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Financial Development and Economic Growth: An Empirical Investigation of three European Union Member - Countries

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Abstract:

Purpose: *This paper investigates the relationship between financial development and economic growth for three European Union member countries, Greece, Ireland and UK.*
Design/Methodology/Approach: *For this reason the existence of the long-run relationship between these variables applying the cointegration analysis is examined as suggested by Johansen and Juselious.*
Findings: *Granger causality tests based on a vector error correction model (VECM) indicated that there is a causal relationship between financial development and economic growth in the three European Union's member countries.*
Practical Implications: *The Vector Error Correction specification forces the long-run behaviour of the endogenous variables to converge to their cointegrating relationships, while accommodates the short-run dynamics.*
Originality/Value: *The study offers an in-depth insight into econometric modelling of economic growth.*

Keywords: *Financial Development, Economic Growth, Cointegration, Granger Causality.*

JEL codes: *O11, C22.*

Paper type: *Research study.*

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1. Introduction

The theoretical relationship between financial development and economic growth goes back to the study of Schumpeter (1911) who focuses on the services provided by financial intermediaries and argues that these are essential for innovation and development (Ghali, 1999). Schumpeter’s (1912) view is that a well functioning financial system would induce technological innovation by identifying, selecting and funding those entrepreneurs who would be expected to successfully implement their products and productive processes. Robinson (1952, p.86) claims that “where enterprise leads, finance follows” - it is the economic development which creates the demand for financial services and not vice versa. Financial development follows economic growth as a result of increased demand for financial services. This explanation was originally advanced by Friedman and Schwarz (1963).

Theory provides conflicting aspects for the impact of financial development on economic growth. The most empirical studies are based on those theoretical approaches proposed by some different economic school of thoughts which can be divided into three categories: (i) structuralists, (ii) the repressionists, (iii) endogenous growth theory supporters. The structuralists contend that the quantity and composition of financial variables induces economic growth by directly increasing saving in the form of financial assets, thereby, encouraging capital formation and hence, economic growth (Goldsmith, 1969; Gurley and Shaw 1955; Patrick, 1966; Porter, 1966; Thornton, 1996; Demetriades and Luintel, 1996; Berthelemy and Varoudakis, 1998; Thalassinos and Thalassinos, 2018).

Patrick (1966) identified two possible causal relationships between financial development and economic growth. The first causal relationship - called ‘demand following’ - views the demand for financial services as dependent upon the growth of real output and upon the commercialization and modernization of agriculture and other subsistence sectors. Thus, the creation of modern financial institutions, their financial assets and liabilities and related financial services are a response to the demand for these services by investors and savers in the real economy. The second causal relationship between financial development and economic growth is termed ‘supply leading’ by Patrick (1966). ‘Supply leading’ has two functions: to transfer resources from the traditional, low-growth sectors to the modern high-growth sectors and to promote and stimulate an entrepreneurial response in these modern sectors.

This implies that the creation of financial institutions and their services occurs in advance of demand for them. Thus, the availability of financial services stimulates the demand for these services by the entrepreneurs in the modern, growth-inducing sectors. Therefore, the supply- leading hypothesis contends that financial development causes real economic growth, while in contrary to the demand-following hypothesis argues for a reverse causality from real economic growth to financial development.

2. Literature Review

The financial repressionists, led by, McKinnon (1973) and Shaw (1973) – often referred to as the “McKinnon-Shaw” hypothesis contend that financial liberalization in the form of an appropriate rate of return on real cash balances is a vehicle of promoting economic growth. The essential tenet of this hypothesis is that a low or negative real interest rate will discourage saving. This will reduce the availability of loanable funds for investment which in turn, will lower the rate of economic growth. Thus, the “McKinnon-Shaw” model posits that a more liberalized financial system will induce an increase in saving and investment and therefore, promote economic growth. The Mckinnon-Shaw school examines the impact of government intervention on the development of the financial system. Their main proposition is that government restrictions on the banking system such as interest rate ceilings and direct credit programs have negative effects on the development of the financial sector and, consequently, reduce economic growth (Michalopoulos and Tsermenidis, 2018; Rupeika-Apoga *et al.,* 2018; Thalassinos *et al.,* 2015).

McKinnon (1973) and Shaw (1973) extend the earlier argument by noting that financial deepening implies not only higher productivity of capital but also a higher savings rate and, therefore, a higher volume of investment. Unlike Goldsmith (1969), where growth and financial intermediation are both thought of as endogenous, the focus of McKinnon (1973) and Shaw (1973) is on the effects of public policy regarding financial markets on savings and investment. Furthermore, McKinnon (1973) and Shaw (1973) argue that policies that lead to financial repression – for example, controls which result in negative real interest rates - reduce the incentives to save. Lower savings, in turn, result in lower investment and growth. Therefore, they conclude that higher interest rates resulting from financial liberalization induce households to increase savings.

The two different schools of thought are agreed to the transmission channels effect on the relationship between financial development and economic growth. Most of the theoretical models followed the emergence of endogenous growth theory. The endogenous growth theory has reached to similar conclusions with the McKinnon-Shaw hypothesis by explicitly modelling the services provided by financial intermediaries such as risk-sharing and liquidity provision. This theory also suggests that financial intermediation has a positive effect on steady-state growth (Greenwood and Jovanovic, 1990; Shan et al, 2001), while the government intervention in the financial system has a negative effect on economic growth (King and Levine, 1993b). Endogenous growth theory also predicts that trade liberalisation between two or more countries reduces redundant research efforts and increases: (i) the market size for products, (ii) the efficiency of investment and (iii) positive externalities for firms (Rivera-Batiz and Romer, 1991).

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 channelled 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 growth (Greenwood and Jovanovic, 1990; Bencivenga and Smith, 1991; Bencivenga *et al.* 1996; King and Levine, 1993a). In the models of Levine (1991), Bencivenga and Smith (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 (Bencivenga *et al.*, 1996).

During liquidity shocks, investors can sell their shares to another agent. Financial markets may also promote growth by increasing the proportion of resources allocated to firms. Through the diversification of productivity risk, even risk-averse investors can invest in firms. Portfolio diversification, through the stock market, may have an additional growth effect by encouraging specialization of production (Saint-Paul, 1992). Saint-Paul (1992) develops a model where financial markets affect technological choice. In this model, agents can choose between two technologies: One technology is highly flexible and allows productive diversification, but has low productivity; the other is rigid, more specialized, and more productive. Financial markets, in contrast, allow individuals to hold a diversified portfolio to insure themselves against negative demand shocks and, at the same time, to choose the more productive technology.

