Analyzing cointegration and international linkage between Bucharest stock exchange and European developed stock markets

Felicia Ramona Birău, Jatin Trivedi

***Abstract* —** The aim of this paper is to highlight the existence of cointegration and international linkage between Bucharest stock exchange and certain European developed stock markets, namely the French, German and Greek stock markets. In recent past, international stock markets have become increasingly connected among each other. In addition, these issues were exacerbated by the dramatic impact of the global financial crisis, which started with the US subprime mortgage crisis in mid-2007. Further analysis suggests that financial contagion effects triggers a profound significance in terms of international portfolio diversification and risk management. The primary focus is to consider the financial econometrics framework based on Unit Root Test, Augmented Dickey-Fuller stationary test, BDS test and Granger causality test. This empirical research covers the period from January 2003 until December 2012 of daily returns of selected stock markets major indices. The selected time series are divided into two sub-periods in order to examine both pre-crisis and post-crisis effects.

***Keywords*—**cointegration, dinamic international linkage, global financial crisis, Granger causality

I. Introduction

Cointegration and international linkage between emerging and developed stock markets highlight the influence of causal transmission patterns focused on financial shocks propagation. In recent past, there has been a significant structural reform of international stock markets based on cross-border transactions, exchange control, investment policy non-restrictions, derivatives, international portfolio diversification, liberalization of financial operations.

In this respect, a variety of financial econometric tools have been developed in order to investigate whether economic variables follow a rather similar trend. The basic characteristics of cointegration methods highlight significant issues in applied empirical analysis. In other words, if a pair of stock asset prices is cointegrated then one stock price can be predicted due to the evolution of the other stock price. Implicitly, the main significance of financial cointegration results is focused on the possibility of obtaining additional benefits based on international portfolio diversification. The main motivation for this study derives from the nearly unpredictable and extremely fascinating behavior of emerging capital markets in contraposition with the much more efficient and stable behavior of mature capital markets. The empirical analysis conducted in this paper is focused on Bucharest Stock Exchange (Romania), Athens Stock Exchange (Greece), Frankfurt Stock Exchange (Germany) and Paris Stock Exchange (Bourse) - NYSE Euronext (France). Technically, an young and quite fragile stock market such as Bucharest Stock Exchange is characterized by rapid growth and extremely varied opportunities which could easily attract the attention of international investors. Nevertheless, according to FTSE Country Classification issued on March 2012, Romania is included in the frontier emerging market category, while Greece is on the watch list for possible demotion from developed to advanced emerging market. In other words, Athens Stock Exchange has experienced quite intense the negative impact of recent economic, social and financial events. On the other hand, frontier markets can be perceived as a subset of emerging markets. Summarily, frontier markets are generally less liquid and have lower market capitalization than emerging or developed capital markets. Moreover, according to FTSE Country Classification as at March 2012, France and Germany are included in the first category, i.e developed markets. Paris Stock Exchange is the first European integrated stock exchange. The Frankfurt Stock Exchange is the world's 10th largest stock exchange by market capitalization. It accounts for over 90 percent of the turnover in the German market and a very large share of the European market.

The CAC 40 is France's benchmark stock market index, similar to the Dow Jones Industrial Average in the United States. The index comprises of the 40 most significant values among the 100 highest market caps on the NYSE Euronext. The DAX (Deutscher Aktien IndeX,) is a blue chip stock market index consisting of the 30 major German companies trading on the Frankfurt Stock Exchange. The ATHEX Composite Index is the most commonly followed index in Greece and is a market capitalization-based index that tracks

F. R. Birau is with the University of Craiova, Faculty of Economics and Business Administration, Department of Statistics and Economic Informatics, CO 200585, ROMANIA, e-mail birauramona@yahoo.com, mobile phone 40767.970.777

J. Trivedi is with Balaji Institute of International Business, Faculty of Finance and Business Management, Department of Finance & Economics, INDIA, e-mail contact.tjatin@gmail.com

the share price movement of 60 leading Greek companies. BET-C is the composite index of Bucharest stock exchange (BSE). It is a market capitalization weighted index and reflects the price movement of all the companies listed on the BSE regulated market, i.e Ist and IInd Category, excepting the SIFs.

II. Literature review

Emerging capital markets constitute a very attractive and seemingly unexplored research field. Their investment potential involves that research focus towards identifying various opportunities in trade and oriented foreign capital. This particular section of the paper presents a brief everview of economic literature in this quite exclusive area of interest. Grubel (1968) highlighted the benefits arising from international diversification of portfolios, based on empirical evidence of certain developed stock markets including the USA, Canada, U.K., Germany, France, Australia, Italy, Belgium, Netherlands, Japan, and South Africa. Eun and Shim (1989) investigated international transmission of stock market movements among several mature markets, such as : Australia, Japan, Hong Kong, U.K, Switzerland, France, Germany, Canada and U.S.A.. The authors have identified a series of multilateral interconnections. The primary results of their research have suggested that the correlations of U.S.A with Asian-Pacific and European stock markets, with the exception of U.K, are rather inconclusive and low, particularly because of the different trading hours of these stock markets. The same issues of research, namely dinamic linkages and international cointegration between stock markets, but based on rather distinct applied methodologies, have been follow by several other researchers, such as : Finnerty and Scheeweis (1979), Schollhammer and Sand (1985), Granger (1986), Kohlhagen (1983), Khoury et. al. (1987), Chan, Gup and Pan (1997), Scheicher (2001), Kelly et al. (2008), Raj and Dhal (2009). Likewise, Arshanapalli and Doukas (1993) discussed a very interesting topic, i.e. the dramatic influence of the October 1987 financial crisis among the stock markets of France, U.K., Germany and U.S.A. Moreover a variety of empirical studies have examined the international interdependence of stock markets, providing minor correlations between the returns of developed and emerging stock markets in the favor of portfolios diversification, of which stands : Dwyer and Hafer (1988), Hauser et. al. (1994) and Errunza (1994). An almost pervasive conclusion was that existing diversification of international stock market portofolios can not be considered to be effective if those markets are cointegrated and there are asset price co-movements. Abimanyu, Y., et. all (2008) investigated the international linkages of the Indonesian capital market using cointegration tests to examine the long-run equilibrium relationship between the stock markets of Indonesia with China, France, Germany, Hong Kong, Japan, Korea, Malaysia, Netherlands, Philippine, Singapore, Thailand, Taiwan, the United Kingdom and the United States. The method used in the paper is visual inspection, followed by Johansen cointegration. Empirical results highlighted that there exist cointegration between these stock market indices except between Indonesia and Philippine. Singh (2010) investigated Chinese and Indian stock market linkages with several developed stock markets, namely U.S., U.K., Japan and Hong Kong. The author concluded that both Chinese and Indian market are correlated with all the selected developed markets based on the analysis of Granger causality. Singh suggested that the benefits of any short-term diversification, or speculative activities, are limited between Chinese and Indian stock market (emerging). In this respect, according to Pretorious (2002) international investors need to understand the forces behind the interdependence of emerging stock markets in order to realize the potential risks and rewards of global diversification.

