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A Causal Relationship between Financial Market Development and Economic Growth

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Abstract: Problem statement: This study investigated the causal relationship between financial market development and economic growth for United Kingdom for the period 1965-2007 using a Vector Error Correction Model (VECM). Questions were raised whether financial market development causes economic growth or reversely taking into account the negative effect of interest rate. The objective of this study was to examine the causal relationships between these variables using Granger causality tests based on a Vector Error Correction Model (VECM). **Approach:** To achieve this objective classical and panel unit root tests were carried out for all time series data in their levels and their first differences. Johansen co-integration analysis was applied to examine whether the variables are co-integrated of the same order taking into account the maximum eigenvalues and trace statistics tests. A vector error correction model was selected to investigate the long-run relationship between financial market development and economic growth. Finally, Granger causality test was applied in order to find the direction of causality between the examined variables of the estimated model. **Results:** A short-run increase economic growth of per 1% leaded to an increase of stock market index per 0.6% in United Kingdom, while an increase of interest rate per 1% leaded to a decrease of stock market index per 1.59% in United Kingdom. The estimated coefficient of error correction term found statistically significant with a negative sign, which confirmed that there was not any problem in the long-run equilibrium between the examined variables. The results of Granger causality tests indicated that there is a bilateral causal relationship between economic growth and financial market development. **Conclusion:** Therefore, it can be inferred that economic growth has a positive effect on financial market development, while interest rate has a negative effect on it in United Kingdom.

Key words: Financial market development, economic growth, panel unit roots, Granger causality

INTRODUCTION

The causal relationship between economic growth and financial market development has been the subject of intensive theoretical and empirical studies. The question is whether financial market development causes economic growth or reversely. The main objective of this study was to investigate the causal relationship between economic growth and financial market development.

The recent revival of interest in the link between financial development and growth stems mainly from the insights and techniques of endogenous growth models, which have shown that there can be self-sustaining growth without exogenous technical progress and that the growth rate can be related to preferences, technology, income distribution and institutional arrangements. This provides the theoretical underpinning that early contributors lacked: financial intermediation can be shown to have not only level effects but also growth effects.

Pagano (1993) suggests three ways in which the development of financial sector might affect economic growth under the basic endogenous growth model. First, it can increase the productivity of investments. Second, an efficient financial sector reduces transaction costs and thus increases the share of savings channeled into productive investments. An efficient financial sector improves the liquidity of investments. Third, financial sector development can either promote or decline savings.

Many models emphasize that well-functioning financial intermediaries and markets ameliorate information and transactions costs and thereby foster efficient resource allocation and hence faster long-run

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growth (Bencivenga and Smith, 1991; Bencivenga *et al*., 1996; King and Levine, 1993).

In the models of Levine (1991) and Saint-Paul (1992) financial markets improve firm efficiency by eliminating the premature liquidation of firm capital, enhancing the quality of investments and therefore increasing enhance economic growth. Enhanced stock market liquidity reduces the disincentives for investing in long-duration and higher-return projects, since investors can easily sell their stake in the project before it matures and is expected to boost productivity growth (King and Levine, 1993).

The issue of causal relationship between financial development and economic growth has been an intensive subject of interest for many theoretical and empirical studies. Therefore, this study tries to fill the theoretical and empirical gaps created by the different economic school of thoughts related to the impact of economic growth on financial development for a developed European Union member-state such as United Kingdom.

United Kingdom consists one of the most important developed countries of European Union characterized by a high rate of economic growth, a constant monetary and fiscal economic policy and very low inflation and unemployment rates, a healthy and competitive economy avoiding the negative effects of financial crisis in an unstable economic environment.

The model hypothesis predicts that economic growth facilitates financial market development taking into account the negative effect of interest rate on financial market development and economic growth.

This study has two objectives:

- To examine the long run relationship among economic growth, interest rate and financial market development using Johansen co-integration analysis taking into account classical and panel unit root tests
- To apply Granger causality test based on a vector error correction model in order to examine the causal relationships between the examined variables

The remainder of the study proceeds as follows: Initially the data and the specification of the multivariate VAR model are described. For this purpose stationarity test and Johansen co-integration analysis are examined taking into account the estimation of vector error correction model.