Under Saint-Paul’s (1992) model, productivity growth is achieved through a broader division of labour and specialization of enterprises. Specialization, however, carries risk. Financial intermediaries support specialization by permitting investors to hedge with a diversified portfolio. Specialization in the absence of a properly functioning financial sector, however, may be too risky individual investor. If it is, financing for efficiency improving projects dries up. King and Levine (1993b) employ an endogenous growth model in which the financial intermediaries obtain information about the quality of individual projects that is not readily available to private investors and public markets. This information advantage enables financial intermediaries to fund innovative products and productive processes, thereby inducing economic growth (De La Fuente and Marin, 1994). Levine (1997) who proposed that financial development promotes economic growth through the two ‘channels’ of capital accumulation and technological innovation, while King and Levine (1993) have identified innovation as the main channel of transmission between finance and growth. Financial markets evaluate the potential innovative projects, and finance the most promising ones through efficient resource allocation.

The remainder of the paper proceeds as follows: Section 3 describes the specification of the model, while section 4 presents the results of unit root tests. Section 5 summarises the Johansen cointegration analysis and section 6 analyses the vector error correction models. Finally, section 7 presents Granger causality tests and section 8 provides the conclusions of this paper.

3. Research Methodology

In this study the method of vector autoregressive model (VAR) is adopted to estimate the effects of stock and credit market development on economic growth through the effect of industrial production. The use of this methodology predicts the cumulative effects taking into account the dynamic response among economic growth and the other examined variables (Pereira and Hu, 2000).

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

GDP = f (SM, BC, IND)

where:
GDP is the gross domestic product;
SM is the general stock market index;
BC are the domestic bank credits to private sector;
IND is the industrial production index.

Following the empirical studies of Roubini and Sala-i-Martin (1992), King and Levine (1993a) the variable of economic growth (GDP) is measured by the rate of change of real GDP, while the credit market development is expressed by the domestic bank credits to private sector (BC) as a percentage of GDP. This measure has a basic advantage from any other monetary aggregate as a proxy for credit market development. Although it excludes bank credits to the public sector, it represents more accurately the role of financial intermediaries in channeling funds to private market participants (Beck *et al.*, 2000; Levine *et al.*, 2000). The general stock market index is used as a proxy for the stock market development The general stock market index (SM) expresses better the stock exchange market, while the industrial production index (IND) measures the growth of industrial sector and its effect on economic growth (Gursoy and Muslumov 1998; Shan *et al.,* 2001; Hassapis and Kalyvitis, 2002; Katsouli, 2003; Nieuwerburgh *et al.,* 2005; Shan, 2005; Vazakides, 2006).

The data that are used in this analysis are annual covering the period 1965-2007 for Ireland and UK, and 1978-2007 for Greece, regarding 2000 as a base year. All time series data are expressed in their levels and are obtained from International Financial Statistics of International Monetary Fund, (IMF, 2007).

Economic theory does not often provide guidance in determining which variables have stochastic trends, and when such trends are common among variables. If these variables share a common stochastic trend, their first differences are stationary and the variables may be jointly cointegrated. For univariate time series analysis involving stochastic trends, augmented Dickey- Fuller unit root tests are calculated for individual series to provide evidence as to whether the variables are integrated. This is followed by a multivariate cointegration analysis.

4. Empirical Analysis

For more than a decade, the issue of testing for unit roots has attracted tremendous attention by econometricians and a large number of papers have been published. The recent developments in time-series econometrics and the empirical evidence have shown that most time series data are not stationary in their levels in the sense that the mean and variance of the variable(s) depend on time, and they tend to explode as time goes on. It has been shown that these non stationary time series, when are subjected to exogenous (random) shock do not return to their long run path. Under these circumstances, many of the properties of least square estimators as well as tests of significance are invalid. The regression models containing non stationary variables are shown to reject spurious relationships and yield inconsistent and less efficient OLS parameters. The spurious regression problem arises in the case where truly unrelated series are seen to be related because of the fact that they share a common time trend (Chang, 2002; Dritsakis and Adamopoulos, 2004; Chang and Caudill, 2005).

This problem does not arise if the variables are cointegrated, see Phillips (1987) which requires each one of the variable to be integrated. To determine whether a time series is stationary or not, involves conducting tests for the presence of unit root. Hence, tests for unit root and cointegration are conducted before proceeding with the Granger-causality tests (Katos, 2004). A time series with stable mean value and standard deviation is called a stationary series. If d differences have to be made to produce a stationary process, then it can be defined as integrated of order d. Engle and Granger (1987) state that if several variables are all I(d) series, their linear combination may be stationary.

Although the variables may drift away from equilibrium for a while, economic forces may be expected to act so as to restore equilibrium, thus, they tend to move together in the long run irrespective of short run dynamics. The two tests that have been very popular and used widely for testing for the existence of unit roots are Dickey-Fuller (DF) and `Augmented' Dickey-Fuller (ADF) tests (Dickey-Fuller, 1979; Chang and Caudill, 2005). According to Chang (2002) in order to test for the order of integration for each variable, namely the R&D expenses, the productivity index, the information and communications technology index, it is common practice to run the ADF test, which involves the estimation one of the following equations respectively:

$$\Delta X_t = \beta X_{t-1} + \sum_{j=1}^{p} \delta_j \Delta X_{t-j} + \varepsilon_t \quad (1)$$

$$\Delta X_t = \alpha_0 + \beta X_{t-1} + \sum_{j=1}^{p} \delta_j \Delta X_{t-j} + \varepsilon_t \quad (2)$$

$$\Delta X_t = \alpha_0 + \alpha_1 t + \beta X_{t-1} + \sum_{j=1}^{p} \delta_j \Delta X_{t-j} + \varepsilon_t \quad (3)$$

where Δ is the first difference operator, α0 is an intercept, t represents a time trend, α1 is the coefficient of the time trend, Xt is the variable, p is the appropriate lag length of the augmented terms Δδj, while εt is a stationary random error (white noise)

The additional lagged terms are included to ensure that the errors are uncorrelated. The maximum lag length begins with 3 lags and proceeds down to the appropriate lag by examining the AIC and SC information criteria. The null hypothesis is that the variable Xt is a non-stationary series (H0: β=0) and is rejected when β is significantly negative (Ha: β<0). If the calculated ADF statistic is higher than McKinnon's critical values, then the null hypothesis (H0) is not rejected and the series is non-stationary or not integrated of order zero I(0). Alternatively, rejection of the null hypothesis implies stationarity. Failure to reject the null hypothesis leads to conducting the test on the difference of the series. Further differencing is conducted until stationarity is reached and the null hypothesis is rejected (Chang, 2002; Dritsakis and Adamopoulos, 2004; Chang and Caudill, 2005).

