Investigating International Causal Linkages Between Latin European Stock Markets In Terms Of Global Financial Crisis : A Case Study For Romania, Spain And Italy

Marian Siminică, Ph.D

University of Craiova, Faculty of Economics and Business Administration
Craiova, Romania
msiminica@yahoo.com

Ramona Birău, Ph.D

Regional Public Finances General Directorate of Craiova
Craiova, Romania
birauramona@yahoo.com

Abstract

The aim of this research paper is to investigate international causal linkages between Latin European stock markets, such as Romania, Spain and Italy in terms of global financial crises. Moreover, the structure of this research paper includes both theoretical developments and new empirical findings. In recent past, the global phenomenon of increasing co-integration, co-movement and financial contagion between developed and emerging stock markets have significantly influenced foreign investment behavior. The global financial crisis has seriously affected the international financial architecture and global economic stability due to unprecedented dynamic financial contractions. In addition, as strictly economic approach, Romanian labor migration generates a very high level in Italy and Spain as main destination countries. On the other hand, financial integration and international causal linkages suggest a certain behavioral pattern between receiving societies. The financial econometrics approach includes various tools such as Unit Root Test, Hodrick-Prescott (HP) filter, Augmented Dickey-Fuller stationary test, BDS test and Granger causality test. The final results provides a comprehensive framework regarding international portfolio diversification, risk management and strategic investment decision making process.

Key words : stock market linkages, cointegration, volatility, spillover effects, investment process, financial integration, Granger causality, risk management, time-varying processes

Introduction

Causality and international linkage between emerging and developed stock markets highlight the significant influence of dynamic transmission patterns focused on financial shocks propagation. Beyond the effects of globalization, financial markets are influenced by certain issues such as : cross-border transactions, investment policy reforms and liberalization of financial operations. The liberalization and integration process of financial markets emphasizes various opportunities based on reduction of capital transaction cost and foreign capital inflows. Moreover, international investors are focused on the potential correlation among returns of different national stock markets in order to diversify the investment risk based on international diversification of portfolios. The multidimensional implications of financial integration generate the possibility of identifying investment strategies in order to optimize the structure of risk management. Technically, financial time series, such as daily stock market returns are defined on the basis of certain stylized facts, namely : volatility clustering, high-frequency, non-stationarity of price levels, leverage effect, heteroskedastic log returns, extreme variations in time, deterministic chaos, fat-tailed distribution (leptokurtosis), nonlinearity, asymmetry.

The formal regulatory regarding the latest official assessment raport of FTSE Country Classification issued on September 2013 provides the following classification of countries : developed, advanced emerging, secondary emerging and frontier. According to the previous classification, Romania is included in the frontier market category on the basis of significant selection criteria. Moreover, it is characterized by negative features such as : illiquidity, insufficient transparency, financial regulation issues, underdeveloped trading mechanisms. Thus, Bucharest Stock Exchange is assimilated as a relatively young, fragmented and not very stable stock market. However, the assumption of frontier market can be very attractive considering the fact that it generates rapid growth and various opportunities for international investors. On the other hand, Spain and Italy are included in the category developed countries. In other words, Milan Stock Exchange (Milano Italia Borsa) and Madrid Stock Exchange (Bolsa de Madrid) represent more stable and efficient stock markets.

Literature review

The global financial crisis that erupted in mid-2007 in U.S.A. triggered dramatic consequences for most of stock markets across the world. An extreme financial phenomena does not follow a historical pattern so it is very difficult to predict with high accuracy. According to Birău (2014a) various stock crashes followed by severe financial crisis occurred rather frequently in the last century and sometimes reaching global magnitude, such as : the Great Depression between the years 1929-1933, Latin American financial debt crisis of the 1980s, Black Monday (Black Monday) in 1987, the Asian financial crisis of 1997 – 1998, Russian financial crisis or Ruble crisis in 1998, DOTCOM bubble during 2000 and 2002 and the Subprime crisis that erupted in August 2007 in U.S.A.

Eun and Shim (1989) empirically analyzed the interdependence structure of major national stock markets. Moreover, the authors suggested that innovations in U.S. market are suddenly transmitted to other stock markets despite the fact that none of these markets can adequately justify its movements. They investigated the existence of 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. Moreover, Abimanyu 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.

Balios and Xanthakis (2003) investigated international interdependence and dinamic linkages between developed stock markets, namely U.K, Germany, France, Italy, Spain, U.S. and Japan. They concluded that U.S. stock market is the leading stock market in the world and U.K stock market is the leading stock market in Europe. On the other hand, Singh (2010) investigated Chinese and Indian stock market linkages with several developed stock markets, such as U.S., U.K., Japan and Hong Kong. The empirical results revealed that both Chinese and Indian market are correlated with all the selected developed markets based on the analysis of Granger causality. Pretorious (2002) suggested that it is very important for international investors to understand the forces behind the interdependence of emerging stock markets in order to be informed about the potential occurrence of systemic risks and their global implications.

According to Khan (2011) an increasing number of investors are interested to invest in developing countries so it is very important to answer the following rhetorical question "Does sensitivity to the world economy explain country performance over the great recession?" The author investigated the existence of cointegration between stock markets of US and 22 other major economies.

Birău and Trivedi (2013) empirically analyzed the existence of cointegration and international linkage between Bucharest stock exchange and certain European developed stock markets, ie France, Germany and Greece. The empirical research covered the sample period from January 2003 until December 2012 which were divided into two sub-periods in order to examine both pre-crisis and post-crisis effects. Regarding the first period of analysis, ie 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. The second period of analysis, ie January 2008 – December 2012 suggested that Granger causality runs one way, from Greece to Romania, but not the other way and there is no particular causality between German and Romanian, respectively French and Romanian stock markets. Birău (2014b) investigated the existence of dynamic causal linkages between international developed stock markets of Spain and Canada. The empirical results of Granger causality tests among developed stock markets of Spain and Canada highlighted significant investment opportunities based on international portfolio diversification and risk management strategies. Granger causality runs simultaneously in both directions for Spain and Canada based on a feedback relationship.

A macroeconomic approach based on statistical surveys

Basically, this research paper provides additional empirical evidence and a consistent theoretical approach. Currently, Romania (2007), Spain (1986) and Italy (1952) are member states in the European Union (EU28), but are characterized by rather different development levels. Beyond the common Latin roots, the national languages of Romania, Spain and Italy are closely related to each other based on linguistic similarities. Moreover, Romanian labor migration revealed a very high level in Italy and Spain as main destination countries.