III. Methodological approach

In order to test for cointegration and international linkage between Greek and Romanian stock markets, an financial econometric procedure is implemented. The empirical analysis is based on daily stock returns of selected stock markets major indices for the period January 2003 until December 2012. The time series is divided into two sub-periods in order to investigate both pre-crisis and post-crisis effects. The empirical analysis includes Unit Root Test, Augmented Dickey-Fuller stationary test, BDS test and Granger causality test. Technically, financial time series, such as daily stock market returnsthey are distinguished through a range of stylized facts, such as high-frequency, volatility clustering, non-stationarity of price levels, leverage effect, heteroskedastic log returns, fat-tailed distribution. The continuously-compounded daily returns are calculated using the log-difference of the closing prices of stock markets selected indices, ie BET-C Index (Romania) and Athex Composite Index (Greece), as follows :

$$r_t = \ln\left(\frac{p_t}{p_{t-1}}\right) = \ln(p_t) - \ln(p_{t-1})$$

Empirical analysis includes testing the existence of unit roots or in other wordsthe integration order regarding each of the selected indices following the analysis of Augmented Dickey-Fuller (ADF) test. This particular diagnostic test is used in order to determine the non-stationarity or the integration order of a financial time series. The random walk model is the basic example of what is known in the literature as a unit root process. Technically, ADF diagnostic test investigates the potential presence of unit roots divided into the following categories : unit root with a constant and a trend, unit root with a constant, but without a time trend, and finally unit root without constant and temporal trend, based on the following regression model :

$$\Delta y_t = c + \beta \cdot t + \delta \cdot y_{t-1} + \sum_{i=1}^{p} \gamma_i \Delta y_{t-i} + \varepsilon_t$$

where p represents the number of lags for which it was

investigated whether fulfilling the condition that residuals are white noise, c is a constant, t is the indicator for time trend and Δ is the symbol for differencing. In addition, it is important to emphasize the essence of a stochastic trend that can not be predicted due to the time dependence of residual's variance. Strictly related to the ADF test, if the coefficients to be estimated β and δ have the null value then the analyzed financial time series is characterized by a stochastic trend. The null hypothesis, ie the time series has a unit root is rejected if t-statistics is lower than the critical value. The empirical analysis should distinguish between stationary and nonstationary stochastic processes or financial time series has a major importance in terms of trend ie if it is deterministic (completely predictable and not variable) or stochastic (not predictable).

The BDS test (Brock, Dechert and Scheinkman, 1987) was computed in order to determine whether the residuals are independent and identically distributed, especially in the case of a nonlinear system. In this respect BDS test is a econometric tool for detecting serial dependence in financial time series. Furthermore, the BDS diagnostic test is based on the null hypothesis of independent and identically distributed (i.i.d) time series. The Granger causality test is mainly considering the possible relationships between two or more time series. Basically, it is a statistical hypothesis test that highlights the possible influence of a time series data in forecasting another series. Primary, causality highlights a relationship between cause and effect. According to Granger (1969), if some other time series Yt contains informations regarding the past periods which are useful in the prediction Xt and in addition this informations are included in no other series used in the predictor, then this implies that Yt caused Xt. Granger suggested that if X_t and Y_t are two different stationary time series variables with zero means, then the canonical causal model has the following form :

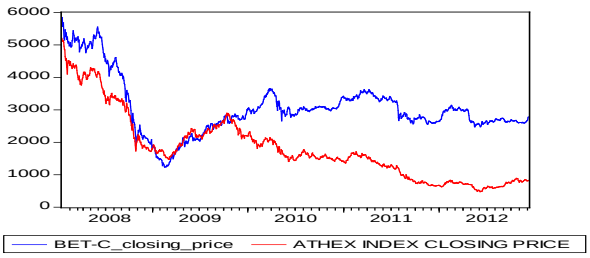
$$X_t = \sum_{j=1}^{m} a_j X_{t-j} + \sum_{j=1}^{m} b_j Y_{t-j} + \varepsilon_t$$

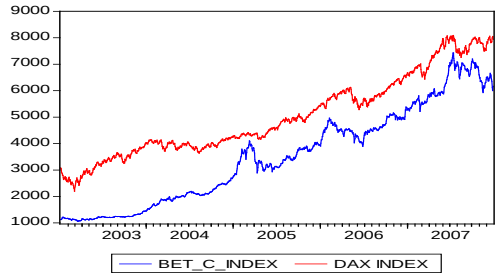
$$Y_t = \sum_{j=1}^{m} c_j X_{t-j} + \sum_{j=1}^{m} d_j Y_{t-j} + \eta_t$$