In order to find the proper structure of the ADF equations, in terms of the inclusion in the equations of an intercept (α0) and a trend (t) and in terms of how many extra augmented lagged terms to include in the ADF equations, for eliminating possible autocorrelation in the disturbances, the usual Akaike's (1973) information criterion (AIC) and Schwarz's (1978) criterion (SC) were employed. The minimum values of AIC and SC indicated the 'best' structure of the ADF equations. With respect to testing autocorrelation in the disturbances, so the usual Lagrange multiplier LM(1) test was used for this case (Chang and Caudill, 2005).

The time trend is included in the auxiliary regression equation if the reported ADF t-statistics, with and without a deterministic trend, are substantially different from each other. If the series do not contain a trend, including it in the regression will generally reduce the power of the test. A sufficient number of lagged first differences are included to remove any serial correlation in the residuals.

In order to determine k, an initial lag length of 4 is selected, and the fourth lag is tested for significance using the standard asymptotic t-ratio. If the fourth lag is insignificant, the lag length is reduced successively until a significant lag length is obtained. If no lagged first differences are used, the ADF test reduces to the Dickey-Fuller (DF) test Chang (2002). The Eviews 4.1 (2000) software package which is used to conduct the ADF tests, reports the simulated critical values based on response surfaces. The results of the Dickey-Fuller (DF) and Augmented’ Dickey-Fuller (ADF) 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. The observed t-statistics in the table 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 1% and 5% levels of significance. However, the results of the DF and ADF 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 (Chang, 2002; Dritsakis and Adamopoulos, 2004; Chang and Caudill, 2005). Therefore, all series that are used for the estimation of ADF equations are non-stationary in their levels, but stationary and integrated of order one I(1), in their first differences. Moreover, the LM(1) test shows that there is no correlation in the disturbance terms for all variables in their first differences.

Table 1. *DF/ADF unit root tests*

Variables	In levels					In first differences				
	lag eq_f	adf_test stat	cr_val 1% 5% 10%	SBC AIC	LM [prob]	lag eq_f	adf_test stat	cr_val 1% 5% 10%	SBC AIC	LM [prob]
GDPGRE	(p=0) (1)	13.45 [1.00]	-2.64 -1.95 -1.61	-4.66 -4.71	0.58 [0.56]	(p=0) (3)	-3.98 [0.02]	-3.72 -3.58 -3.22	-4.38 -4.53	0.47 [0.62]
BCGRE	(p=0) (2)	-1.65 [0.44]	-3.67 -2.96 -2.62	-2.22 -2.32	0.87 [0.43]	(p=0) (1)	-4.38 [0.00]	-2.65 -1.95 -1.60	-2.19 -2.24	0.56 [0.57]
SMGRE	(p=1) (3)	-3.64 [0.04]	-4.32 -3.88 -3.72	-1.20 -1.39	0.19 [0.82]	(p=0) (1)	-3.02 [0.00]	-2.65 -1.95 -1.60	-1.04 -1.09	1.89 [0.17]
INDGRE	(p=0) (1)	1.33 [0.95]	-2.64 -1.95 -1.61	-4.55 -4.60	0.12 [0.88]	(p=0) (1)	-5.84 [0.00]	-2.65 -1.95 -1.60	-4.61 -4.66	0.21 [0.81]
GDPIRE	(p=1) (1)	3.20 [0.99]	-2.62 -1.94 -1.61	-4.95 -5.04	0.32 [0.72]	(p=0) (1)	-3.25 [0.09]	-3.24 -3.15 -3.04	-4.41 -4.56	0.32 [0.72]
BCIRE	(p=0) (2)	5.05 [1.00]	-3.59 -2.93 -2.60	-2.45 -2.54	0.20 [0.81]	(p=0) (1)	-4.06 [0.01]	-3.94 -3.52 -3.19	-2.27 -2.40	0.50 [0.60]
SMIRE	(p=1) (1)	1.93 [0.98]	-2.62 -1.94 -1.61	-2.25 -2.34	1.66 [0.20]	(p=0) (1)	-2.95 [0.00]	-2.62 -1.94 -1.61	-2.25 -2.29	0.40 [0.66]
INDIRE	(p=1) (2)	1.02 [0.91]	-2.62 -1.94 -1.61	-4.75 -4.83	0.12 [0.88]	(p=0) (1)	-5.38 [0.00]	-2.66 -1.95 -1.60	-4.24 -4.29	0.14 [0.86]
GDPUK	(p=0) (1)	6.38 [1.00]	-2.62 -1.94 -1.61	-3.92 -3.97	0.37 [0.68]	(p=0) (3)	-5.61 [0.00]	-4.19 -3.52 -3.19	-3.82 -3.95	0.01 [0.98]
BCUK	(p=1) (1)	2.07 [0.98]	-2.62 -1.94 -1.61	-2.96 -3.05	0.65 [0.52]	(p=0) (1)	-3.06 [0.00]	-2.62 -1.94 -1.61	-2.95 -2.99	0.85 [0.43]
SMUK	(p=1) (3)	-3.44 [0.05]	-4.19 -3.62 -3.49	-3.30 -3.46	4.50 [0.01]	(p=2) (2)	-5.77 [0.00]	-3.61 -2.93 -2.60	-3.43 -3.61	0.34 [0.71]
INDUK	(p=0) (1)	1.85 [0.98]	-2.62 -1.94 -1.61	-6.07 -6.11	1.42 [0.25]	(p=0) (1)	-4.29 [0.00]	-2.62 -1.94 -1.61	-4.61 -4.65	1.48 [0.23]

Note: *Eq_f = equation form; Cr_val = critical values; AIC= Akaike criterion, SBC = Schwarz Bayesian criterion; LM = Langrage Multiplier test.*

Following the studies of Chang and Caudill (2005), Chang et al (2009), Dritsakis and Adamopoulos (2004), 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 Engle and Granger (1987), a set of variables, Yt is said to be cointegrated of order (d, b) - denoted CI(d, b) - if Yt is integrated of order d and there exists a vector, β, such that β′Yt is integrated of order (d-b). Cointegration tests in this paper are conducted using the method developed by Johansen (1988) and Johansen and Juselius (1990).