The World Bank provides a wide range of information on GNI per capita, ie formerly GNP per capita, which is basically the gross national income converted to U.S. dollar, based on the Atlas method, divided by the midyear population. According to the official presentation based on World Bank national accounts data and OECD National Accounts data files, GNI represents the sum of value added by all resident producers including any product taxes (less

subsidies) not included in the valuation of output plus net receipts of primary income (compensation of employees and property income) from abroad.
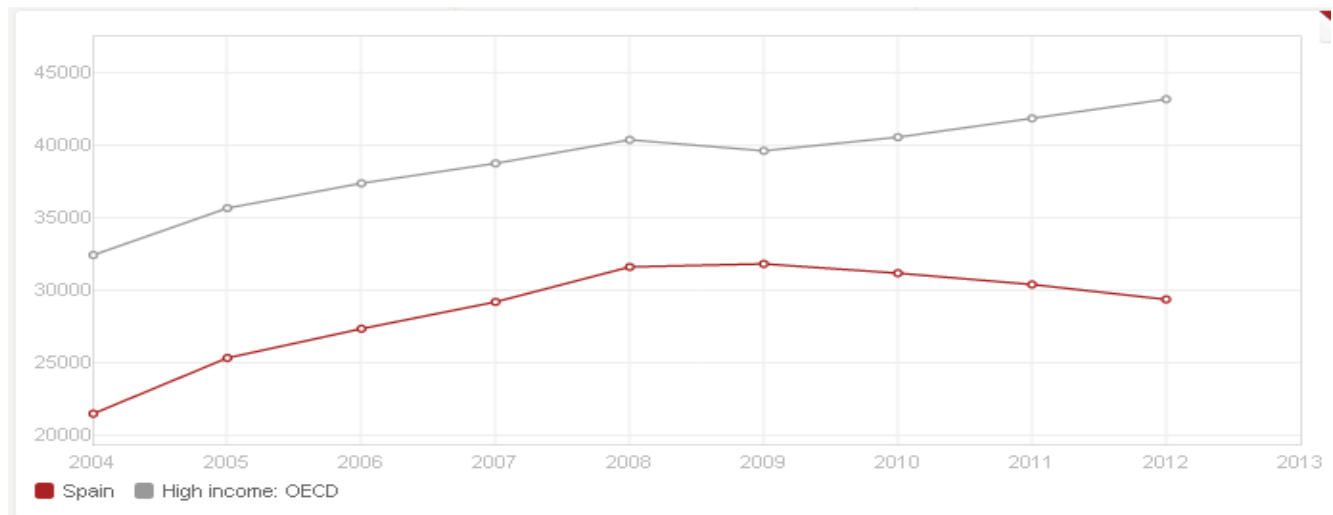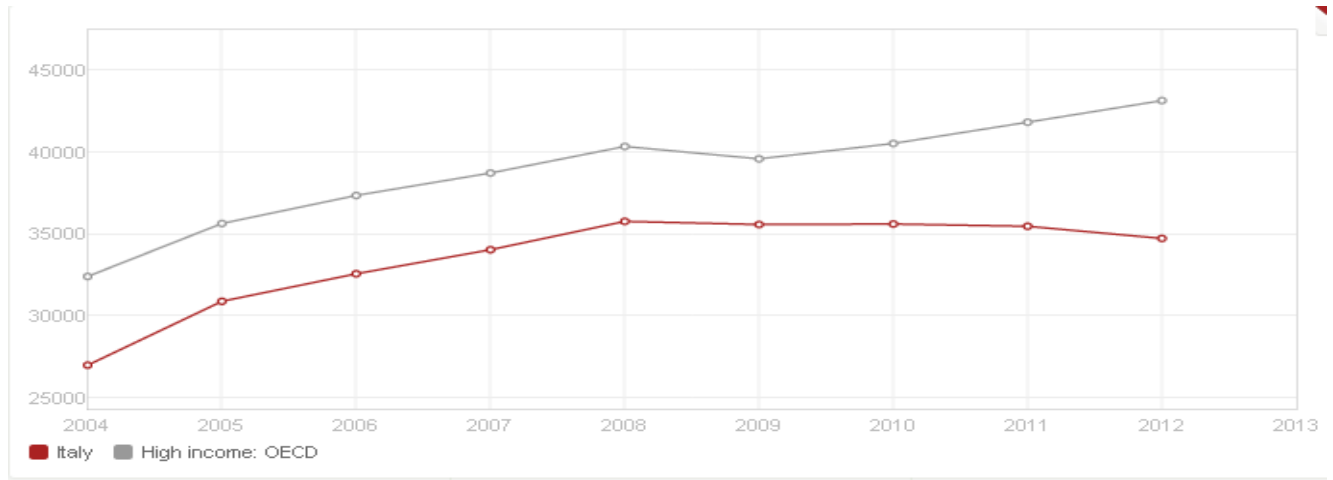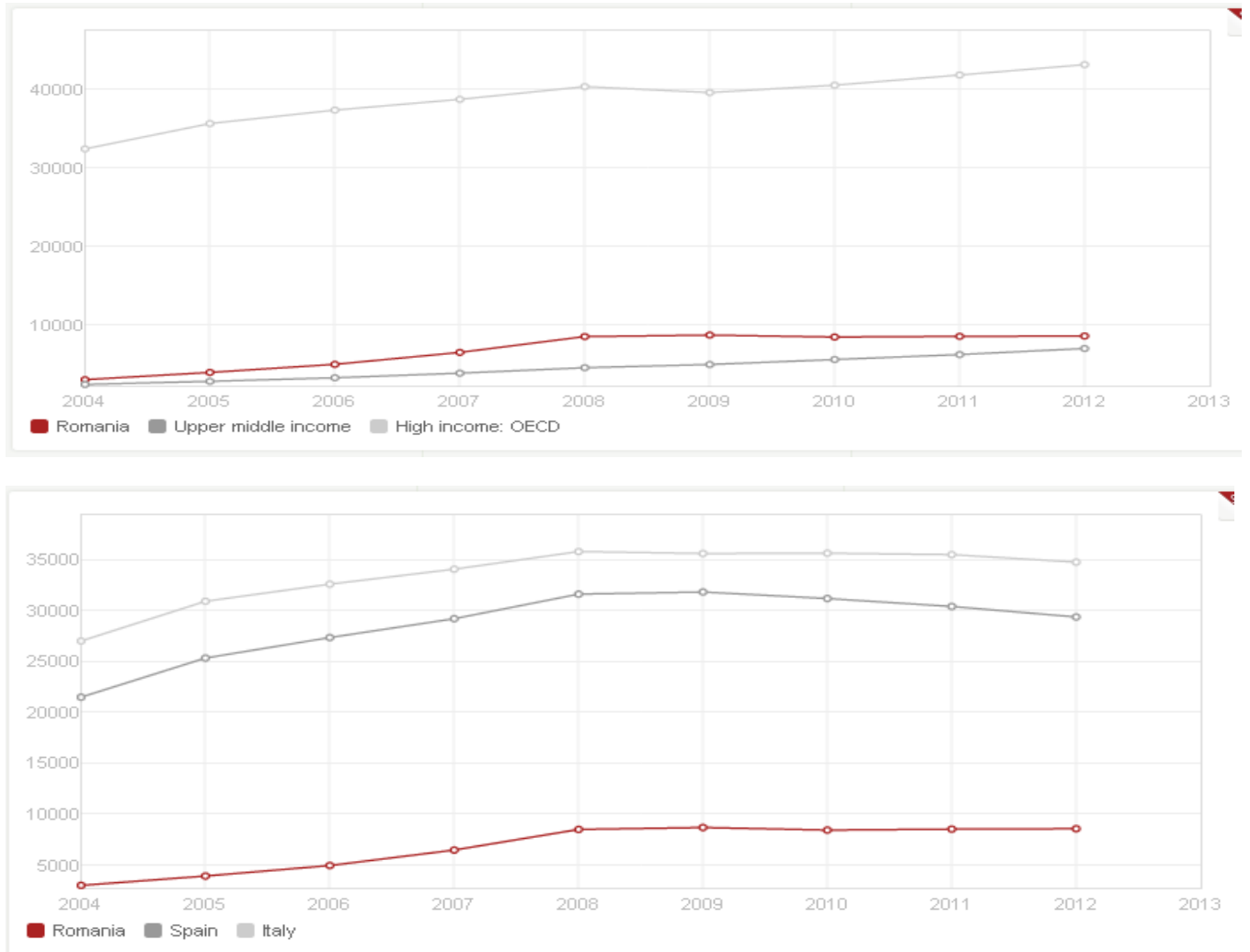
Fig.1 GNI per capita based on World Bank Atlas method of conversion