Finally, Granger causality test is applied in order to find the direction of causality between the examined variables of the estimated model. The empirical results are presented analytically and some discussion issues resulted from this empirical study are developed shortly, while the final conclusions are summarized relatively.

MATERIALS AND METHODS

Data and specification model: In this study the method of Vector Autoregressive Model (VAR) is applied to estimate the effects of economic growth and interest rate on financial market development. The use of this methodology predicts the cumulative effects taking into account the dynamic response among financial market development and the other examined variables (Katos *et al*., 1996; Shan, 2005).

In order to test the causal relationships, the following multivariate model is to be estimated:

$$F = f(G, I) \tag{1}$$

Where:
F = The general stock market index
G = The gross domestic product
I = The interest rate

Following the empirical study of (King and Levine, 1993) the variable of economic Growth (G) is measured by gross domestic product. The general stock market index is used as a proxy for the financial market development. The general stock market index (F) expresses better the financial market development than other financial indices. Taking into account the effect of Interest rate (I) (Levine *et al*., 2000; Nieuwerburgh *et al*., 2006; Vazakidis, 2006).

The data that are used in this analysis are annual covering the period 1965-2007 for United Kingdom, regarding 2000 as a base year and are obtained from international financial statistics yearbook (International Monetary Fund, 2007). All time series data are expressed in their levels and Eviews econometric computer software is used for the estimation of the model.

Unit root tests: For univariate time series analysis involving stochastic trends, Phillips-Perron (PP) unit root test is calculated for individual series to provide evidence as to whether the variables are integrated. This is followed by a multivariate co-integration analysis.

Phillips-Perron (PP) (Phillips and Perron, 1988) test is an extension of the Dickey-Fuller (DF) test (Dickey and Fuller, 1979), which makes the semi-parametric correction for autocorrelation and is more robust in the case of weakly autocorrelation and heteroskedastic regression residuals. According to Choi (1992), the Phillips-Perron test appears to be more powerful than the ADF test for the aggregate data.

Although the Phillips-Perron (PP) test gives different lag profiles for the examined variables (time series) and sometimes in lower levels of significance, the main conclusion is qualitatively the same as reported by the Dickey-Fuller (DF) test. Since the null hypothesis in the Augmented Dickey-Fuller test is that a time series contains a unit root, this hypothesis is accepted unless there is strong evidence against it. However, this approach may have low power against stationary near unit root processes.

The Phillips-Perron (as cited in Laopodis and Sawhney, 2007) unit root test which is very general and can be used in the presence of heteroscedastic and autocorrelated innovations is specified as follows:

$$\ln(1+r) = \alpha + \beta\left(\frac{t\text{-}T}{2}\right) + \delta\ln(1+r_{t-1}) + \zeta_t \tag{2}$$

for t = 1,2,…..,T where r_t denotes interest rate at time t, (t-T/2) is a time trend and T is the sample size.

Equation 2 tests three hypotheses: The first hypothesis is that the series contains a unit root with a drift with a drift and a time trend: $H_0^1:\delta=1$. The second hypothesis is that the series contains a unit root but without a time trend: $H_0^2:\beta=0$, $\delta = 1$. The third hypothesis is that the series contains a unit root but without a drift or a time trend: $H_0^3: a=0$, $\beta = 0$, $\delta = 1$. The statistics that are used to test each hypothesis are $Z(t_\delta)$, $Z(\Phi_2)$, $Z(\Phi_3)$, respectively and their corresponding equations are as follows:

$$Z(t_\delta) = \left(\frac{\sigma_0}{\sigma_{Tl}}\right)t_\sigma - \left(\frac{T^3}{3^{1/2}4D^{1/2}_{xx\sigma Tl}}\right)\left(\sigma^2_{Tl}\text{-}\sigma^2_0\right) \tag{2a}$$