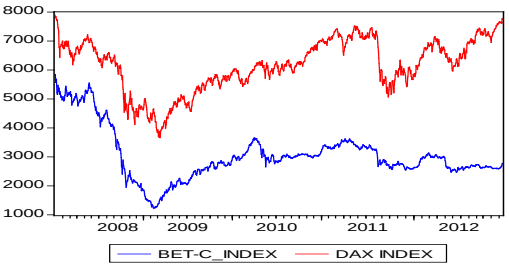
where ε_t and η_t play the role of two uncorrelated white-noise series, namely $E[\varepsilon_t \varepsilon_s] = 0 = E[\eta_t \eta_s]$ for $s \neq t$ and on the other hand $E[\varepsilon_t \varepsilon_s] = 0$ for $\forall t, s$. Practically, the idea of causality requires that in the case when Y_t is causing X_t some b_j is different from zero and vice versa, ie in the case when X_t is causing Y_t some c_j is different from zero. A different situation implies that causality is valid simultaneously in both directions or simply a so-called "feedback relationship between X_t and Y_t".

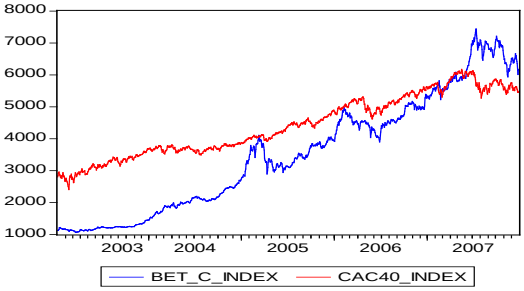
IV. Empirical Analysis

The empirical analysis is based on daily returns of selected stock markets major indices for the period January 2003 until December 2012. The time series is divided into two sub-periods in order to investigate both pre-crisis and post-crisis effects. In the analyzed periods, the behavior of the selected stock indices clearly revealed the impact of the global financial crisis, as it can be seen in the following figures :









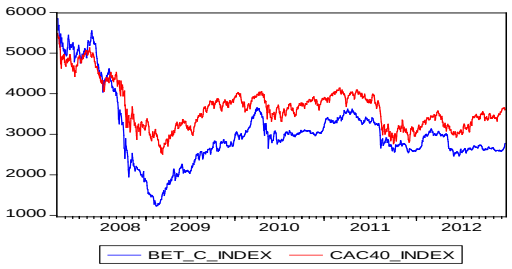


Fig. 1 : The trend of BET-C Index, Athex Composite Index, CAC40 index and DAX index

Source: Own computations based on selected financial data series

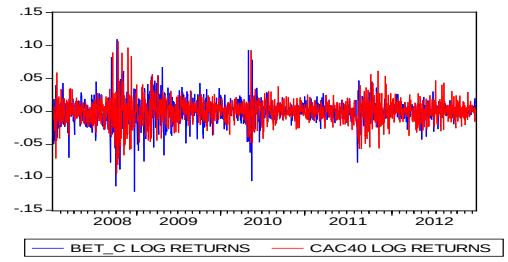
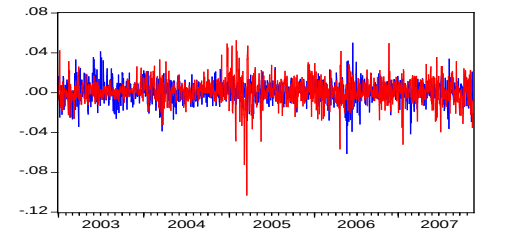
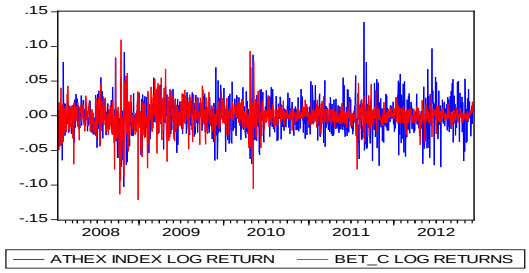
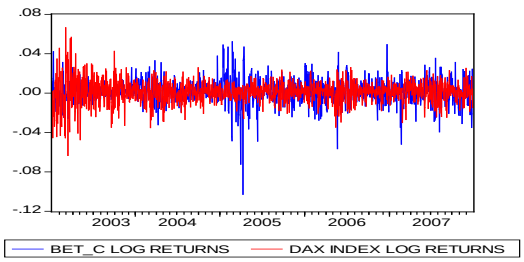


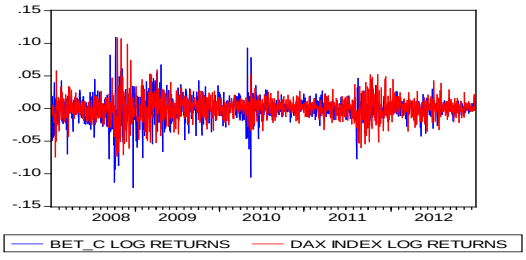
Fig. 2 : The log-returns of BET-C Index, Athex Composite Index, CAC40 index and DAX index

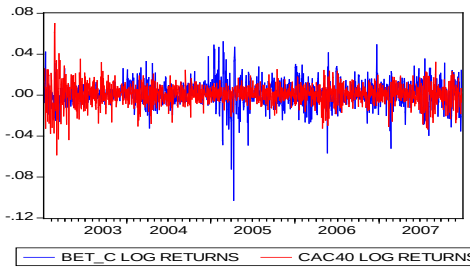
Source: Own computations based on selected financial data series