(U.S. dollars)

Source : The World Bank – computation based on World Bank national accounts data and OECD National Accounts data files

Considering the world development indicators highlighted by the World Bank, Italy is a high income country with a total population of 59.54 million (2012) and a Gross Domestic Product (GDP) (current US$) of $2.013 trillion (2012). However The GDP growth in Italy was negative, ie -2.5% per 2012 and the inflation was 1.2% per 2013. Moreover, Spain is also a high income country with a total population of 46.76 million (2012) and a GDP (current US$) of $1.322 trillion (2012). In addition, the GDP growth in Spain was negative, ie -1.6% per 2012 and the inflation was 1.4% per 2013. On the other hand, Romania is a upper middle income country with a total population of 20.08 million (2012) and a relatively low GDP (current US$) of $169.4 billion (2012). Nevertheless, the GDP growth in Romania was positive, ie 0.4% per 2012 and the inflation was 4.0% per 2013.

Methodological approach and empirical results

The empirical analysis is based on the daily returns of the major stock indices during the sample period between January 2007 and April 2013.

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), IBEX 35 Index (Spain) and FTSE MIB Index (Italy), as follows :

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

where p is the daily closing price. Data series consists of the daily closing prices for each sample stock index during the period between January 2007 and April 2013 with the exception of legal holidays or other events when stock markets haven't performed transactions.

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. The FTSE MIB index measures the performance of 40 of the most liquid and capitalised stocks listed on the Borsa Italiana. Moreover, FTSE MIB index is the primary benchmark index for the Italian equity markets capturing approximately 80% of the domestic market capitalization. On the other hand, The IBEX 35 index is the benchmark stock market index of the Madrid Stock Exchange (Bolsa de Madrid). The IBEX 35 index is a capitalization-weighted index comprising the 35 most liquid

Spanish stocks traded in the Madrid Stock Exchange.

The applied financial econometrics research methodology includes : descriptive statistics, Unit Root Test, Augmented Dickey-Fuller stationary test, Hodrick-Prescott (HP) filter, BDS test and Granger causality test.
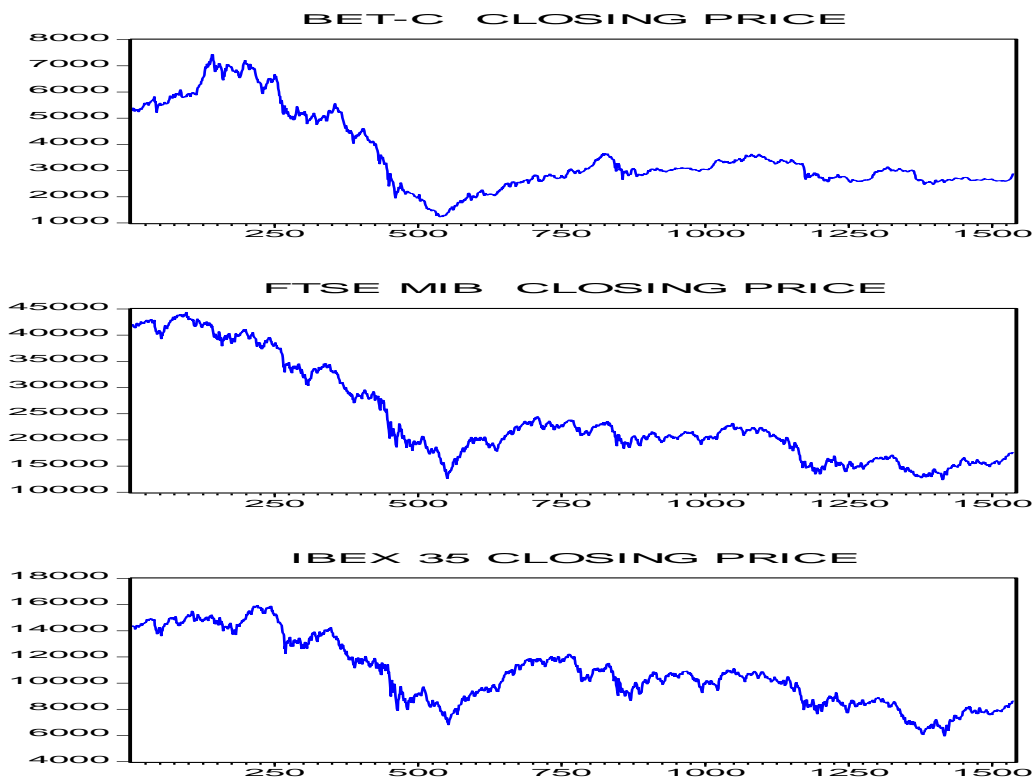

Fig. 2 : The trend of BET-C Index (Romania), IBEX 35 Index (Spain) and FTSE MIB Index (Italy)   - individual graphics -