The multivariate cointegration techniques developed by Johansen (1988) and Johansen and Juselius (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. This procedure is currently the most reliable test for cointegration and avoids the problems with Engle and Granger's (1987) two-step procedure, as shown in Gonzalo (1994). The Johansen method applies the maximum likelihood procedure to determine the presence of cointegrated vectors in nonstationary time series (Dritsakis and Adamopoulos, 2004).

Further, this method is independent of the choice of the endogenous variable because it treats all the variables in the model as endogenous within a VAR (vector autore-gression) framework. More importantly, this method allows one to estimate and test for the presence of more than one cointegrated vector(s) in the multivariate system. In addition, it enables the researchers to test for various structural hypotheses involving restricted versions of the cointegrated vectors and speed of adjustment parameters using likelihood ratio tests. The main features of this method are discussed below.

Following the studies of Johansen (1988), Johansen and Juselius (1990), Chang (2002), and Chang et al (2009), a VAR (vector autoregressive) representation of the N-dimensional data vector zt is specified as follows:

$$z_t = \Pi_1 z_{t-1} + \Pi_2 z_{t-2} + ... + \Pi_{\kappa-1} z_{t-k+1} - \Pi_{\kappa} z_{t-\kappa} + \delta + \varepsilon_t \qquad (4)$$

where zt = (n□1) vector of I(1) variables; Π =(n□n) matrix of unknown parameters to be estimated (i=1,……k); εt = independent and identically distributed (n×1) vector of error terms; and t =1; . . . ; T observations. Now using the notation Δ = (1-L), where L is the lag operator, the VAR system of equations in (4) can be reparameterized in the error correction form as:

$$\Delta z_t = \sum_{i=1}^{k-1} \Gamma_t \Delta z_{t-i} + \Pi z_{t-k} + \varepsilon_t \qquad (5)$$

where Δzt is an I(0) vector, I is an (n□n) identity matrix,

$$\Gamma_i = \sum_{i=1}^{\kappa-1} \Pi_i - I = -(\mathrm{I} - \Pi_1 - .....\Pi_i) \text{ ………i=1,2.....k-1, and}$$

$$\Pi = \sum_{j=1}^{\kappa}\Pi_j - I = -(\mathrm{I} - \Pi_1 - .....\Pi_t)$$

Equation 5 is known as a vector error correction (VEC) model.

Following the studies of Chang (2002), Chang et al (2009) the Π matrix conveys information about the long-run relationship between zt variables and the rank of Π is the number of linearly independent and stationary linear combinations of variables studied. Thus, testing for cointegration involves testing for the rank of Π matrix r by examining whether the eigenvalues of Π are significantly different from zero.

The main focus of the Johansen-Juselius technique is on the parameter matrix Π. The rank r of this matrix r(Π), where (0<r<N), will determine the number of cointegrated vectors in the VAR system. If the rank of this matrix is found to be r, then there are r linear combinations of the variables in the VAR system, which are stationary and all other linear combinations are non-stationary. Johansen's approach derives maximum likelihood estimators of the cointegrated vectors for an autoregressive process with independent errors. The matrix Π can be rewritten as Π=αβ where α is the speed of adjustment vector (also called loading) which shows the adjustment of the system towards the cointegrated (long-run) relations after a stochastic shock, and β is the cointegrated vector (Dritsakis and Adamopoulos, 2004; Chang and Caudill, 2005). Hence, Equation (5) can be rewritten as:

$$\Delta z_t = \sum_{i=1}^{k-1}\Gamma_t \Delta z_{t-i} + (\beta\alpha) z_{t-k} + \varepsilon_t$$

The dimension of α and β are (N□r) and the VAR system is subject to the condition that Π is less than full rank matrix, i.e. r < N (where N is the number of variables). The procedure boils down to testing for the value of r on the basis of the number of significant eigenvalues of Π.

Following the studies of Chang (2002), Chang and Caudill (2005), Johansen (1988) and Johansen and Juselius (1990) propose two test statistics for testing the number of cointegrated vectors (or the rank of Π): the trace (λtrace) and the maximum eigenvalue (λmax) statistics. The likelihood ratio statistic (LR) for the trace test (λtrace) as suggested by Johansen (1988) is:

$$\lambda_{trace}(r) = -T\sum_{i=r+1}^{p}\ln(1-\hat{\lambda}_i) \qquad (6)$$

where $\hat{\lambda}_i =$ is the largest estimated value of ith characteristic root (eigenvalue) obtained from the estimated Π matrix, r = 0, 1, 2,…….p-1, and T is 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 λtrace 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) (Dritsakis and Adamopoulos, 2004; Chang and Caudill, 2005). Alternatively, the maximum eigenvalue (λ_{max}) statistic as suggested by Johansen is:

$$\lambda_{max}(r, r+1) = -T \ln(1-\hat{\lambda}_{r+1}) \qquad (7)$$

The λ_{max} statistic tests the null hypothesis that the number of r cointegrated vectors is r against the alternative of (r+1) cointegrated 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 λmax will be small.

It is well known that Johansen‘s cointegration 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) and the likelihood ratio (LR) test are used to select the number of lags required in the cointegration test (Chang, 2002). If there is any divergence of results between these two tests, it is recommended that one should rely on the evidence based on the trace test (λtrace) which shows more robustness to both skewness and excess kurtosis in the residuals than the λ_{max} test (Dritsakis and Adamopoulos, 2004).

Before undertaking the cointegration tests let us first suppose the possible maximum order of lags (p) on the VAR model. Given the annual nature of the data, initially the value p =3 seems to be reasonable choice. The Schwarz Criterion (SC) and the likelihood ratio (LR) test suggested that the value p=3 is the appropriate specification for the order of VAR model for Greece, Ireland and UK. Table 2 presents the results from the Johansen (1988) and Johansen and Juselius (1990) cointegration test.

The cointegration vector of the model of Greece presented in table 2 has rank r<n (n=3) The process of estimating the rank r is related with the assessment of eigenvalues, which are the following for Greece: $\hat{\lambda}_1 = 0.61$, $\hat{\lambda}_2 = 0.38$, $\hat{\lambda}_3 = 0.23$, $\hat{\lambda}_4 = 0.002$, for Ireland: $\hat{\lambda}_1 = 0.63$, $\hat{\lambda}_2 = 0.20$, $\hat{\lambda}_3 = 0.07$, $\hat{\lambda}_4 = 0{,}02$, for UK: $\hat{\lambda}_1 = 0.63$, $\hat{\lambda}_2 = 0.40$, $\hat{\lambda}_3 = 0.16$, $\hat{\lambda}_4 = 0{,}01$.