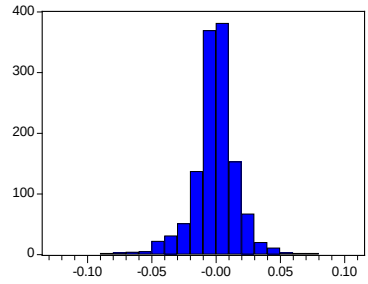


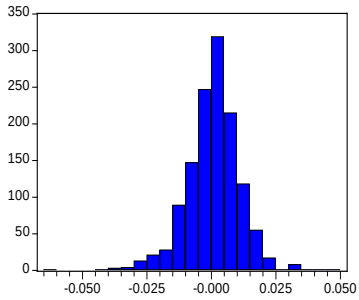


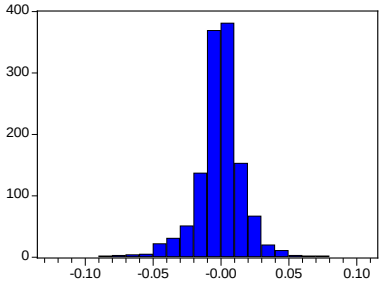




The fundamental characteristics of selected indices are represented by the following issues : Jarque-Bera test's statistic which allows to eliminate the normality of distribution hypothesis, parameter of asymmetry of distribution or Skewness and Kurtosis parameter which measures the peakedness or flatness of the distribution (leptokurtic distribution).