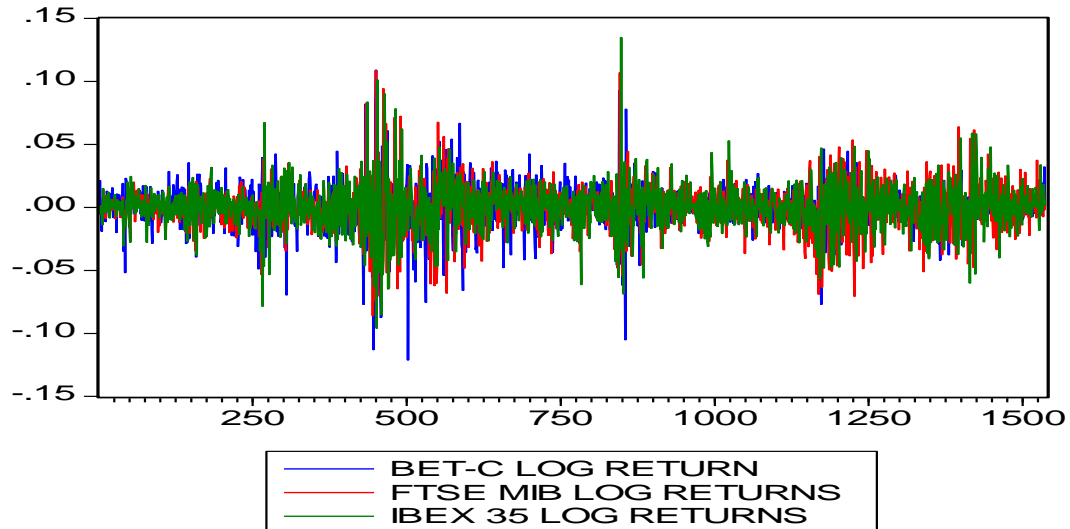**Source: Own computations based on selected financial data series**

Fig. 3 : The log-returns of BET-C Index (Romania), IBEX 35 Index (Spain) and FTSE MIB Index (Italy) - joint graphic -

Source: Own computations based on selected financial data series
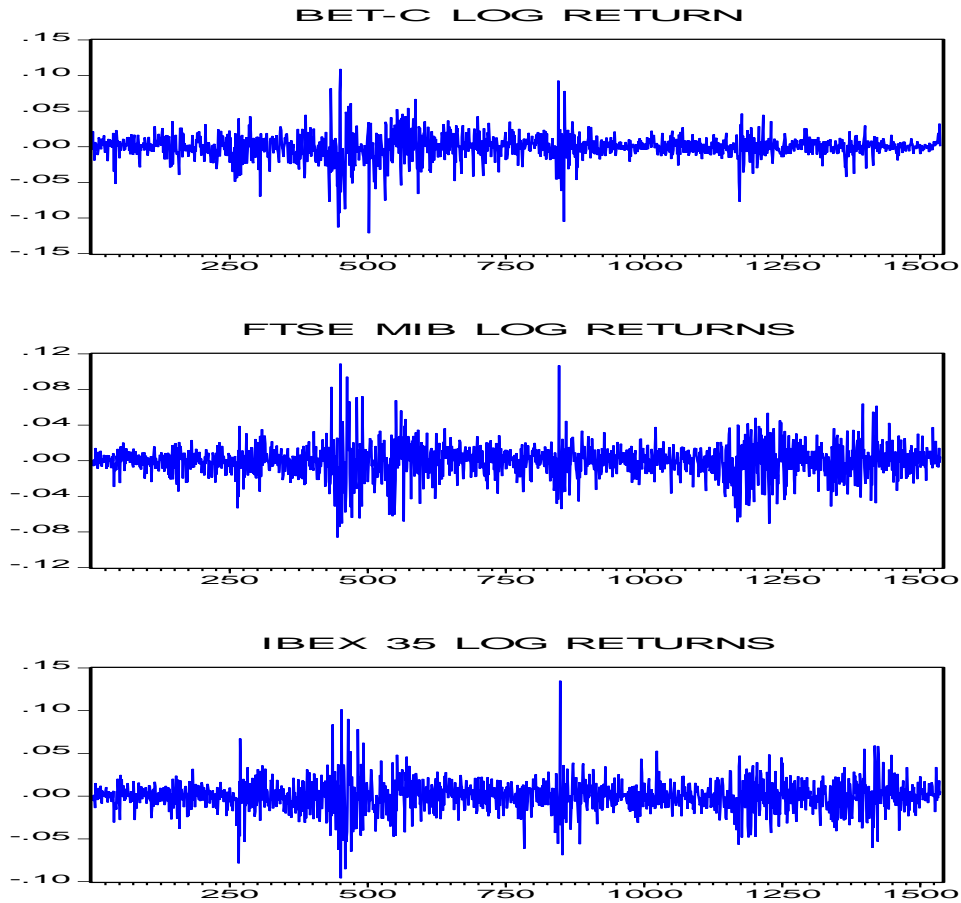
Fig. 4 : The log-returns of BET-C Index (Romania), IBEX 35 Index (Spain) and FTSE MIB Index (Italy) - individual graphics -

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
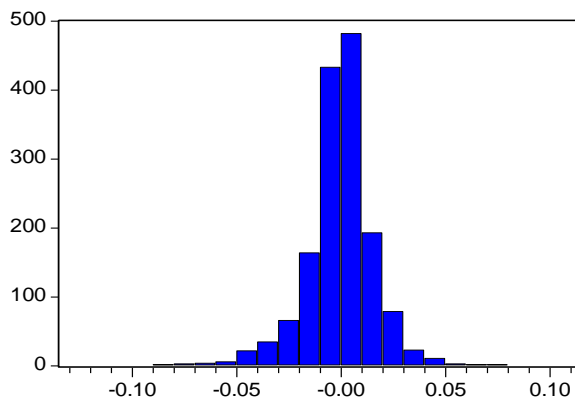
hypothesis, parameter of asymmetry distribution or Skewness and Kurtosis parameter which measures the peakedness or flatness of the distribution (leptokurtic distribution). The test Jarque-Bera is based on the following mathematical expressions :

$$JB = n\left[\frac{s^2}{6} + \frac{(k-3)^2}{24}\right] = \frac{n}{6}\cdot(s^2 + \frac{(k-3)^2}{4})\text{ , considering :}$$

$$s = \frac{\mu_3}{\sigma^3} = \frac{\frac{1}{n}\sum_{i=1}^{n}(x_i - \bar{x})^3}{[\frac{1}{n}\sum_{i=1}^{n}(x_i - \bar{x})^2]^{\frac{3}{2}}} \qquad k = \frac{\mu_4}{\sigma^4} = \frac{\frac{1}{n}\sum_{i=1}^{n}(x_i - \bar{x})^4}{\left[\frac{1}{n}\sum_{i=1}^{n}(x_i - \bar{x})^2\right]^2}$$

Series: BET_C_LOG_RETURN	
Sample 1 1538	
Observations 1537	
Mean	-0.000393
Median	0.000197
Maximum	0.108906
Minimum	-0.121184
Std. Dev.	0.017836
Skewness	-0.685424
Kurtosis	10.16679
Jarque-Bera	3409.716
Probability	0.000000