$$Z(\Phi_3) = \left(\frac{\sigma_0^2}{\sigma_{Tl}^2}\right)\Phi_3 - \left(\frac{1}{2\sigma_{Tl}^2}\right)\left(\sigma^2_{Tl}-\sigma^2_0\right)x \left[T(\delta-1) - \left(\frac{T^6}{48D_{xx}}\right)\left(\sigma^2_{Tl}-\sigma^2_0\right)\right] \tag{2b}$$

$$Z(\Phi_2) = \left(\frac{\sigma_0^2}{\sigma_{Tl}^2}\right)\Phi_2 - \left(\frac{1}{3\sigma_{Tl}^2}\right)\left(\sigma^2_{Tl}-\sigma^2_0\right)x \left[T(\delta-1) - \left(\frac{T^6}{48D_{xx}}\right)\left(\sigma^2_{Tl}-\sigma^2_0\right)\right] \tag{2c}$$

Where:

$$\Phi_3 = \frac{T\left(\sigma_0^2 - \left(\bar{r}\text{-}\bar{r}_{t-1}\right)^2 - \sigma^2\right)}{2\sigma^2} \tag{2d}$$

$$\Phi_2 = \frac{T\left(\sigma_0^2 - \sigma^2\right)}{3\sigma^2} \tag{2e}$$

and σ^2 is the OLS residual variance, σ_0^2 is the variance under the particular hypothesis for the standard t-test for $\delta = 1$. D_{xx} is the determinant of the (X'X), where X is the T_3 matrix of explanatory variables in Eq. 2.

Finally, σ_{Tl} is a consistent estimator of the variance of ζ and is computed as follows:

$$\sigma^2_{Tl} = \sum_{t=1}^{T}\frac{\zeta_t^2}{T} + \frac{\left(2\sum_{t=1}^{l}\sum_{t=s=1}^{T}\left(1-s/(l+1)\right)\zeta_t\zeta_{t-s}\right)}{T} \tag{2f}$$

where, s and l are the lag truncation numbers and s<l. The estimator σ_{Tl} is consistent under general conditions because it allows for effects of serially correlated and heterogeneously distributed innovations. The three statistics are evaluated under various lags (l = 0-12).

Besides classical unit roots in this study the methodology of panel units roots tests is examined.

Following the study of Christopoulos and Tsionas (2004), Levin *et al*. (2002) denoted as LLC panel unit root tests respectively resulted to the same conclusion. They consider the following basic ADF specification:

$$\Delta y_{it} = \alpha y_{it-1} + \sum_{j=1}^{p_i}\beta_{ij}\Delta y_{it-j} + X'_{it}\delta + \varepsilon_{it} \tag{3}$$

where we assume a common $\alpha = \rho\text{-}1$ but allow the lag order for the difference terms, p_i to vary across cross-sections. The null and alternative hypotheses for the tests may be written as: H_0: a = 0 but H_1: a<0. In LLC panel unit root test, the null hypothesis is the existence of a unit root, while under the alternative, there is no unit root.

Levin *et al*. (2002) consider the model:

$$y_{it} = \rho_i y_{i,t-1} + z'_{it}\gamma + u_{it} \tag{3a}$$

Where:

z_{it} = Deterministic variables
u_{it} = iid$(0,\sigma^2)$
$\rho_i = \rho$

They assume that there is a common unit root process so that ρ_i is identical across cross-sections.