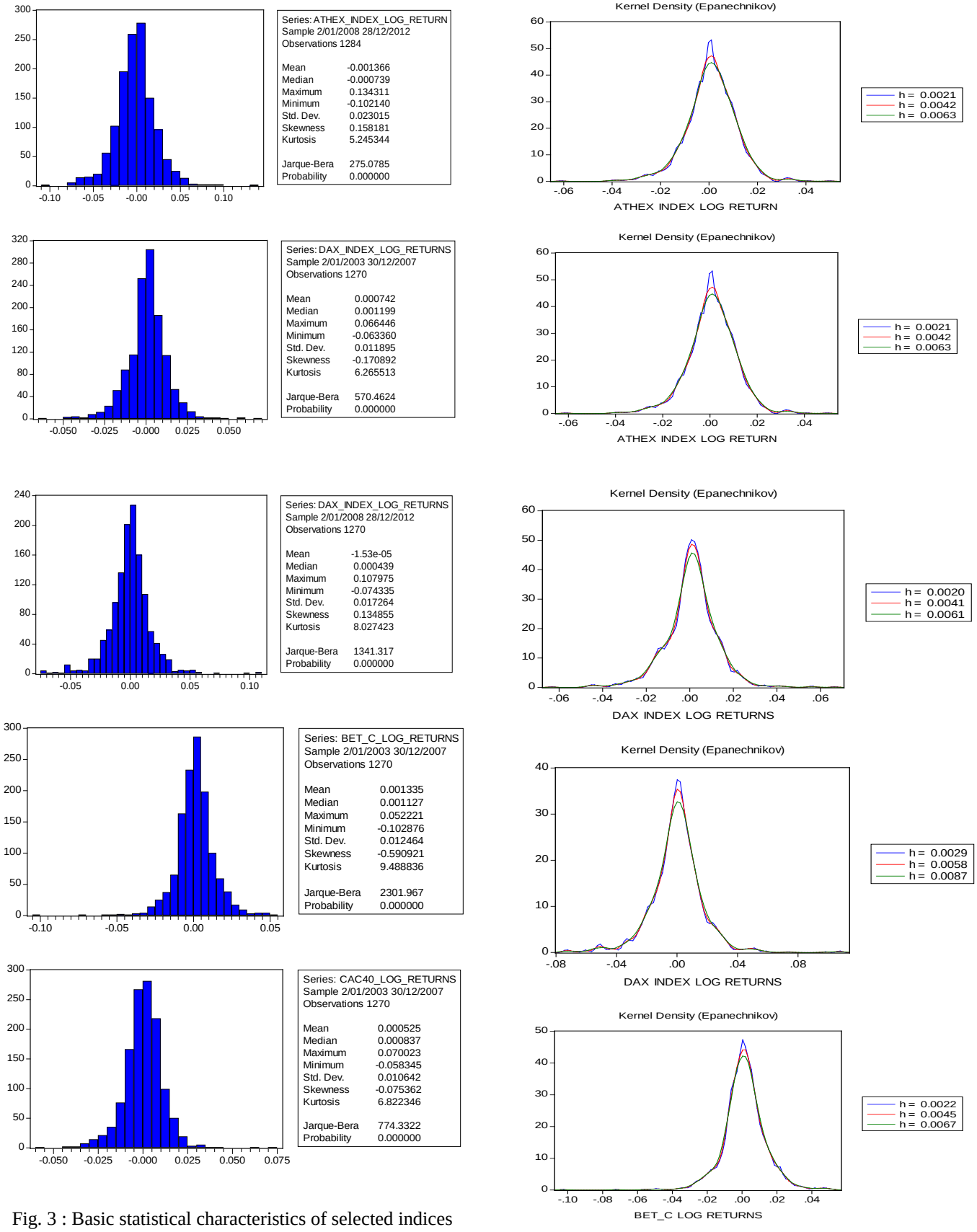


Fig. 3 : Basic statistical characteristics of selected indices

Source: Own computations based on selected financial data series

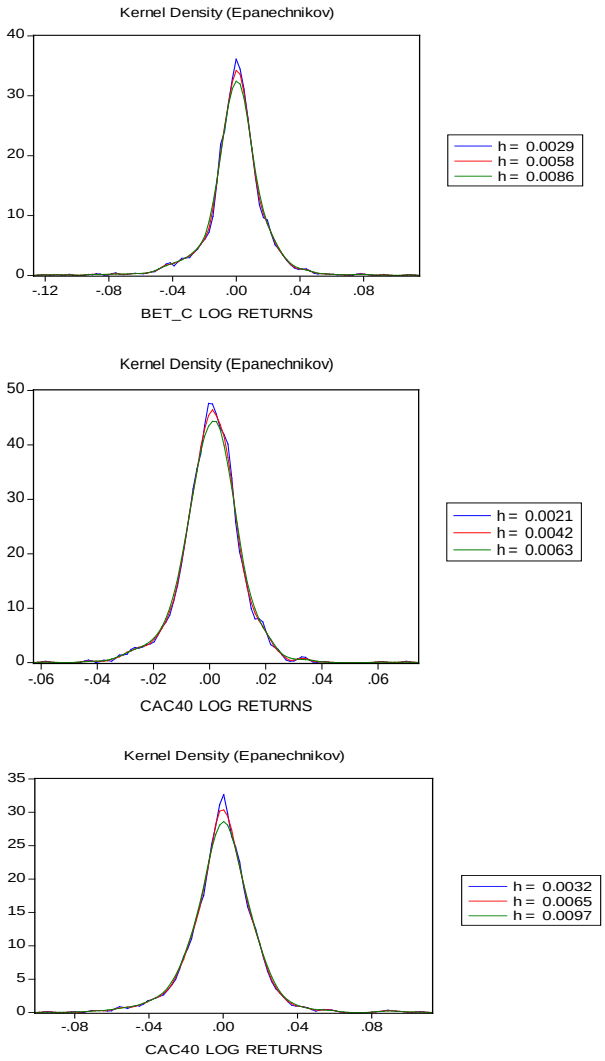


Fig. 4 : The log-returns distribution

Source: Own computations based on selected financial data series

Augmented Dickey-Fuller test was applied for both periods in order to determine the stationarity of the analyzed time series. The null hypothesis is that the analyzed time series contains a unit root and it is implicitly non-stationary. Empirical analysis based on the log-returns of the selected indices reflects the fact that ttest_ADF<t_{critic} (1%, 5%, 10%) so the null hypothesis H0 is rejected and the analyzed time series is stationary. Simultaneous, it is obtain the following result : Prob (0%) < test levels (1%, 5%, 10%) so the null hypothesis H_0 is rejected and the analyzed time series is stationary.

Table 1: Augmented Dickey-Fuller Test
- Period I-
January 2003 – December 2007

Null Hypothesis: ATHEX_INDEX_LOG_RETURN has a unit root

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-12.53810	0.0000
Test critical values:	1% level	-3.435239	
	5% level	-2.863587	
	10% level	-2.567909	

Null Hypothesis: BET_C_LOG_RETURNS has a unit root

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.113786	0.0000
Test critical values:	1% level	-3.435440	
	5% level	-2.863676	
	10% level	-2.567957	

Null Hypothesis: DAX_INDEX_LOG_RETURNS has a unit root

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-13.13935	0.0000
Test critical values:	1% level	-3.435327	
	5% level	-2.863626	
	10% level	-2.567930	

Null Hypothesis: CAC40_LOG_RETURNS has a unit root

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-12.02675	0.0000
Test critical values:	1% level	-3.435336	
	5% level	-2.863629	
	10% level	-2.567932	

Source: Own computations based on selected financial data series

- Period II-
January 2008 – December 2012

Null Hypothesis: ATHEX_INDEX_LOG_RETURN has a unit root

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.452005	0.0000
Test critical values:	1% level	-3.435323	
	5% level	-2.863624	
	10% level	-2.567929	

Null Hypothesis: BET_C_LOG_RETURNS has a unit root

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-11.99126	0.0000
Test critical values:	1% level	-3.435319	
	5% level	-2.863622	
	10% level	-2.567928	

Null Hypothesis: DAX_INDEX_LOG_RETURNS has a unit root

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-16.83893	0.0000
Test critical values:	1% level	-3.435307	
	5% level	-2.863617	
	10% level	-2.567925	

Null Hypothesis: CAC40_LOG_RETURNS has a unit root

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-17.67908	0.0000
Test critical values:	1% level	-3.435307	
	5% level	-2.863617	
	10% level	-2.567925	

Source: Own computations based on selected financial data series

The *BDS test* was used in order to determine whether the residuals are independent and identically distributed. The BDS statistics converges in distribution to N(0,1) thus the null hypothesis of independent and identically distributed is rejected based on a result such as $\left|V_{m,\varepsilon}\right| > 1{,}96$ in terms of a 5% significance level. BDS test is a two-tailed test and is based on the following hypothesis :

H_0: sample observations are independently and identically distributed (I.I.D.)

H_1: sample observations are not I.I.D., aspect involving that the time series is non-linearly dependent if first differences of the natural logarithm have been calculated

The null hypothesis was rejected in all four sample cases for both sample periods. The following outputs highlight the value of the standardised BDS statistics and the corresponding two-sided probabilities.

Table 2: BDS Test
- Period I -
January 2003 – December 2007

BDS Test for ATHEX_INDEX_LOG_RETURN
Sample: 1/01/2003 31/12/2007

Dimension	BDS Statistic	Std. Error	z-Statistic	Prob.
2	0.005071	0.002247	2.257028	0.0240
3	0.016096	0.003555	4.527468	0.0000
4	0.025036	0.004215	5.939179	0.0000
5	0.028986	0.004374	6.626092	0.0000
6	0.030813	0.004200	7.335964	0.0000

BDS Test for BET_C_LOG_RETURNS

Dimension	BDS Statistic	Std. Error	z-Statistic	Prob.
2	0.030466	0.002574	11.83643	0.0000
3	0.054958	0.004095	13.41970	0.0000
4	0.070269	0.004883	14.39043	0.0000
5	0.077438	0.005096	15.19516	0.0000
6	0.080453	0.004921	16.34772	0.0000