For Greece, Ireland and UK critical values for the trace statistic defined by equation (6) are 39.89 and 45.58 for Ho: r = 0 and 24.31 and 29.75 for Ho: $r \leq 1$, 12.53 and 16.31 for Ho: $r \leq 2$ at the significance level 5% and 1% respectively as reported by

Osterwald-Lenum (1992), while critical values for the maximum eigenvalue test statistic defined by equation (7) are 23.80 and 28.82 for Ho: $r = 0$, 17.89 and 22.99 for Ho: $r \leq 1$, 11.44 and 15.69 for Ho: $r \leq 2$.

The results that appear in Table 2 suggest that the number of statistically significant cointegration vectors for Greece, Ireland and UK are equal to 1 and are the following:

$$GDP = 0.99 *SM + 0.19 *BC + 0.15 *IND \tag{8}$$

$$GDP = 1.15 *SM + 0.05 *BC + 0.42 *IND \tag{9}$$

$$GDP = 0.71 *SM + 0.24 *BC + 0.11 *IND \tag{10}$$

Table 2. *Johansen and Juselious Cointegration Tests (GDP, BC, SM, IND)*

Country	**Greece**				**Ireland**				**UK**			
Testing Hypothesis	**Johansen Test Statistics**				**Johansen Test Statistics**				**Johansen Test Statistics**			
	λ_{trace}	Cr_v 5% 1%	λ_{max}	Cr_v 5% 1%	λ_{trace}	Cr_v 5% 1%	λ_{max}	Cr_v 5% 1%	λ_{trace}	Cr_v 5% 1%	λ_{max}	Cr_v 5% 1%
H_0: r = 0 and r=1	46.18	39.89 45.58	25.85	23.80 28.82	53.89	39.89 45.58	40.58	23.80 28.82	69.07	39.89 45.58	40.50	23.80 28.82
H_0: r ≤ 1 and r=2	20.32	24.31 29.75	13.02	17.89 22.99	13.31	24.31 29.75	9.31	17.89 22.99	28.56	24.31 29.75	20.70	17.89 22.99
H_0: r ≤ 2 and r=3	7.30	12.53 16.31	7.30	11.44 15.69	4.00	12.53 16.31	3.04	11.44 15.69	7.85	12.53 16.31	7.31	11.44 15.69
Cointegrated vectors	1		1 (only for 5%)		1		1		1 (only for 1%)		1 (only for 1%)	

Note: *Cr_v = critical values.*

It is obvious from the above cointegrated vector that stock market and credit market development have a positive effect on economic growth in the long-run. According to the signs of the vector cointegration components and based on the basis of economic theory the above relationships can be used as an error correction mechanism in a VAR model for Greece, Ireland and UK respectively.

Once a cointegrated relationship among relevant economic variables is established, the next issue is how these variables adjust in response to a random shock. This is an issue of the short-run disequilibrium dynamics. The short run dynamics of the model is studied by analysing how each variable in a cointegrated system responds or corrects itself to the residual or error from the cointegrated vector. This justifies the use of the term error correction mechanism.

Since the variables included in the VAR model are found to be cointegrated, the next step is to specify and estimate a vector error correction model (VECM) including the error correction term to investigate dynamic behaviour of the model. The correspondence between cointegration and error correction model is formalized in the Granger Repre-sentation Theorem Granger (1983). According to the Granger Representation Theorem, if a set of variables are cointegrated then there exists a valid error-correction term (Dritsakis and Adamopoulos, 2004; Chang and Caudill, 2005).

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 supposed to be cointegrated, 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 cointegrated 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; Chang *et al.,* 2009).

The existence of a long-run equilibrium relationship among the dependent and independent variables, as reflected in the cointegrated regression, implies that the residuals from the cointegrated regression can be used as the error-correction term EC_{t-1} to explain the system's short-run dynamics (Engle and Granger, 1987; Chang et al., 2009). The coefficients of the error-correction terms, however, represent the proportion by which the long-run disequilibrium (or imbalance) in the dependent variables are corrected in each short-term period. 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 was first introduced by Sargan (1964) and subsequently popularized by studies of Davidson and McKinnon (1978), Hendry et al (1984), Engle and Granger (1987), Johansen and Juselius (1990), Dritsakis and Adamopoulos, 2004), Chang and Caudill (2005), Chang et al (2009). 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:

$$\Delta LGDP_t = \beta_0 + \sum_i^n \beta_1 \Delta LGDP_{t-i} + \sum_i^n \beta_2 \Delta LBC_{t-i} + \sum_i^n \beta_3 \Delta LSM_{t-i} + \sum_i^n \beta_4 \Delta LIND_{t-i} + \lambda EC_{t-i} + \varepsilon_t \qquad (11)$$

where:
Δ is the first difference operator;
EC_{t-1} is the error correction term lagged one period;
λ is the short-run coefficient of the error correction term ($-1<\lambda<0$);
ε_t is the white noise term.

In testing for cointegration a question arises as to whether or not deterministic variables such as a constant and trend should enter the long-run relationship. Johansen (1992) propose to use the so-called ‘‘Pantula principle’’ in determining the appropriate model (cointegration relationship) based on the joint hypothesis of both rank order and deterministic trend. As proved by Johansen (1992) the intercept terms in the VEC model should be associated with the existence of a deterministic linear trend in the data do not contain a time trend. If however the data do not contain a time trend, the VEC model should include a restricted intercept term associated to the cointegrated vectors.

For the ECM, the appropriate lag length is selected by using Hendry’s modeling strategy to eliminate lags with insignificant parameter estimates based on lowest values for the Schwarz Information Criterion (SC) Initially, the ECM was estimated using the lags of those first differences of variables, whose coefficients were statistically not significant were deleted, so that a parsimonious ECM was obtained relatively (Chang, 2002; Chang *et al,* 2009).

Furthermore, in order to select an ECM, it is needed to satisfy a range of diagnostic tests. The diagnostic tests usually include Lagrange Multiplier, or Breusch-Godfrey (1978) test for autocorrelation, White (1980) test for heteroscedasticity, Ramsey (1969) RESET test for the functional form of the model, and Jargue-Bera (1980) test for normality. The VEC specification forces the long-run behaviour of the endogenous variables to converge to their cointegrated 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 error-correction model with the computed t-values of the regression coefficients in parentheses is reported in Table 3.