The LLC test statistic is a t-statistic on ρ given by:

$$t_\rho = \frac{(\hat{\rho}-1)\sqrt{\sum_{i=1}^{N}\sum_{t=1}^{T}\tilde{y}_{i,t-1}^2}}{s_e} \quad (3b)$$

Where:

$\tilde{y}_{it} = y_{it} - \sum_{s=1}^{T} h(t,s) y_{is}$

$\tilde{u}_{it} = u_{it} - \sum_{s=1}^{T} h(t,s) u_{is}$

$h(t,s) = z_t'(\sum_{t=1}^{T} z_t z_t') z_s$

$s_e^2 = (NT)^{-1}\sum_{i=1}^{N}\sum_{t=1}^{T}\tilde{u}_{it}^2$

$\hat{\rho}$ = The OLS estimate of ρ (Christopoulos and Tsionas, 2004)

It can be shown that if there are only fixed effects in the model, then:

$$\sqrt{N}T(\hat{\rho}-1) + 3\sqrt{N} \rightarrow N(0, \tfrac{51}{5}) \quad (3c)$$

and if there are fixed effects and a time trend:

$$\sqrt{N}(T(\hat{\rho}-1) + 7.5) \rightarrow N(0, \tfrac{2895}{112}) \quad (3d)$$

Im *et al*. (1997) denoted as IPS panel unit root tests respectively resulted to the same conclusion. In IPS panel unit root test, the null hypothesis is the existence of a unit root (Table 2). The IPS statistic is based on averaging individual Dickey-Fuller unit root test (t_i) according to:

$$t_{IPS} = \frac{\sqrt{N}(\bar{t} - E[t_i \mid \rho_i = 0])}{\sqrt{var[t_i \mid \rho_i = 0]}} \rightarrow N(0,1) \quad (4)$$

where, $\bar{t} = N^{-1}\sum_{i=1}^{N} t_i$. The moments of $E[t_i \mid \rho_i = 0]$ and $var[t_i \mid \rho_i = 0]$ are obtained by Monte Carlo simulation and are tabulated in IPS (Christopoulos and Tsionas, 2004).

The econometric software Eviews which is used to conduct the PP, tests, reports the simulated critical values based on response surfaces. The results of the Phillips and Perron (1988) unit root test and of Levin *et al*. (2002) and Im *et al*. (1997) panel unit roots tests for each variable appear in Table 1.

If the time series (variables) are non-stationary in their levels, they can be integrated with integration of order 1, when their first differences are stationary.

Table 1: PP unit root tests

	PP_ test stat		
Variables	$Z(\Phi_3)$	$Z(\Phi_2)$	$Z(t_\delta)$
In levels			
F	1.66 (for k = 1)	0.31 (for k = 1)	-2.14 (for k = 1)
G	5.75 (for k = 2)	2.74 (for k = 2)	-0.89 (for k = 1)
I	-0.53 (for k = 1)	-1.06 (for k = 1)	-2.27 (for k = 1)
In 1rst differences			
ΔF	-2.82 (for k = 1)	-3.11*** (for k = 1)	-3.20**,*** (for k = 1)
ΔG	-3.11 (for k = 4)	-4.64 (for k = 3)	-5.61 (for k = 1)
ΔI	-5.02 (for k = 1)	-4.96 (for k = 1)	-5.13 (for k = 1)

$Z(\Phi_3)$, $Z(\Phi_2)$, $Z(t_\delta)$, are the PP statistics; k, l= bandwidth lengths: Newey-West using Bartlett kernel. The critical values at 1%, 5% and 10% are -2.62, -1.94, -1.61, for $Z(\Phi_3)$, -3.60, -2.93, -2.60 for $Z(\Phi_2)$ and for -4.19, -3.52, -3.19 for $Z(t_\delta)$, respectively. ***, **, *: Indicate that those values are not consistent with relative hypotheses at the 1, 5 and 10% levels of significance relatively

Table 2: IPS, LLC panel unit root tests

	LLC test stat			IPS test stat	
Variables	LLC_N	LLC_C	LLC_T	IPS_C	IPS_T
In levels					
F	0.03	0.01	-0.11	0.62	-3.44
G	0.05	0.04	-0.03	3.02	-0.80
I	-0.00	-0.05	0.14	-0.90	-2.24
In 1rst differences					
LLC test stat IPS test stat					
ΔF	-0.66	-0.81	-0.85	-5.77	-6.00
ΔG	-0.25	-0.71	-0.91	4.56	-5.61
ΔI	-0.77	-1.13	-1.37	-4.69	-5.28