Series: FTSE_MIB_LOG_RETURNS	
Sample 1 1538	
Observations 1536	
Mean	-0.000565
Median	0.000230
Maximum	0.108742
Minimum	-0.085991
Std. Dev.	0.018504
Skewness	0.030021
Kurtosis	6.767386
Jarque-Bera	908.5954
Probability	0.000000

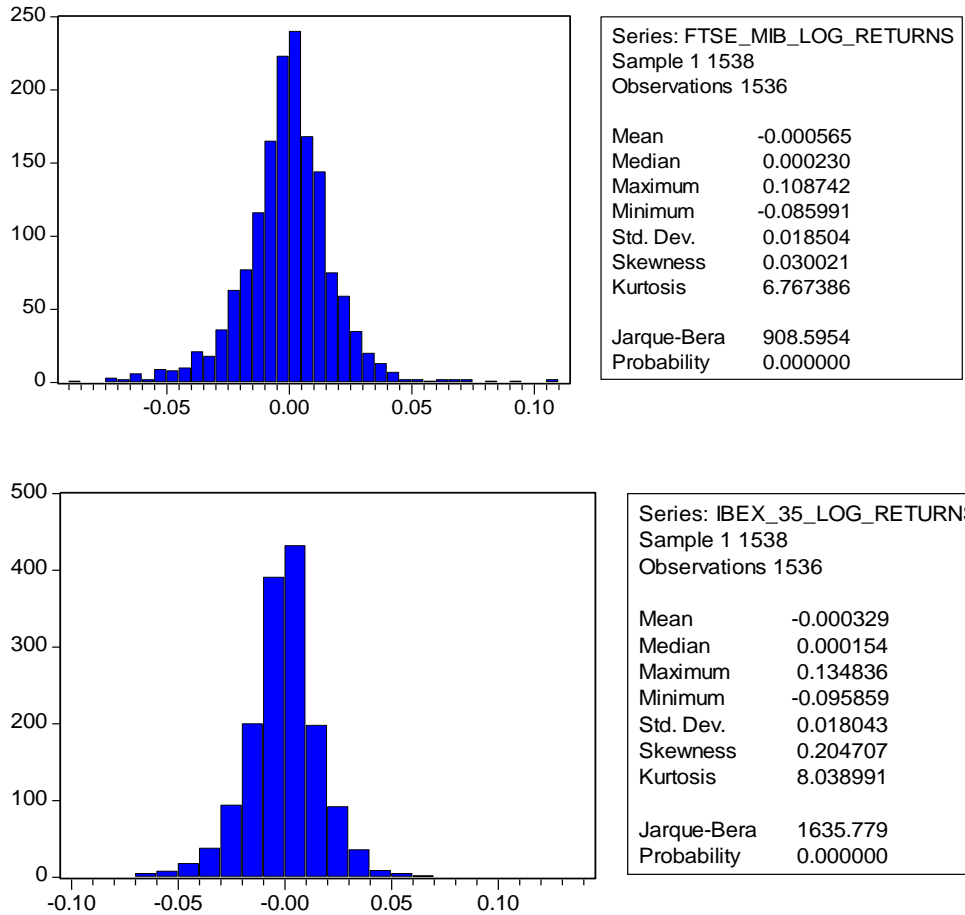| Series: IBEX_35_LOG_RETURNS	
Sample 1 1538	
Observations 1536	
Mean	-0.000329
Median	0.000154
Maximum	0.134836
Minimum	-0.095859
Std. Dev.	0.018043
Skewness	0.204707
Kurtosis	8.038991
Jarque-Bera	1635.779
Probability	0.000000

Fig. 5 : Basic statistical characteristics of selected stock indices

Source: Own computations based on selected financial data series

Augmented Dickey-Fuller (ADF) test is used in order to determine the non-stationarity or the integration order of a financial time series. A series noted y_t is integrated of order one, ie $y_t \sim I(1)$ and contains a unit root if y_t is non-stationary, but on the other hand Δy_t is stationary, ie $\Delta y_t = y_t - y_{t-1}$. Moreover, extrapolating the previous expression, a series y_t is integrated of

order d, ie $y_t \sim I(d)$ if y_t is non-stationary, but $\Delta^d y_t$ is stationary. Practically, 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. Theoretically, ADF test is focused 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.

Table 1: Augmented Dickey-Fuller (ADF) Test

Null Hypothesis: BET_C_LOG_RETURN has a unit root

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.649379	0.0000
Test critical values:	1% level	-3.434459	
	5% level	-2.863242	
	10% level	-2.567724	

Null Hypothesis: FTSE_MIB_LOG_RETURNS has a unit root

		t-Statistic	Prob.*

Augmented Dickey-Fuller test statistic		-19.12321 0.0000
Test critical values:	1% level	-3.434415
	5% level	-2.863222
	10% level	-2.567714

Null Hypothesis: IBEX_35_LOG_RETURNS has a unit root

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-19.70668	0.0000
Test critical values:	1% level	-3.434415	
	5% level	-2.863222	
	10% level	-2.567714	

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. 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 BDS methodology involves a time series x_t for t=1, 2, 3…T based on its m-history $x_t^m = \left(x_t, x_{t-1},..., x_{t-m+1} \right)$ where m is the called embedding dimension. Implicitly, the *correlation integral* (a measure of time patterns frequency) is estimated as follows :

$$C_{m,\varepsilon} = \frac{2}{T_m \left(T_m - 1 \right)} \sum_{m \le s < t \le T} \sum I \left(x_t^m , x_s^m , \varepsilon \right)$$

and

$$C_m \left(\varepsilon \right) = \lim_{n \to \infty} C_{m,n} \left(\varepsilon \right)$$

where $T_m = T-m+1$ and $I \left(x_t^m , x_s^m , \varepsilon \right)$ represents a binary function which has the following values for i=0, 1, 2…m-1:

$$I \left(x_t^m , x_s^m , \varepsilon \right) = \begin{cases} 1 & if & \left| x_{t-i} - x_{s-i} \right| < \varepsilon \\ 0 & otherwise \end{cases}$$

Table 2 : BDS Test

BDS Test for BET_C_LOG_RETURN

Dimension	BDS Statistic	Std. Error	z-Statistic	Prob.
2	0.037404	0.002553	14.65042	0.0000
3	0.069451	0.004061	17.10348	0.0000
4	0.093462	0.004840	19.30854	0.0000
5	0.109259	0.005051	21.63141	0.0000
6	0.115585	0.004877	23.69986	0.0000

BDS Test for FTSE_MIB_LOG_RETURNS

Dimension	BDS Statistic	Std. Error	z-Statistic	Prob.

