_{i=1}^{n=2} \alpha_{4i} \Delta LFTSE_{t-i} \\ &+ \epsilon_t \dots \dots \dots 2 \\ \Delta LBMS_t &= \lambda_0 - \pi ECT_{-1} + \sum_{i=1}^{n=2} \lambda_{1i} \Delta LBMS_{4t-i} + \sum_{i=1}^{n=2} \lambda_{2i} \Delta LGDPPC_{t-i} + \sum_{i=1}^{n=2} \lambda_{3i} \Delta LPSC_{t-i} + \sum_{i=1}^{n=2} \lambda_{4i} \Delta LFTSE_{t-i} \\ &+ \epsilon_t \dots \dots \dots 3 \\ \Delta LFTSE_t &= \gamma_0 - \pi ECT_{-1} + \sum_{i=1}^{n=2} \gamma_{1i} \Delta LFTSE_{t-i} + \sum_{i=1}^{n=2} \gamma_{2i} \Delta LGDPPC_{t-i} + \sum_{i=1}^{n=2} \gamma_{3i} \Delta LPSC_{t-i} + \sum_{i=1}^{n=2} \gamma_{4i} \Delta LBMS_{4t-i} \\ &+ \epsilon_t \dots \dots \dots 4 \end{aligned}$$

where:

- $\Delta$  = the difference operator
- LGDPPC = log of real GDP per capital
- LPSC = log of domestic credit by banking sector as a share of GDP
- LBMS = log of broad money supply as a share of GDP
- LFTSE = log of stock market capitalization as a share of GDP
- $\beta, \alpha, \lambda, \pi$  and  $\gamma$  = the parameters to be estimated
- ECT - 1 = represent the error correction term lagged one period
- $\epsilon_t$  = represent the independent residuals for each equation
- n = 2 = represents the total number of lags for each of the variables as indicated by Schwartz and Hannan-Quinn information criteria.

The four equations describe a system in which each variable is a function of its own lag and the lag of the other variables in the system. In this case, the system contains four variables: LGDPPC, LPSC, LBMS and LFTSE. In the first equation, LGDPPC is expressed as a function of its own lags and the lags of the other three variables. The same thing applies to the other equations. The essence of the VEC model above is to test the stability of the long run

relationship between financial development and economic growth. For the variables to maintain a stable long run relationship, at least one of the coefficients of the ECT-1 term ( $\pi$ ) should be significant with a negative sign. If this is not the case, then the inference will be that the long run relationship between financial development and economic growth is not stable as the variables will be bound to drift away from their long run path if there is a shock to the system. Also, the absolute value of  $\pi$  indicates the speed with which past disequilibrium in the system will be corrected in each subsequent time. The value of  $\pi$  is expected to lie between 0 and 1 inclusive, where a value of zero indicates that 0% of the disequilibrium in the system will be corrected every quarter). Whereas a value of one means that 100% of disequilibrium in the system are adjusted in the subsequent period. The summary result from the VEC model is presented in Table 6.