Notes: LLC is the Levin, Lin and Chu t-test and IPS is the Im, Pesaran and Shin t-test test for unit root test in the model. The critical values for LLC_N test are 5.63 and -6.51 without constant or trend in levels and first differences respectively. The critical values for LLC_C test are 4.42 and -6.61 including only constant in levels and first differences respectively. The critical values for LLC_T test are 0.007 and -6.79 including constant and trend in levels and first differences respectively. The critical values for IPS_c test are 4.69 and -6.76 including only constant in levels and first differences respectively. The critical values for IPS_c test are 0.02 and -7.29including only constant and trend in levels and first differences respectively

Johansen co-integration analysis: Since it has been determined that the variables under examination are integrated of order 1, then the co-integrated test is performed. The testing hypothesis is the null of non-co-integration against the alternative that is the existence of co-integration using the Johansen maximum likelihood procedure (Johansen and Juselious, 1990; 1992, Chang and Caudill, 2005).

Once a unit root has been confirmed for a data series, the question is whether there exists a long-run equilibrium relationship among variables. According to (Granger, 1986), a set of variables, Y_t is said to be co-integrated of order (d,b)-denoted CI(d,b)-if Y_t is integrated of order d and there exists a vector, β, such that $\beta' Y_t$ is integrated of order (d-b).

Co-integration tests in this study are conducted using the method developed by (Johansen and Juselious, 1990; Johansen, 1988). The multivariate co-integration techniques developed by (Johansen and Juselious, 1990; 1992) using a maximum likelihood estimation procedure allows researchers to estimate simultaneously models involving two or more variables to circumvent the problems associated with the traditional regression methods used in previous studies on this issue. Therefore, the Johansen method applies the maximum likelihood procedure to determine the presence of co-integrated vectors in non-stationary time series.

Following the study of Chang and Caudill (2005), Johansen (1988) and Osterwald-Lenum (1992) propose two test statistics for testing the number of co-integrated vectors (or the rank of Π): The trace (λ_{trace}) and the maximum eigenvalue (λ_{max}) statistics.

The Likelihood Ratio statistic (LR) for the trace test (λ_{trace}) as suggested by (Johansen, 1988) is:

$$\lambda_{trace}(r) = -T\sum_{i=r+1}^{p}\ln(1-\hat{\lambda}_i) \quad (5)$$

Where:

$\hat{\lambda}_i$ = The largest estimated value of ith characteristic root (eigenvalue) obtained from the estimated Π matrix

r = 0, 1, 2, …p-1

T = The number of usable observations

The λ_{trace} statistic tests the null hypothesis that the number of distinct characteristic roots is less than or equal to r, (where r is 0, 1, or 2) against the general alternative. In this statistic λ_{trace} will be small when the values of the characteristic roots are closer to zero (and its value will be large in relation to the values of the characteristic roots which are further from zero).

Alternatively, the maximum eigenvalue (λ_{max}) statistic as suggested by Johansen is:

$$\lambda_{max}(r,\ r+1) = -T\ln(1-\hat{\lambda}_{r+1}) \quad (6)$$

The λ_{max} statistic tests the null hypothesis that the number of r co-integrated vectors is r against the alternative of (r + 1) co-integrated vectors. Thus, the null hypothesis r = 0 is tested against the alternative that r = 1, r = 1 against the alternative r = 2 and so forth. If the estimated value of the characteristic root is close to zero, then the λ_{max} will be small.

It is well known that Johansen's co-integration tests are very sensitive to the choice of lag length. Firstly, a VAR model is fitted to the time series data in order to find an appropriate lag structure. The Schwarz Criterion (SC) (Schwarz, 1978) is used to select the number of lags required in the co-integration test. The Schwarz Criterion (SC) suggested that the value p = 3 is the appropriate specification for the order of VAR model for UK. Table 3 shows the results from the Johansen co-integration test.