BDS Test for DAX_INDEX_LOG_RETURNS
Sample: 2/01/2003 30/12/2007

Dimension	BDS Statistic	Std. Error	z-Statistic	Prob.
2	0.015444	0.002472	6.246379	0.0000
3	0.037859	0.003920	9.657122	0.0000
4	0.056012	0.004658	12.02458	0.0000
5	0.065633	0.004844	13.54805	0.0000
6	0.071788	0.004662	15.39922	0.0000

BDS Test for CAC40_LOG_RETURNS
Sample: 2/01/2003 30/12/2007

Dimension	BDS Statistic	Std. Error	z-Statistic	Prob.
2	0.014515	0.002402	6.043728	0.0000
3	0.035888	0.003812	9.415291	0.0000
4	0.051857	0.004533	11.44021	0.0000
5	0.059374	0.004718	12.58410	0.0000
6	0.062500	0.004544	13.75433	0.0000

Source: Own computations based on selected financial data series

- Period II-
January 2008 – December 2012

BDS Test for ATHEX_INDEX_LOG_RETURN
Sample: 2/01/2008 28/12/2012

Dimension	BDS Statistic	Std. Error	z-Statistic	Prob.
2	0.007186	0.002368	3.035103	0.0024
3	0.015522	0.003766	4.121944	0.0000
4	0.024885	0.004487	5.545472	0.0000
5	0.031293	0.004681	6.685776	0.0000
6	0.033976	0.004517	7.521714	0.0000

BDS Test for BET_C_LOG_RETURNS

Dimension	BDS Statistic	Std. Error	z-Statistic	Prob.
2	0.039753	0.002892	13.74592	0.0000
3	0.073034	0.004602	15.86845	0.0000
4	0.099749	0.005490	18.16943	0.0000
5	0.117372	0.005733	20.47461	0.0000
6	0.125251	0.005539	22.61237	0.0000

BDS Test for DAX_INDEX_LOG_RETURNS
Sample: 2/01/2008 28/12/2012

Dimension	BDS Statistic	Std. Error	z-Statistic	Prob.
2	0.012360	0.002654	4.656439	0.0000
3	0.032428	0.004218	7.688040	0.0000
4	0.049484	0.005023	9.851312	0.0000
5	0.059507	0.005236	11.36456	0.0000
6	0.065369	0.005051	12.94291	0.0000

BDS Test for CAC40_LOG_RETURNS
Sample: 2/01/2008 28/12/2012

Dimension	BDS Statistic	Std. Error	z-Statistic	Prob.
2	0.009852	0.002507	3.930107	0.0001
3	0.027465	0.003981	6.899483	0.0000
4	0.039788	0.004737	8.399204	0.0000
5	0.049158	0.004934	9.962716	0.0000
6	0.054913	0.004755	11.54738	0.0000

Source: Own computations based on selected financial data series

Regarding Granger causality test, based on the Probability values reported in the tables below, empirical analysis reveals some very interesting results in the context of the global financial crisis. Considering that the null hypothesis is rejected if the F-value exceeds the critical F value at the selected level of significance (5%) or if the P-value is lower than the α level of significance, financial crisis impact is even more significant.

Table 3 : Granger Causality tests
- Period I-
January 2003 – December 2007

Pairwise Granger Causality Tests
Sample: 1/01/2003 27/11/2007

Null Hypothesis:	Obs	F-Statistic	Probability
BET_C_LOG_RETURNS does not Granger Cause ATHEX_INDEX_LOG_RETURN	1265	0.92890	0.42602
ATHEX_INDEX_LOG_RETURN does not Granger Cause BET_C_LOG_RETURNS		0.47314	0.70104

Pairwise Granger Causality Tests
Sample: 2/01/2003 30/12/2007

Null Hypothesis:	Obs	F-Statistic	Probability
DAX_INDEX_LOG_RETURNS does not Granger Cause BET_C_LOG_RETURNS	1265	1.50780	0.22179
BET_C_LOG_RETURNS does not Granger Cause DAX_INDEX_LOG_RETURNS		1.27220	0.28057

Pairwise Granger Causality Tests
Sample: 2/01/2003 30/12/2007

Null Hypothesis:	Obs	F-Statistic	Probability
CAC40_LOG_RETURNS does not Granger Cause BET_C_LOG_RETURNS	1265	2.75824	0.06379
BET_C_LOG_RETURNS does not Granger Cause CAC40_LOG_RETURNS		0.35857	0.69875

Source: Own computations based on selected financial data series

- Period II-
January 2008 – December 2012

Pairwise Granger Causality Tests
Sample: 2/01/2008 6/12/2012

Null Hypothesis:	Obs	F-Statistic	Probability
BET_C_LOG_RETURNS does not Granger Cause ATHEX_INDEX_LOG_RETURN	1265	1.06181	0.36431
ATHEX_INDEX_LOG_RETURN does not Granger Cause BET_C_LOG_RETURNS		2.74985	0.04157

Pairwise Granger Causality Tests
Sample: 2/01/2008 28/12/2012

Null Hypothesis:	Obs	F-Statistic	Probability
DAX_INDEX_LOG_RETURNS does not Granger Cause BET_C_LOG_RETURNS	1265	1.33465	0.26362
BET_C_LOG_RETURNS does not Granger Cause DAX_INDEX_LOG_RETURNS		0.61813	0.53911

Pairwise Granger Causality Tests

Sample: 2/01/2008 28/12/2012

Null Hypothesis:	Obs	F-Statistic	Probability
CAC40_LOG_RETURNS does not Granger Cause BET_C_LOG_RETURNS	1265	2.02230	0.13278
BET_C_LOG_RETURNS does not Granger Cause CAC40_LOG_RETURNS		0.50078	0.60618