<u>n</u>

2	0.014375	0.002304	6.239415	0.0000
3	0.035941	0.003656	9.830998	0.0000
4	0.052971	0.004347	12.18478	0.0000
5	0.064634	0.004525	14.28432	0.0000
6	0.071673	0.004358	16.44745	0.0000

BDS Test for IBEX_35_LOG_RETURNS

Dimension	BDS Statistic	Std. Error	z-Statistic	Prob.
2	0.013962	0.002266	6.162988	0.0000
3	0.030358	0.003602	8.428382	0.0000
4	0.041428	0.004291	9.654089	0.0000
5	0.051520	0.004475	11.51306	0.0000
6	0.057228	0.004318	13.25392	0.0000

Source: Own computations based on selected financial data series

According to Brock, Dechert, Scheinkman, LeBaron (1996), the BDS statistics is calculated as follows :

$$V_{m,\varepsilon} = \sqrt{T}\ \frac{C_{m,\varepsilon} - C_{1,\varepsilon}^{m}}{S_{m,\varepsilon}}$$

where $S_{m,\varepsilon}$ is defined as the standard deviation of $\sqrt{T}\left(C_{m,\varepsilon} - C_{1,\varepsilon}^{m}\right)$. In addition, 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.

The null hypothesis was rejected in all three sample cases based on selected stock indices. The following outputs highlight the value of the standardised BDS statistics and the corresponding two-sided probabilities.

The empirical analysis includes the use of Hodrick-Prescott (HP) filter which is a specialized filter for trend and business cycle estimation. Hodrick-Prescott filter has a wide applicability in economics. The basic idea suggests that in the center of the sample financial time series the filter is symmetric and towards the end of the series is becoming increasingly asymmetric. On the other hand, Hodrick-Prescott filter involves the decomposition of the sample financial time series into a trend component and a residual component, which may or may not include a cyclical component.
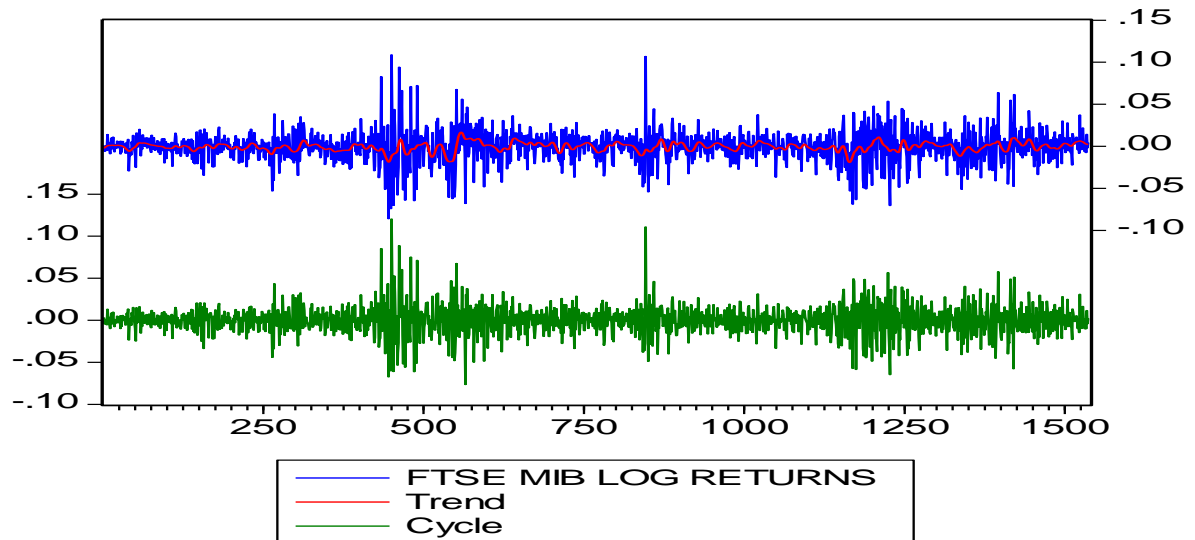
The following figures highlights the use of Hodrick – Prescott Filter in the case selected stock returns :

Hodrick-Prescott Filter (lambda=100)
BET-C LOG RETURN — Trend — Cycle

Hodrick-Prescott Filter (lambda=100)
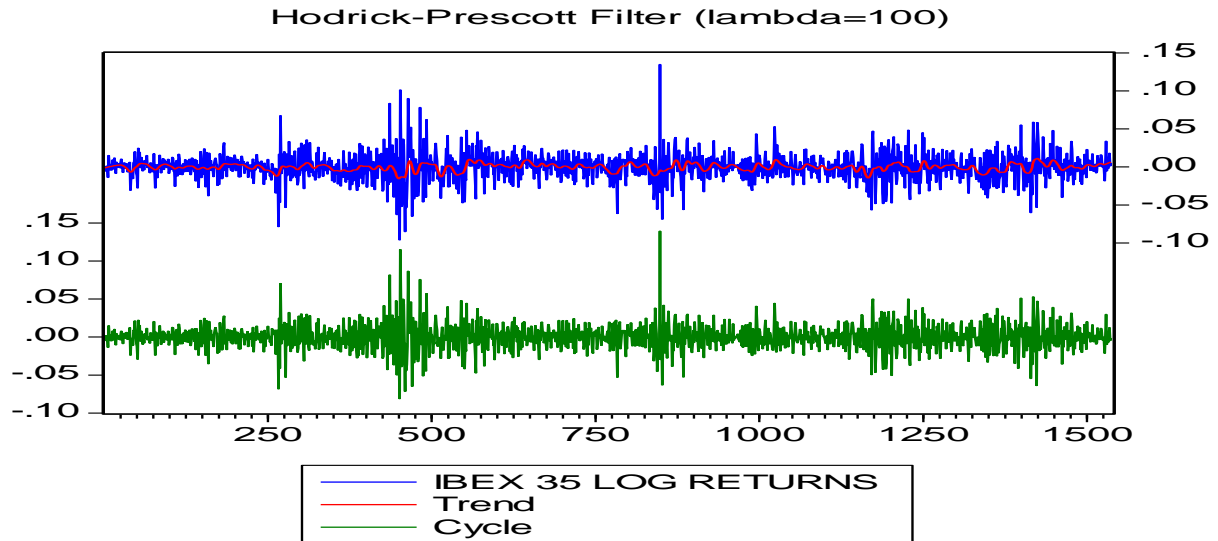FTSE MIB LOG RETURNS — Trend — Cycle
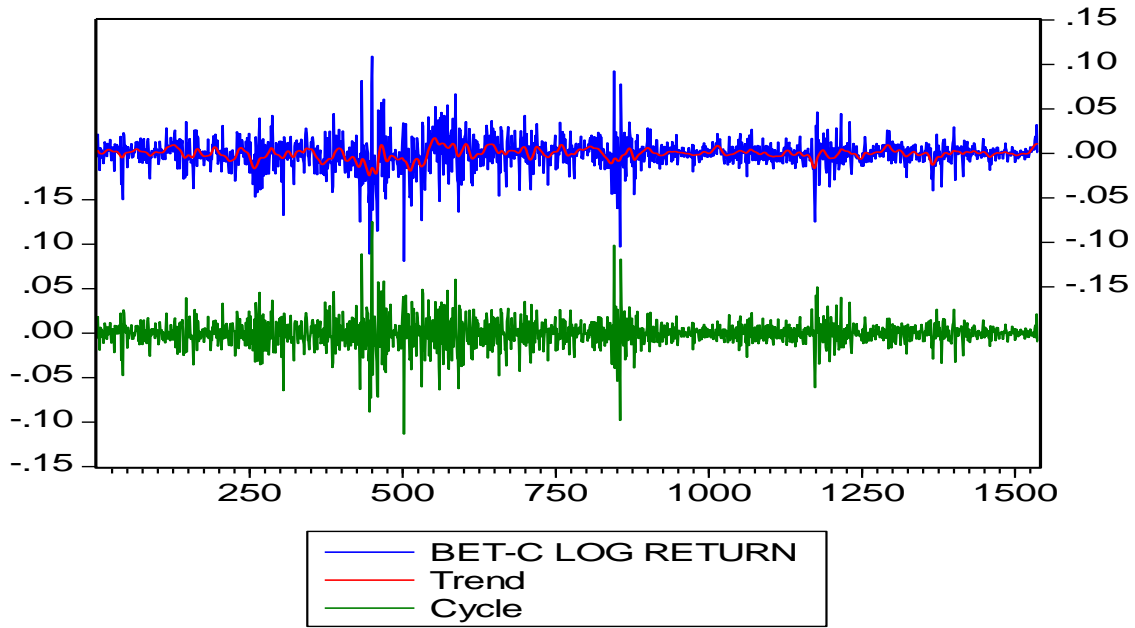
Fig. 6 : Hodrick – Prescott Filter