Vector error correction model: According to Chang and Caudill (2005), since the variables included in the VAR model are co-integrated, the next step is to specify and estimate a Vector Error Correction Model (VECM) including the error correction term to investigate dynamic behavior of the model. Once the equilibrium conditions are imposed, the VEC model describes how the examined model is adjusting in each time period towards its long-run equilibrium state.

Since the variables are co-integrated, then in the short run, deviations from this long-run equilibrium will feed back on the changes in the dependent variables in order to force their movements towards the long-run equilibrium state. Hence, the co-integrated vectors from which the error correction terms are derived are each indicating an independent direction where a stable meaningful long-run equilibrium state exists (Chang, 2002).

The VEC specification forces the long-run behavior of the endogenous variables to converge to their co-integrated relationships, while accommodates short-run dynamics. The dynamic specification of the model allows the deletion of the insignificant variables, while the error correction term is retained. The size of the error correction term indicates the speed of adjustment of any disequilibrium towards a long-run equilibrium state (Engle and Granger, 1987). The error-correction model with the computed t-values of the regression coefficients in parentheses is reported in Table 4.

The final form of the Error-Correction Model (ECM) was selected according to the approach suggested by Hendry (Maddala, 1992). The general form of the Vector Error Correction Model (VECM) is the following one:

$$\Delta F_t = \beta_1\sum_{i}^{n}\Delta F_{t-i} + \beta_2\sum_{i}^{n}\Delta G_{t-i} + \beta_3\sum_{i}^{n}\Delta I_{t-i} + \lambda EC_{t-i} + \varepsilon_t \quad (7)$$

Where:

Δ = The first difference operator

EC_{t-1} = The error correction term lagged one period

λ = The short-run coefficient of the error correction term (-1<λ<0)

ε_t = The white noise term

Table 3: Johansen Co-integration tests(F, G, I)

Johansen test statistics				
Testing	Critical value		Critical value	
Hypothesis	λ_{trace}	5%	λ_{max}	5%
None*	46.02	34.87	23.68	22.04
At most 1	22.34	20.18	14.63	15.87
At most 2	7.71	9.16	7.71	9.16

Trace test and maximum eigenvalue tests indicate 1 co-integrating equation(s) at the 0.05 level; *: Denotes rejection of he hypothesis at the 0.05 level; **: MacKinnon *et al*. (1999) p-values

Table 4: Vector error correction model

$\Delta F_t = 0.01 + 0.60\ \Delta G_t + 0.46\ \Delta F_{t-1} - 1.59\ \Delta I_t - 0.17\ ect_{t-1}$
[0.0.45] [0.10] [0.00] [0.010] [0.002]

$R^2 = 0.58$ DW = 1.67

Notes: [ ]: I denote the probability levels; Δ: Denotes the first differences of the variables; R^2: Coefficient of determination; DW: Durbin-Watson statistic

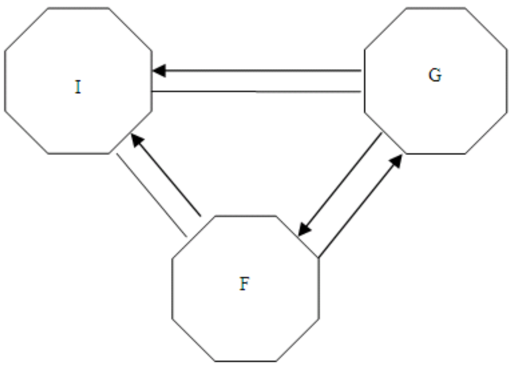

Fig. 1: Causal relations of examined variables

Granger causality tests: Granger causality is used for testing the long-run relationship between financial development and economic growth. The Granger procedure is selected because it consists the more powerful and simpler way of testing causal relationship (Granger, 1986).