Source: Own computations based on selected financial data series

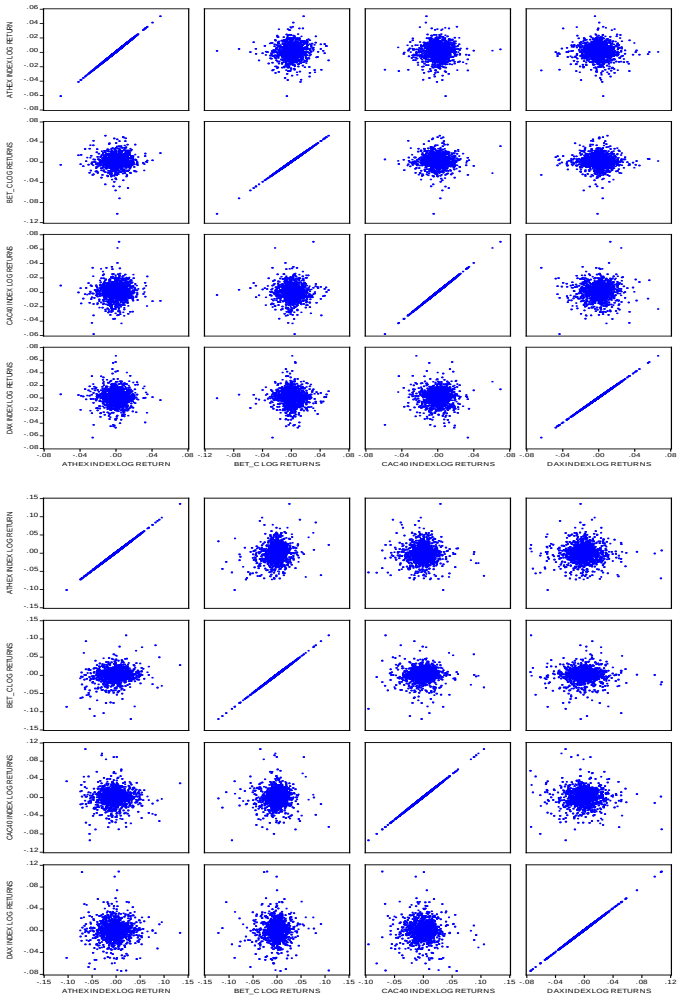


Fig. 4 : Matrix of all pairs of selected stock market indices
a) Jan 2003 – Dec 2007 and b) Jan 2008 – Dec 2012

Source: Own computations based on selected financial data series

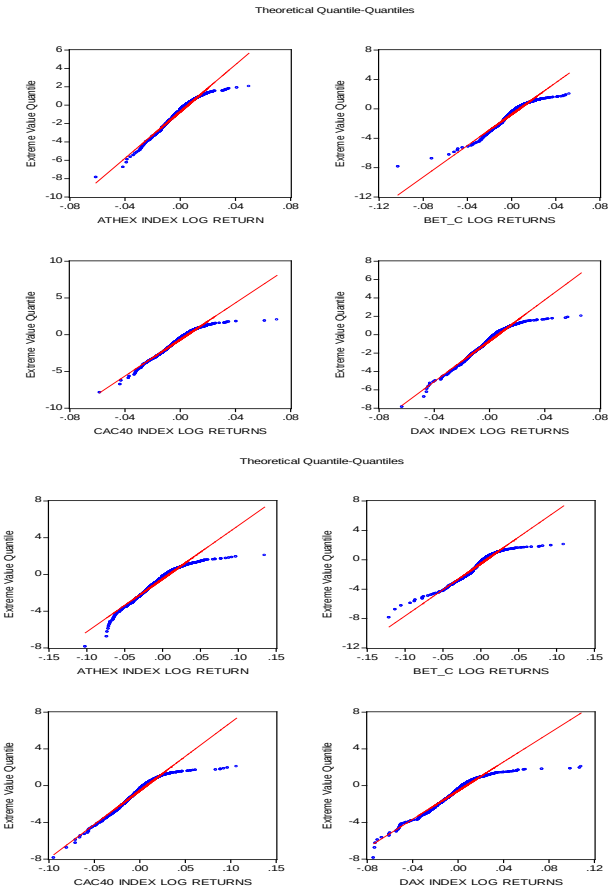


Fig.5 : Theoretical Quantile – Quantiles (Extreme values)
a) Jan 2003 – Dec 2007 and b) Jan 2008 – Dec 2012

Source: Own computations based on selected financial data series

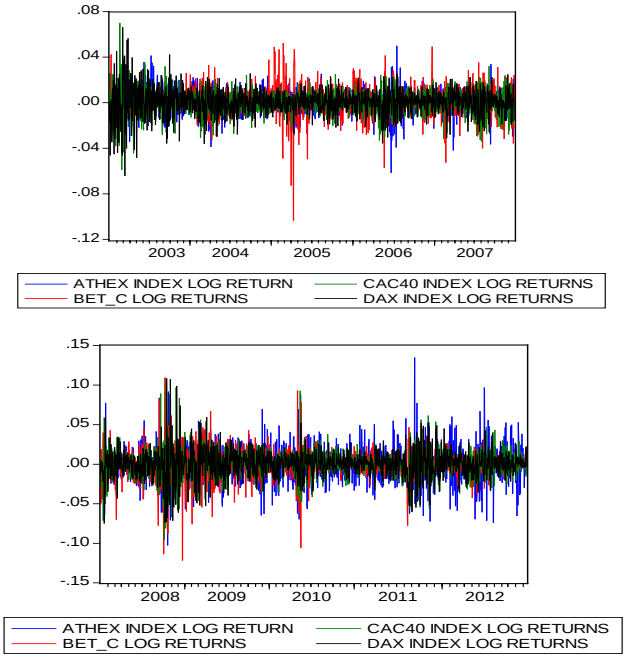


Fig.6 : Common graphs of selected stock indices
a) Jan 2003 – Dec 2007 and b) Jan 2008 – Dec 2012