From the results of Table 3 we can see that a short-run increase of stock market index per 1% induces an increase of economic growth per 0.06% in Greece, 0.19% in UK, 0.08% in Ireland, an increase of bank lending per 1% induces an increase of economic growth per 0.14% in Greece, 0.007% in Ireland, 0.05% in UK., while an increase of productivity per 1% induces an increase of economic growth per 0.32% in Greece, 0.02% in UK and 0.2% in Ireland. 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, its relatively value -0.03[0.001] for Greece, -0.02[0.002] for Ireland, -0.01[0.04] for UK), shows a satisfactory rate of convergence to the equilibrium state per period.

Table 3. *Vector Error Correction Model*

Independent Variable	**Country**		
	Greece	**Ireland**	**UK**
Constant	-0.01	0.001[0.06]	0.006[0.52]
ΔGDP_{t-1}		0.17[0.37]	
ΔGDP_{t-3}	0.12[0.56]		
ΔSM_{t}	0.06[0.11]		
ΔSM_{t-1}		0.08[0.04]	
ΔSM_{t-2}			0.19[0.07]
ΔBC_{t-1}		0.007[0.87]	0.09[0.39]
ΔBC_{t-2}			-0.04[0.66]
ΔBC_{t-3}	0.14[0.04]		
ΔIND_{t-1}		0.20[0.11]	-0.13[0.60]
ΔIND_{t-2}			0.15[0.51]
ΔIND_{t-3}	0.32[0.17]		
ECT_{t-1}	-0.03[0.001]	-0.02[0.002]	-0.01[0.04]
R^2	0.68	0.88	0.30
DW	1.74	2.28	2.03
F-stat	8.54[0.00]	52.25[0.00]	2.29[0.05]
Serial Correlation	0.15[0.69]	8.53[0.003]	0.01[0.89]
Functional Form	0.72[0.39]	2.48[0.11]	0.97[0.32]
Normality	0.47[0.78]	76.23[0.00]	24.10[0.00]
Heteroscedasticity	3.25[0.07]	0.74[0.38]	0.11[0.73]

Notes: *[ ]= I denote the probability levels; Δ: Denotes the first differences of the variables; R^2 = Coefficient of multiple determinations adjusted for the degrees of freedom (d.f); DW= Durbin-Watson statistic; A: $X^2(n)$= Lagrange multiplier test of residual serial correlation based on x^2 distribution with (n) degrees of freedom; B: $X^2(n)$= Ramsey Reset test for the functional form based on x^2 distribution with (n) degrees of freedom; C: $X^2(n)$= normality test for the residuals and is based on skewness and kurtosis based on x^2 distribution with (n) degrees of freedom; D: $X^2(n)$= is the heteroscedasticity test and it is based on squared fitted values, based on x^2 distribution with (n) degrees of freedom.*

Granger causality is used for testing the long-run relationship between financial development and economic growth. Although there are many approaches to examine causal linkages, like Sims causality (1972), Geweke causality (1984) and Hsiao causality (1979), the Granger procedure is selected because it consists the more powerful and simpler way of testing causal relationship (Granger, 1969). The following bivariate model is estimated:

$$Y_t = a_{10} + \sum_{j=1}^{k} a_{1j} Y_{t-j} + \sum_{j=1}^{k} b_{1j} X_{t-j} + u_t \tag{12}$$

$$X_t = a_{20} + \sum_{j=1}^{k} a_{2j} X_{t-j} + \sum_{j=1}^{k} b_{2j} Y_{t-j} + u_t \tag{13}$$

where Y_t is the dependent and X_t is the explanatory variable and u_t is a zero mean white noise error term in Eq (12), while X_t is the dependent and Y_t is the explanatory variable in Equation (13).

So, four alternative causal relationships are tested:

- if $\{\alpha_{11}, \alpha_{12}, \dots\dots\dots \alpha_{1k}\} \neq 0$ and $\{\beta_{21}, \beta_{22}, \dots\dots\dots \beta_{2k}\} = 0$, then there exists a unidirectional causality from X_t to Y_t, denoted as X→Y.
- if $\{\alpha_{11}, \alpha_{12}, \dots\dots\dots \alpha_{1k}\} = 0$ and $\{\beta_{21}, \beta_{22}, \dots\dots\dots \beta_{2k}\} \neq 0$, then there exists a unidirectional causality from Y_t to X_t, denoted as Y→ X.
- if $\{\alpha_{11}, \alpha_{12}, \dots\dots\dots \alpha_{1k}\} \neq 0$ and $\{\beta_{21}, \beta_{22}, \dots\dots\dots \beta_{2k}\} \neq 0$, then there exists a bilateral causality between X_t and Y_t denoted as X↔Y.
- if $\{\alpha_{11}, \alpha_{12}, \dots\dots\dots \alpha_{1k}\} = 0$ and $\{\beta_{21}, \beta_{22}, \dots\dots\dots \beta_{2k}\} = 0$, then there exists a no causality between X_t and Y_t, Seddighi *et al.* (2000).

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

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

where:
RSS_U= is 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 and q = is the lag length.

The hypotheses in this test are the following (Seddighi *et al.*, 2000; Katos 2004):

H_0: X does not Granger cause Y, i.e. $\{\alpha_{11}, \alpha_{12}, \dots\dots \alpha_{1k}\} = 0$, if $F_c <$ critical value of F.
H_a: X does Granger cause Y, i.e. $\{\alpha_{11}, \alpha_{12}, \dots\dots\dots \alpha_{1k}\} \neq 0$, if $F_c >$ critical value of F.

and
H_0: Y does not Granger cause X, i.e. $\{\beta_{21}, \beta_{22}, \dots\dots \beta_{2k}\} = 0$, if $F_c <$ critical value of F.
H_a: Y does Granger cause X, i.e. $\{\beta_{21}, \beta_{22}, \dots\dots\dots \beta_{2k}\} \neq 0$, if $F_c >$ critical value of F.

The results related to the existence of Granger causal relationships among economic growth, stock market, credit market and productivity appear in Table 4. The results of Table 4 indicate that there is:

- bidirectional causality between stock market and productivity for Greece and Ireland, stock market and economic growth for Ireland and UK;
- unidirectional causal relationship between economic growth and productivity with direction from economic growth to productivity for Greece;

- unidirectional causal relationship between economic growth and credit market with direction from economic growth to credit market for Ireland and UK;
- unidirectional causal relationship between economic growth and stock market with direction from economic growth to stock market for Greece;
- unidirectional causal relationship between productivity and credit market with direction from productivity to credit market for Greece and Ireland;
- unidirectional causal relationship between stock and credit market with direction from credit market to stock market for Ireland and UK.