**Table 6.** Summary Output from the VEC Regression Equations

Regression coefficients	Equation 1 D(LGDPPC)	Equation 2 D(LPSC)	Equation 3 D(LBMS)	Equation 4 D(LFTSE)
ECT-1	-0.001713 [ 0.1735 ]	-0.026728 ** [ 0.0000 ]	0.001631 [ 0.1594 ]	-0.051007 [ 0.1177 ]
D(LGDPPC(-1))	-0.017068 [ 0.8384 ]	0.082349 [0.0883 ]	0.582196 ** [0.0001 ]	0.888547 [ 0.3467 ]
D(LGDPPC(-2))	0.095648 ** [ 0.0298 ]	0.248913 [0.0883 ]	0.217319 [0.1503 ]	0.803653 [ 0.3961 ]
D(LPSC(-1))	0.095648 ** [ 0.0226 ]	0.291141 ** [0.0001 ]	-0.145352 [0.0532 ]	-0.132393 [ 0.7781 ]
D(LPSC(-2))	-0.002926 [ 0.9434 ]	-0.031080 [0.6638 ]	0.063121 [0.3943 ]	-0.744022 [ 0.1107 ]
D(LBMS(-1))	-0.058492 [ 0.2260 ]	0.201522 ** [0.0167 ]	0.513021 ** [0.0000 ]	0.217508 [ 0.6891 ]
D(LBMS(-2))	0.023482 [ 0.6343 ]	0.170044 ** [0.0479 ]	0.204256 ** [0.0220 ]	0.199386 [ 0.7201 ]
D(LFTSE(-1))	0.005408 [ 0.4229 ]	0.003641 [ 0.7555 ]	0.007834 [0.5178 ]	0.087692 [ 0.2495 ]
D(LFTSE(-2))	0.019418 ** [ 0.0043 ]	-0.020666 [0.0777 ]	-0.025396 ** [0.0366 ]	-0.088075 [ 0.2465 ]
CONSTANT	0.003883 [ 0.0023 ]	-0.004108 [0.0608 ]	0.001842 [0.4152 ]	0.000565 [ 0.9682 ]
R-squared	0.169423	0.360099	0.338271	0.053602
Adjusted R-squared	0.131284	0.330716	0.307885	0.010145
S.E. of regression	0.008839	0.015322	0.015868	0.099643
F-statistic	4.442280	12.25529	11.13263	1.233440
Durbin-Watson stat	2.103053	2.006807	2.097203	1.975347

[Probability value in curly bracket]

\*\* = represents coefficients that are significant at 0.05 level

From table 6, the coefficient of interest is the lagged error correction term (ECT-1) for each equation and the corresponding probability value in bracket. It is shown in the table that the estimated coefficient of the ECT (-1) for LPSC is significant at the 0.05 level and has a negative sign. This means that if there is a temporary shock to the system, the system has the inbuilt mechanism to revert to its equilibrium path in the subsequent period. The magnitude of the estimated coefficient of the error correction term for LPSC indicates that about 2.67 percent of the previous quarter disequilibrium in the system is corrected every quarter of the year. The speed of adjustment is relatively slow. However, overall, the model shows that there is a stable long run relationship between financial development and economic growth in the UK.

#### 4.5 Granger Causality Test

Having found a stable long run relationship between financial development and economic growth, the aim of this section is to ascertain the direction of causality between them. According to Granger (1980), a variable  $X_t$  is said to cause another variable  $Y_t$ , if and only if  $Y_t$  can be predicted with greater accuracy using the lagged or past values of  $X_t$  than not using such past values (Asteriou & Hall, 2011). Causality in econometrics is different from the concept in everyday use; it refers more to the ability of one variable to predict (and therefore cause) the other variable (Asteriou & Hall, 2011).

##### 4.5.1 Granger Causality from Financial Development to Economic Growth

The granger causality from financial development to economic growth will be carried out by testing the hypothesis that the coefficients of the lagged financial development proxies in equation one of the VEC model are jointly equals to zero.

$$H_0: LPSC_{t-1} = LPSC_{t-2} = 0, LBMS_{t-1} = LBMS_{t-2} = 0, LFTSE_{t-1} = LFTSE_{t-2} = 0$$

The hypothesis states that LPSC (lag 1 and 2) equals zero, LBMS (lag 1 and 2) equals zero and LFTSE (lag 1 and 2) equals zero. This hypothesis means that the lagged values of the financial development proxies in equation one does not predict (and thus cause) LGDPPC. In Eview software, this restriction is undertaken as a Wald test. The Wald test will be based on the Chi-square distribution. The test is performed by examining the significance of the probability value. If the probability of the Chi-square statistics is significant (by virtue of being less than 0.05), the null hypothesis is rejected which then implies that the financial development proxies can predict and thus Granger cause growth of real GDP per capita. The output of the test is presented table 7.