Source: Own computations based on selected financial data series
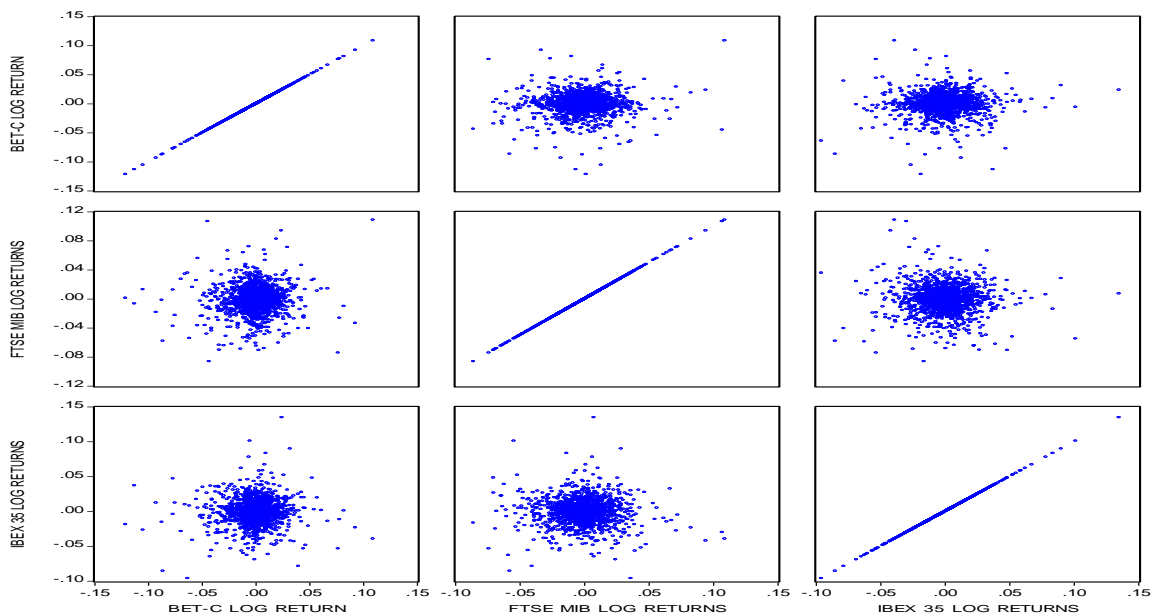
Fig.7 : Matrix of all pairs of selected stock market indices

Source: Own computations based on selected financial data series
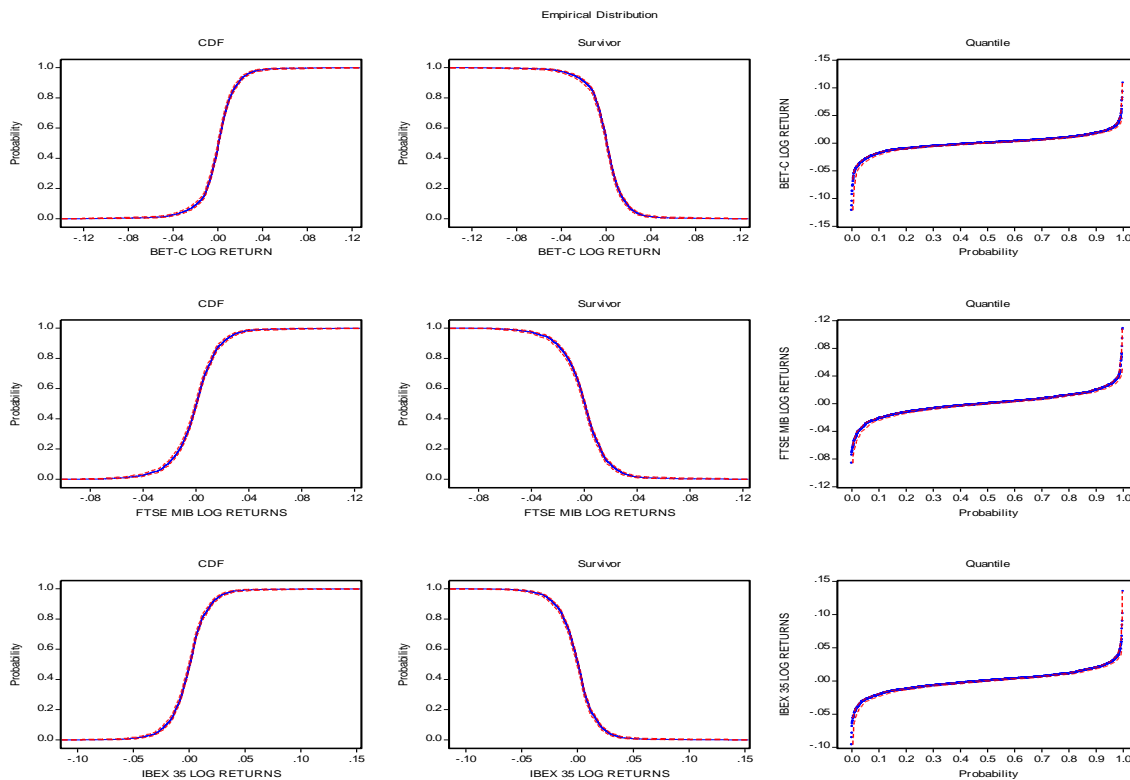