Source: Own computations based on selected financial data series

V. Conclusion

The main motivation to accomplish this research study derives from the necessity to determine whether there is a low correlation among returns of different national stock markets. This situation leads to the possibility of obtaining significant benefits based on international diversification of portfolios. Contrariwise, a strong correlation implies the revaluation of investment strategies considering the fact that financial assets issued by markets with higher growth rates are expected to earn higher rates of returns. The liberalization of financial markets highlights a wide range of opportunities based on reduction of capital transaction cost and foreign capital inflows. Practically, in order to diversify the investment risk, investors should focus very seriously on on certain factors such as cointegration and dinamic linkages among international stock markets. The results of Granger causality tests among Bucharest Stock Exchange and Athens Stock Exchange highlight the profound implications of the global financial crisis. Regarding the first period of analysis, namely January 2003 – December 2007, it appears that there is no particular causality between Greek and Romanian, German and Romanian, respectively French and Romanian stock markets. On the other hand, the second period of analysis provides somewhat different results. Therefore, based on unidirectional return causalities it appears that Granger causality runs one way, from Greece to Romania, but not the other way. The impulse responses under financial crisis are quite relevant. In the period January 2008 – December 2012 there is no particular causality between German and Romanian, respectively French and Romanian stock markets.

References

[1] Abimanyu, Y., et. all, "International Linkages to the Indonesian Capital Market: Cointegration Test", Jakarta, Capital Market and Financial Institution Supervisory Agency, Ministry of Finance of Indonesia, 2008.

[2] Arshanapalli, B., Doukas, J., "International Stock Market Linkages: Evidence from the Pre- and Post-October 1987 Period", Journal of Banking and Finance, 17, 1993, pp. 193-208.

[3] Birău, R., Ehsanifar, M., Mohammadi, H., "Forecasting the Bucharest Stock Exchange BET-C Index based on Artificial Neural Network and Multiple Linear Regressions", the 1st WSEAS International Conference on Mathematics, Statistics & Computer Engineering, Dubrovnik, Croatia, June 25-27, 2013

[4] Birău, R., "Cointegration and international linkage between Greek and Romanian stock markets", 2nd WSEAS International Conference on Finance, Accounting and Auditing, Brasov, Romania, June 1-3, 2013, ISBN: 978-1-61804-192-0, pp.114-119

[5] Birău, F.R, "The propagation effects of financial crisis on Ljubljana Stock Exchange", paper presented at the International Finance and Banking Conference FI BA 2013, (XI edition), Bucharest, Romania, March 28-29, 2013.

[6] Brock, W. A., W. Dechert, & J. Scheinkman., "A test for independence based on the correlation dimension", Working paper, University of Winconsin at Madison, University of Houston, and University of Chicago, 1987

[7] Dickey, D.A., Fuller, W. A., "Likelihood Ratio Statistics for Autoregressive Time Series with a Unit Root", Econometrica, 1981, pp. 1057-1072

[8] Engle R. F., Granger C. W. J., "Cointegration and Error Correction: Representation, Estimation and Testing", Econometrica, 55, 1987, pp. 251-76

[9] Eun, C.S., S. Shim, "International Transmission of Stock Market Movements", Journal of Financial and Quantitative Analysis, 1989 pp. 241-256

[10] Granger C.W.J., "Developments in the Study of Cointegrated Economic Variables", Oxford Bulletin of Economics and Statistics, 48, 1986

[11] Granger, C., Morgenstern, O., Predictability of stock market prices, MA: Lexington, Heath Lexington Books, 1970

[12] Granger, C.W.J., "Investigating Causal Relations by Econometric Models and Cross-spectral Methods", Econometrica 37 (3): 424–438, 1969

[13] Gujarati, D.N., "Basic Econometrics", Fourth Edition, United States Military Academy, West Point, McGraw-Hill Higher Education, 2003

[14] Harris, R. and R. Sollis, Applied Time Series Modelling and Forecasting, John Wiley&Sons, 2003

[15] Koutmos, G., Negakis, C. and Theodossiou, P., "Stochastic behaviour of the Athens stock exchange", Applied Financial Economics, 3, pp.119-126, 1993

[16] Masooda, O., et. all, "Cointegration of Baltic Stock Markets in the Financial Tsunami: Empirical Evidence", International Journal of Business, 15(1), 2010

[17] Nelson, D., "Conditional heteroscedasticity in asset returns: a new approach", Econometrica, 59(2), 1991

[18] Singh, G.S.P., "Chinese and Indian Stock Market Linkages with Developed Stock Markets", Asian Journal of Finance & Accounting, Vol. 2, No. 2: E2, 2010.

[19] Siourounis, G., "Modelling volatility and testing for effciency in emerging capital markets: the case of the Athens stock exchange", Applied Financial Economics, 2002, 12, pp.47-55

[20] Trivedi, J., Birău, R., "Analysis of international contagion in emerging stock markets in terms of global financial crisis", 2nd WSEAS International Conference on Finance, Accounting and Auditing, Brasov, Romania, June 1-3, 2013, ISBN: 978-1-61804-192-0, pp.120-125

[21] Trivedi, J., Birău, R., "Investigating international transmission patterns of stock price volatility", 2nd WSEAS International Conference on Finance, Accounting and Auditing, Brasov, Romania, June 1-3, 2013, ISBN: 978-1-61804-192-0, pp.126-131

[22] Trivedi, J., Birău, R., "Co-movements between emerging and developed stock markets in terms of global financial crisis", the 1st WSEAS International Conference on Mathematics, Statistics & Computer Engineering, Dubrovnik, Croatia, June 25-27, 2013