**Table 7.** Output of Granger causality from financial development to economic growth

Wald Test:  
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	2.563510	(6, 196)	0.0206
Chi-square	15.38106	6	0.0175

From the table 7, the probability value of the Chi-square statistics is significant (by virtue of being less than 0.05 significant level) which leads to the rejection of the null hypothesis. Hence, the inference is that the financial development proxies Granger cause GDP per capita.

4.5.2 Granger Causality from Economic Growth to Financial Development

The same step above also applies here. In this case, we are trying to test the hypothesis that all the lagged values of GDPPC in equation two, three and four are jointly equals to zero.

$$H_0: \alpha_2 (LGDPPC-1, LGDPPC-2) = 0, \lambda_2 (LGDPPC-1, LGDPPC-2) = 0, \gamma_2 (LGDPPC-1, LGDPPC-2) = 0$$

Just as before, if this hypothesis is accepted, then it means that the lagged values of LGDPPC do not help to predict the changes in the financial development proxies and thus do not granger cause financial development. However, if the hypothesis is rejected, the inference is that the lagged values of GDP per capita jointly cause financial development. The output of the test is presented table 8.

**Table 8.** Output of Granger causality from economic growth to financial development

Wald Test:  
System: %system

Test Statistic	Value	df	Probability
Chi-square	26.45486	6	0.0002

From the table 8, the probability value of the Chi-square statistics is also significant at the 0.05 level which leads to the rejection of the null hypothesis. This implies that the lagged values of GDPPC jointly cause the financial development proxies, meaning that economic growth also Granger causes financial development. The Granger causality tests above confirm the existence of a bidirectional causality between financial development and economic growth. This means that both financial development and economic growth Granger cause each other.

4.5.3 Pairwise Granger Causality Test

The pairwise Granger causality is undertaken to identify causality between GDP per capita and each one of the financial development proxies. That is, to identify which of the financial development proxies is caused by GDP per capita and which of the financial development proxies that Granger causes GDP per capita. We reject each null hypothesis (and therefore, accept the alternative hypothesis) if the probability value is less than 0.05 significance level.

The output is presented table 9. The null hypothesis that PSC does not Granger cause GDPPC is rejected since the p value is less than 0.05. Hence, the inference is that private sector credit (PSC) Granger causes GDP per capita growth. Also, the null hypothesis that GDPPC does not Granger cause BMS is rejected since the p value is less than 0.05. Again, the inference is that GDP per capita growth Granger causes money supply (BMS). Lastly, the null hypothesis that FTSE does not cause GDPPC is rejected since the p value is less than 0.05. The inference is that stock market capitalisation causes GDP per capita.

This analysis shows that while private sector credit (PSC) and stock market capitalisation Granger causes economic growth (GDDPC), economic growth on the other hand Granger causes money supply (BMS).

**5. Conclusion**

The main objective of this research work is to re-examine the finance-growth relationship in the UK from the period of 196q1 to 2015q1. Economic growth was measured using real GDP per capita (GDPPC). The three variables that were used as financial development variables are log of bank credit to the private sector as a proportion of GDP (LCPS), log of broad money supply as a proportion of GDP (LBMS) and the log of stock market capitalisation as a proportion of GDP (LFTSE). To achieve last stated aim, this study employed the Augmented Dickey-Fuller (ADF)

unit root test, Johansens Cointegration test, vector error correction model (VEC) and the Granger causality test. The (ADF) test was applied to ascertain the order of integration of the variables and it was found that the variables are integrated of order one. Following this finding, the Johansens Cointegration test was applied to determine whether the variables are cointegrated. The result showed that a Cointegration exists among the variables which suggests that there is a long run equilibrium relationship between economic growth and financial development in the UK. Following this finding, the vector error correction model was estimated to test the stability of the long run equilibrium relationship between economic growth and financial development variables in a condition of disequilibrium in the short run. The result confirmed that there is a stable long run equilibrium relationship between financial development and economic growth. However, the error correction term showed that about 2.6% of last period disequilibrium is corrected in the subsequent period which is relatively a slow convergence to equilibrium. Finally, the Granger causality test was undertaken in attempt to identify the direction of causality between financial development and economic growth. The result shows that there is a two-way causal relationship between financial development and economic growth in the UK. The pairwise Granger causality shows that while bank credit to the private sector and stock market capitalisation Granger causes economic growth, economic growth on the other causes growth of broad money supply. This result is in congruence with the feedback hypothesis identified in the literature.