Table 4. *Granger causality tests*

Countries	**Dependent variable**	**Independent variable**	**F_1**	**F_2**	**Causal relations**
Greece	**GDP**	**SM**	0,04	19,19	GDP ⇒ SM
		BC	0,40	2,91	No causality
		IND	1,46	3,92	GDP ⇒ IND
	SM	**BC**	0,84	1,81	No causality
		IND	6,29	6,80	SM ⇔ IND
	BC	**IND**	4,15	0,28	IND ⇒ BC
Ireland	**GDP**	**SM**	8,30	16,24	GDP ⇔ SM
		BC	0,39	3,96	GDP ⇒ BC
		IND	2,85	2,01	No causality
	SM	**BC**	5,99	0,86	BC ⇒ SM
		IND	5,69	3,95	SM ⇔ IND
	BC	**IND**	3,40	0,22	IND ⇒ BC
UK	**GDP**	**SM**	6,12	5,96	GDP ⇔ SM
		BC	0.40	4,75	GDP ⇒ BC
		IND	1,94	0,56	No causality
	SM	**BC**	8,75	1,30	BC ⇒ SM
		IND	3,05	3,22	No causality
	BC	**IND**	0,13	0,94	No causality

Note: *Critical values: 3.25 for Ireland and UK, 3.34 for Greece.*

5. Conclusions

This paper employs with the relationship between financial development and economic growth for three European Union's member-countries, using annually data for the period 1965-2007, except for Greece which is studied for the period 1978-2007. The empirical analysis suggested that the variables that determine economic growth in the three European Union member - countries present a unit root. Once a cointegrated relationship among relevant economic variables is established, the next issue is how these variables adjust in response to a random shock.

This is an issue of the short-run disequilibrium dynamics. The short run dynamics of the model is studied by analysing how each variable in a cointegrated system responds or corrects itself to the residual or error from the cointegrating 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 VEC specification forces the long-run behaviour of the endogenous variables to converge to their cointegrating relationships, while accommodates the short-run dynamics. The dynamic specification of the model suggests deletion of the insignificant variables while the error correction term is retained. Granger causality tests indicated that there is bidirectional relationship between stock market and economic growth for Ireland and UK, while there is unidirectional causal relationship between economic growth and stock market with direction from economic growth to stock market for Greece. Therefore, it can be inferred that stock market development has larger effect on economic growth than credit market development in the three European Union's member-countries.

References:

Akaike, H. 1973. Information Theory and an Extension of the Maximum Likelihood Principle. In: Petrov, B. and Csaki, F. (eds) 2nd International Symposium on Information Theory. Budapest: Akademiai Kiado.

Beck, T., Levine, R., Loyaza, N. 2000. Finance and the sources of growth. Journal of Financial Economics, 58, 261-300.

Bencivenga, V., Smith, B. 1991. Financial intermediation and endogenous growth. Review of Economics and Studies, 58, 195-209.

Bencivenga, V., Smith, B., Starr, R. 1996. Equity Martkets, Transaction Costs, and Capital Accumulation: An Illustration. The World Bank Economic Review, 10(2), 241-265.

Berthelemy, J., Varoudakis, A. 1998. Financial Development, Financial Reforms and Growth: A panel data approach. Revue-Economique, 49(1), 195-206.

Breusch, T. 1978. Testing the autocorrelation in dynamic linear models. Australian Economic Papers, 17, 334-335.

Chang, T. 2002. An econometric test of Wagner's law for six countries based on cointegration and error-correction modelling techniques. Applied Economics, 34(9), 1157-1169.

Chang, T., Caudill, S. 2005. Financial development and economic growth: the case of Taiwan. Applied Economics, 37, 1329-1335.

Chang, R., Kaltani, L., Loayza, N. 2009. Openness can be good for growth: The role of policy complementarities. Journal of Development Economics, 90, 33-49.

Davidson, R., McKinnon, J. 1978 Estimation and Inference in Econometrics, Oxford University Press, Oxford.

Demetriades, P., Luintel, K. 1996a. Financial development, economic growth and banking sector controls: evidence from India. Economic Journal, 106, 359-374.

Dickey, D., Fuller, W. 1979. Distributions of the Estimators for Autoregressive Time Series with a Unit Root. Journal of American Statistical Association, 74, 427- 431.

Dritsakis, N., Adamopoulos, A. 2004. Financial development and economic growth in Greece: An empirical investigation with Granger causality analysis. International Economic Journal, 18(4), 547-559.

Engle, R., Granger, C. 1987. Cointegration and error correction: Representation, estimation and testing. Econometrica, 55, 251-276.

Eviews 4.1. 2000. Quantitative Micro Software, Irvine, California.

Friedman, M., Schwartz, A. 1963. A Monetary history of the United States. Princeton: Princeton University Press.

Geweke, J. 1984. Inference and causality in economic time series models. In Griliches, Z., Intriligator, M.D. (eds) Handbook of Econometrics, Amsterdam: North Holland.

Ghali, K. 1999. Financial development and economic growth: The Tyisian experience. Review of Development Economics, 3(3), 310-322.

Goldsmith, R. 1969. Financial Structure and Development. New Haven, Yale University Press.

Gonzalo, J. 1994. Five alternative methods of estimating long-run relationships. Journal of Econometrics, 60, 203-233.

Granger, C. 1983. Cointegrated variables and error-correcting models. UCSD Discussion Paper, 83-113.

Granger, C. 1986. Developments in the study of cointegrated economic variables. Oxford Bulletin of Economics and Statistics, 48, 213-228.

Greenwood, J., Jovanovic, B. 1990. Financial development, growth and distribution of income. Journal of Political Economy, 98, 1076-1107.

Gurley, J., Shaw, E. 1955. Financial Aspects of Economic Development. American Economic Review, 45, 515-537.

Gursoy, T., Muslumov, A. 1998. Stock markets and economic growth: A causality test. MBA thesis, Istanbul Technical University, Turkey.

Hassapis, C., Kalyvitis, S. 2002. On the propagation of stock returns on growth: is the global effect important? Journal of Policy Modeling, 24, 487-502.