The following bivariate model is estimated:

$$Y_t = a_{10} + \sum_{j=1}^{k} a_{1j} Y_{t-j} + \sum_{j=1}^{k} b_{1j} X_{t-j} + u_t \quad (8)$$

$$X_t = a_{20} + \sum_{j=1}^{k} a_{2j} X_{t-j} + \sum_{j=1}^{k} b_{2j} Y_{t-j} + u_t \quad (9)$$

Where:
Y_t = The dependent
X_t = The explanatory variable
u_t = A zero mean white noise error term in Eq. 8 while
X_t = The dependent
Y_t = The explanatory variable in Eq. 9

Table 5: Pairwise Granger causality tests

Sample: 1965-2007
Lags: 2

Null hypothesis:	F-Stat	[Prob]	Causal relation
G does not Granger cause F	5.64	[0.007]	G ↔ F
F does not Granger cause G	5.80	[0.006]	
I does not Granger cause F	0.14	[0.867]	F → I
F does not Granger cause I	3.48	[0.041]	
I does not Granger cause G	0.05	[0.948]	G → I
G does not Granger cause I	3.81	[0.031]	

In order to test the above hypotheses the usual Wald F-statistic test is utilized, which has the following form:

$$F = \frac{(RSS_R - RSS_U)/q}{RSS_U/(T-2q-1)}$$

Where:
RSS_U = The sum of squared residuals from the complete (unrestricted) equation
RSS_R = The sum of squared residuals from the equation under the assumption that a set of variables is redundant, when the restrictions are imposed, (restricted equation)
T = The sample size
q = The lag length

The hypotheses in this test are the following:

$$\begin{aligned} &H_0: \text{ X does not Granger cause Y, i.e.,} \\ &\quad \{\alpha_{11}, \alpha_{12}, \ldots \alpha_{1k}\} = 0, \text{if } F_c < \text{critical value of F} \\ &H_a: \text{ X does Granger cause Y, i.e.,} \\ &\quad \{\alpha_{11}, \alpha_{12}, \ldots \alpha_{1k}\} \neq 0, \text{if } F_c > \text{ critical value of F} \end{aligned} \quad (10)$$

and:

$$\begin{aligned} &H_0: \text{ Y does not Granger cause X, i.e.,} \\ &\quad \{\beta_{21}, \beta_{22}, \ldots \beta_{2k}\} = 0, \text{if } F_c < \text{critical value of F} \\ &H_a: \text{ Y does Granger cause X, i.e.,} \\ &\quad \{\beta_{21}, \beta_{22}, \ldots \beta_{2k}\} \neq 0, \text{ if } F_c > \text{ critical value of F} \end{aligned} \quad (11)$$

Katos (2004) and Seddighi *et al*. (2000).

The results related to the existence of Granger causal relationships among economic growth, stock market development, interest rate appear in Table 5.

RESULTS

The observed t-statistics fail to reject the null hypothesis of the presence of a unit root for all variables in their levels confirming that they are non-stationary at 5% levels of significance (Table 1).

However, the results of the PP, LLC and IPS tests show that the null hypothesis of the presence of a unit root is rejected for all variables when they are transformed into their first differences (Table 2).

Therefore, all series that are used for the estimation are non-stationary in their levels, but stationary and integrated of order one I(1), in their first differences. These variables can be co-integrated as well, if there are one or more linear combinations among the variables that are stationary.

The number of statistically significant co-integrated vectors for United Kingdom is equal to 1 (Table 3) and is the following:

$$F_t = 0.29 + 0.40G_t - 3.03I \quad (12)$$

The co-integration vector of the model of United Kingdom has rank r<n (n = 2). The process of estimating the rank r is related with the assessment of eigenvalues, which are the following for United Kingdom: $\hat{\lambda}_1 = 0.43$, $\hat{\lambda}_2 = 0.30$, $\hat{\lambda}_3 = 0.17$, $\hat{\lambda}_4 = 0.01$, (Table 3). For United Kingdom, critical values for the trace statistic defined by Eq. 5 are 34.87 for none co-integrating vectors and 20.18 for at most one vector, 9.16 for at most two vectors at the 0.05 level of significance as reported by (MacKinnon *et al*., 1999), while critical values for the maximum eigenvalue test statistic defined by Eq. 6 are 22.04 for none co-integrating vectors, 15.87 for at most one vector and 9.16 for at most two vectors respectively (Table 3).