**Table 9.** Pairwise Granger Causality Tests

<b>Null hypothesis</b>	<b>F statistics</b>	<b>Probability</b>
LPSC does not Granger Cause LGDPPC	3.62123	0.0285**
LGDPPC does not Granger Cause LPSC	1.11854	0.3288
LBMS does not Granger Cause LGDPPC	0.66047	0.5177
LGDPPC does not Granger Cause LBMS	7.14595	0.0010**
LFTSE does not Granger Cause LGDPPC	7.35152	0.0008**
LGDPPC does not Granger Cause LFTSE	1.16545	0.3139

\*\* = denotes rejection of null hypothesis at the 0.05 significance level

Comparing with earlier studies in the UK, the general finding from this work is in conformity with the general findings in Vazakidis and Adamopoulos (2011) that financial development and economic growth is bi-causal. However, in terms of each specific variable, the works differ. While Vazakidis and Adamopoulos find that economic growth Granger causes credit market development, this study found the reverse. On the other hand, the finding from this work sharply contradicts the findings by Fethi and Katircioglu (2015) which established a unidirectional causality from financial development to economic growth. In addition to using Stock market capitalisation ratio and bank credit ratio (which are also used in this study), the work also used Stock market volatility as part of financial development measures and additionally control for the effect of physical capital, human capital and number of labourers on economic growth. Thus, this slight differences in financial development proxies and econometric methods might account for the differences in findings.

### 5.1 Policy Implications

The overall purpose of this study is to test for the direction of causality between financial development and economic growth in the UK using time series analysis. The empirical analysis presents evidence of a feedback hypothesis. That is, financial development and economic growth exhibit a two-way causal relationship. Specifically, it was found that while credit to the private sector and stock market growth Granger causes economic growth, economic growth on the other hand Granger causes liquid liabilities or broad money supply. Based on the results obtained, the following conclusions can be reached. Firstly, the findings suggest that credit market and stock market growth are the major channels through which financial development promotes economic growth in the UK. However, the result from the

normalised long run coefficient indicates that in the long run, credit market growth is a good promoter of economic growth than stock market growth. Secondly, economic growth enhances financial development through increased demand for liquid liabilities or broad money supply in the economy. The general implication of this study is that financial development can be used as a policy variable to enhance economic growth and economic growth can also be used as a policy variable to promote financial development in the UK because an improvement in one will have a direct positive spill over effect on the other. As a policy implication, this study proposes that improvement in commercial bank lending to the private sector (households and firms) will have a significant positive effect on UK long run economic growth.

## 5.2 Limitations and Recommendations

The main limitation of this study lies in the proxies used for measuring financial development. In this study, three measures of financial development were used which only concentrates on the activities of the banking sector and the capital market and thus, might not be enough to capture the activities of all the various segments of the financial system. In addition, Cihák et al (2013) argue that the ratio of private credit to GDP captures only the size of a bank's loan book relative to the economic output, but it says nothing about other financial sector components beyond banks, about quality of financial services, efficiency of the financial sector, and its stability. Hence, the author recommends that future research on this topic should consider the following factors when measuring financial development: (1) the Degree to which individuals have access to financial services, (2) the efficiency of the financial intermediaries and markets in allocating financial resources and facilitating transactions and (3) Stability of financial institutions and markets. Also, in terms of econometric analysis, this study did not control for other factors that might have a significant impact on GDP per capita growth aside financial development. Thus, it is recommended for future researchers to take this into consideration as it might lead to a more efficient result.

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