Hendry, D., Pagan, A., Sargan, J. 1984. Dynamic Specification. In Z. Grilliches and M.D. Intrilligater (eds.) Handbook of Econometrics, Vol. II, North Holland, Amsterdam.

Hsiao, C. 1979. Autoregressive modeling of Canadian money and income data. Journal of American Statistical Association, 74, 553-560.

Jarque, C., Bera, A. 1980. Efficient tests for normality, homoscedasticity and serial independence of regression residuals. Economics Letters, 6, 255-259.

Johansen, S. 1988. Statistical Analysis of Cointegration Vectors. Journal of Economic Dynamics and Control, 12, 231-254.

Johansen, S. 1992. Determination of the cointegration rank in the presence of a linear trend. Oxford Bulletin of Economics and Statistics, 54, 383-397.

Johansen, S., Juselious, K. 1990. Maximum Likelihood Estimation and Inference on Cointegration with Applications to the Demand for the Money. Oxford Bulletin of Economics and Statistics, 52, 169-210.

Johansen, S., Juselius, K. 1992. Testing Structural Hypotheses in a Multivariate Cointegration Analysis at the Purchasing Power Parity and the Uncovered Interest Parity for the UK. Journal of Econometrics, 53, 211-244.

International Monetary Fund, (IMF). 2007. International Financial Statistics Yearbook, 2007, Washington DC: Various Years.

Katos, A. 2004. Econometrics: Theory and practice. Thessaloniki, Zygos.

Katsouli, E. 2003. Book review: Money, Finance and Capitalist Development. In Philip Arestis and Malcolme Sawyer, Economic Issues.

King, R., Levine, R. 1993. Finance, entrepreneurship, and growth: Theory and evidence. Journal of Monetary Economics, 32, 513-542.

King, R., Levine, R. 1993a. Finance and Growth: Schumpeter Might be Right. Quarterly Journal of Economics, 108(3), 717-737.

King, R., Levine, R. 1993b. Finance Entrepreneurship and Growth. Journal of Monetary Economics, 32, 513-542.

Levine, R. 1991. Stock Markets, Growth, and Tax Policy. Journal of Finance, 46, 1445-1465.

Levine, R. 1997. Financial development and economic growth: views and agenda. Journal of Economic Literature, 35(2), 688-726.

Levine, R., Loyaza, N., Beck, T. 2000. Financial intermediation and growth: Causality and causes. Journal of Monetary Economics, 46, 31-77.

Maddala, G. 1992. Introduction to Econometrics. Prentice Hall, New Jersey.

McKinnon, R. 1973. Money and capital in economic development. Washington, DC: Brookings Institution.

Michalopoulos, G., Tsermenidis, K. 2018. Country Risk on the Bank Borrowing Cost Dispersion Within the Euro Area during the Financial and Debt Crises. International Journal of Economics & Business Administration, 6(4), 76-92.

Nieuwerburgh, S., Buelens, F., Cuyvers, L. 2006. Stock market and economic growth in Belgium. Explorations in Economic History, 43(1), 13-38.

Osterwald-Lenum, M. 1992. A Note With Quantiles of the Asymptotic Distribution of the Maximum Likelihood Cointegration Rank Test Statistics. Oxford Bulletin of Economics and Statistics, 54, 461-472.

Pagano, M. 1993. Financial markets and growth: An overview. European Economic Review, 37, 613-622.

Patrick, H. 1966. Financial Development and Economic Growth in Underdeveloped Countries. Economic Development and Cultural Change, 14(2).

Pereira, A., Xu, Z. 2000. Export growth and domestic performance. Review of International Economics, 8, 60-73.

Phillips, P. 1987. Time Series Regression with Unit Roots. Econometrica, 2, 277-301.

Ramsey, J. 1969. Test for specification errors in classical linear least squares regression analysis. Journal of the Royal Statistical Society, 350- 371.

Rivera-Batiz, L., Romer, P. 1991. Economic Integration and Endogenous Growth. Quarterly Journal of Economics, 106, 531-555.

Roubini, N., Salla-i-Martin, X. 1992. Financial Repression and Economic Growth. Journal of Development Economics, 39(1), 5-30.

Robinson, J. 1952. The Rate of interest and other essays. London, Macmillan.

Rupeika-Apoga, R., Zaidi, H.S., Thalassinos, E.Y. and Thalassinos, I.E. 2018. Bank Stability: The Case of Nordic and Non-Nordic Banks in Latvia. International Journal of Economics & Business Administration, 6(2), 39-55.

Saint-Paul, G. 1992. Technological Choice, Financial Markets and Economic Development. European Economic Review, 36, 763-781.

Sargan, J. 1964. Wages and prices in the UK: a study in econometric methodology. In Econometric Analysis for National Economic Planning, (Eds) P.E. Hart, G. Mills and J.K. Whittaker, Butterworth, London, 25-54.

Schwarz, R. 1978. Estimating the Dimension of a Model. Annuals of Statistics, 6, 461-464.

Schumpeter, J. 1911. The Theory of Economic Development. Cambridge Harvard University Press.

Schumpeter, J. 1912. The Theory of Economic Development. Cambridge, MA, Harvard University Press, 1934.

Seddighi, H., Lawler, K., Katos, A. 2000. Econometrics A practical approach. London, Routledge.

Shan, J., Morris, A., Sun, F. 2001. Financial development and economic growth. Review of International Economics, 9(3), 443-454.

Shan, J. 2005. Does financial development lead economic growth? A vector auto-regression appraisal. Applied Economics, 37, 1353-1367.

Shaw, E. 1973. Financial Deepening in Economic Development. Oxford. Oxford University Press.

Sims, C. 1972. Money, Income and Causality. American Economic Review, 62, 540-552.

Thalassinos, I.E., Thalassinos, Y. 2018. Financial Crises and e-Commerce: How Are They Related. Available at SSRN: https://ssrn.com/abstract=3330169.

Thalassinos, I.E., Pintea, M., Raţiu, I.P. 2015. The Recent Financial Crisis and Its Impact on the Performance Indicators of Selected Countries during the Crisis Period: A Reply. International Journal of Economics and Business Administration, 3(1), 3-20.

Thornton, J. 1996. Financial deepening and economic growth in developing economies. Applied Economics Letters, 3, 243-246.

Vazakides, A. 2006. Testing simple versus Dimson market models: The case of Athens Stock Exchange. International Research Journal of Finance and Economics, 26-34.

White, H. 1980. A heteroskedastic-consistent covariance matrix estimator and a direct test for heteroskedasticity. Econometrica, 48, 817-38.