Then an error-correction model with the computed t-values of the regression coefficients in parentheses is estimated. The dynamic specification of the model allows the deletion of the insignificant variables, while the error correction term is retained. A short-run increase of economic growth per 1% induces an increase of stock market index per 0.6% in United Kingdom, while an increase of interest rate per 1% induces a decrease of stock market index per 1.59% in United Kingdom.

The estimated coefficient of EC_{t-1} is statistically significant and has a negative sign, which confirms that there is not any a problem in the long-run equilibrium relation between the independent and dependent variables in 5% level of significance, but its relatively value (-0.17) for UK shows a satisfactory rate of convergence to the equilibrium state per period (Table 4). From the above results the VAR model in which stock market development is examined as a dependent variable has obtained the best statistical estimates. In order to proceed to the Granger causality test the number of appropriate time lags was selected in accordance with the VAR model.

According to Granger causality tests there is a bilateral causal relationship between economic growth and financial market development, a unidirectional causality between interest rate and financial market development with direction from financial market development to interest rate and finally a unidirectional causal relationship between economic growth and interest rate with direction from economic growth to interest rate (Fig. 1 and Table 5).

DISCUSSION

The model of financial market development is mainly characterized by the effect of economic growth and interest rate. Financial market development is determined by the trend of general stock market index. The significance of the empirical results is dependent on the variables under estimation.

Most empirical studies examine the causal relationship between economic growth and financial market development using different estimation measures like money supply, bank lending, stock market capitalization, general stock market index.

Granger causality test is the more powerful causality test based on the methodology of vector error correction model in relation to other causality tests like Geweke, Sims, Toda and Yamamoto.

Theory provides conflicting aspects for the direction of causality between financial market development and economic growth. Most empirical studies suggested that there is a unidirectional causality between financial market development and economic growth with direction from financial market development to economic growth, while less empirical studies have found reverse causality between economic growth and financial market development or unidirectional causality with direction from economic growth to financial market development.

The results of this study are agreed with the studies of Hondroyiannis *et al*. (2004) and Shan (2005). Therefore the direction of causal relationship between financial market development and economic growth is regarded as an important issue under consideration in future empirical studies. However, more interest should be focused on the comparative analysis of empirical results for the rest of European Union members-states using different estimation measures and causality estimation methods.

CONCLUSION

This study employs with the relationship between financial market development and economic growth for UK, using annually data for the period 1965-2007. For univariate time series analysis involving stochastic trends, Phillips-Perron (PP) unit roots tests, Levin, Lin and Chu (LL) and Im, Pesaran and Shin (IPS) panel unit roots tests are calculated for individual series to provide evidence as to whether the variables are stationary and integrated of the same order.

The empirical analysis suggested that the variables that determine financial market development present a unit root. Therefore, all series are stationary and integrated of order one I(1), in their first differences. Since it has been determined that the variables under examination are stationary and integrated of order 1, then the Johansen co-integration analysis is performed taking into account the maximum likelihood procedure. The short run dynamics of the model is studied by analyzing how each variable in a co-integrated system responds or corrects itself to the residual or error from the co-integrating vector. This justifies the use of the term error correction mechanism.

The Error Correction (EC) term, picks up the speed of adjustment of each variable in response to a deviation from the steady state equilibrium. The dynamic specification of the model suggests deletion of the insignificant variables while the error correction term is retained. The VEC specification forces the long-run behavior of the endogenous variables to converge to their co-integrating relationships, while accommodates the short-run dynamics. A short-run increase of economic growth per 1% leaded to an increase of stock market index per 0.6% in UK, while an increase of interest rate per 1% leaded to a decrease of stock market index per 1.59% in UK.

Furthermore, Granger causality tests indicated that financial market development and economic growth cause interest rate, while there is a bilateral causality between financial market development and economic growth. Therefore, it can be inferred that economic growth has a positive effect on financial market development taking into account the negative effect of interest rate on financial market development and economic growth.

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