Fig. 8 Distribution graphics CDF - SURVIVOR – QUANTILE

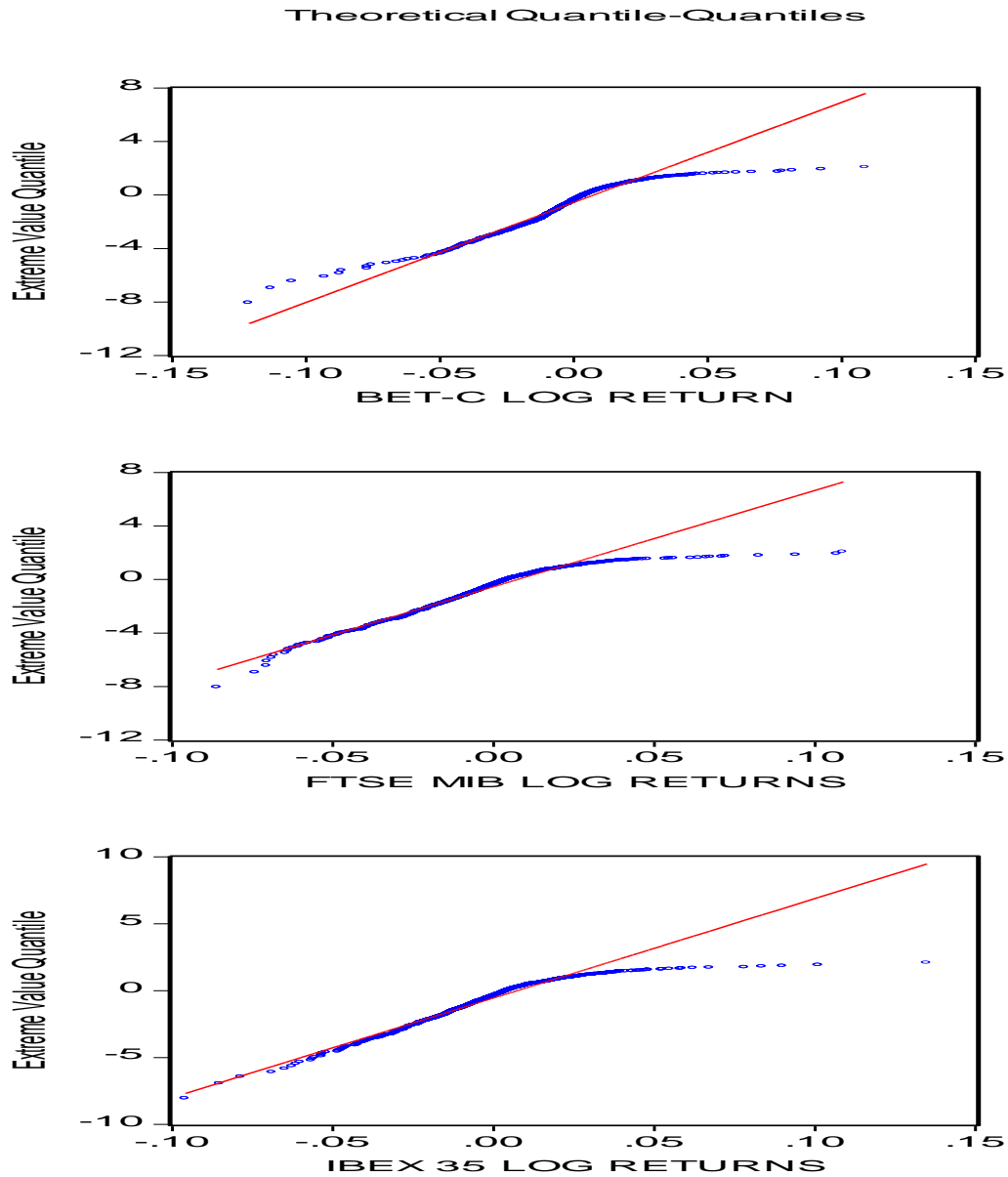**Source: Own computations based on selected financial data series**

Fig.9 : Theoretical Quantile-Quantile Plots

(Extreme values)

Source: Own computations based on selected financial data series

Table 3 : The correlation matrix

	BET_C_LOG_ RETURNS	FTSE_MIB_LOG_ RETURNS	IBEX_35_LOG_ RETURNS
BET_C_LOG_ RETURNS	1	0.0548973773763317	0.0428710355864532
FTSE_MIB_ LOG_RETUR NS	0.0548973773763317	1	-0.0356442275665437
IBEX_35_LO G _RETURNS	0.0428710355864532	-0.0356442275665437	1

Source: Own computations based on selected financial data series

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. Moreover, 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 $E\left[\varepsilon_t \varepsilon_s\right] = 0 = E\left[\eta_t \eta_s\right]$ for $s \neq t$ and on the other hand $E\left[\varepsilon_t \varepsilon_s\right] = 0$ for $\forall t, s$. Practically, the basic concept 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". The F-distribution test is used to test the Granger causality hypotheses based on the following formula :

$$F = \frac{\left(RSS_R - RSS_{UR}\right)/m}{RSS_{UR}/\left(n - k\right)}$$

where RSS_R is the residual sum of squares, RSS_{UR} is the unrestricted residual sum of squares, m is the number of lagged X_t variables, K is the number of parameters in the restricted regression. The null hypothesis Ho implies that lagged X_t terms do not belong in the regression. 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.

Table 4 : Granger Causality tests

Pairwise Granger Causality Tests

Null Hypothesis:	Obs	F-Statistic	Probability
FTSE_MIB_LOG_RETURNS does not Granger Cause BET_C_LOG_RETURN	1534	0.63020	0.53262
BET_C_LOG_RETURN does not Granger Cause FTSE_MIB_LOG_RETURNS		0.90168	0.40610
IBEX_35_LOG_RETURNS does not Granger Cause BET_C_LOG_RETURN	1534	1.26421	0.28276

BET_C_LOG_RETURN does not Granger Cause IBEX_35_LOG_RETURNS		1.01013	0.36441
IBEX_35_LOG_RETURNS does not Granger Cause FTSE_MIB_LOG_RETURNS	1534	0.13020	0.87793
FTSE_MIB_LOG_RETURNS does not Granger Cause IBEX_35_LOG_RETURNS		1.02881	0.35768

Source: Own computations based on selected financial data series

Conclusions

The main aim of this paper is to investigate international causal linkages between Latin European stock markets, such as Romania, Spain and Italy in the turbulent context of the global financial crises. In recent past, the impact of the global financial crisis on economic migration was extremely high as global implications. Theoretically, financial integration and international causal linkages suggest a certain behavioral pattern between receiving societies. The empirical results of Granger causality tests among Latin European stock markets of Romania, Spain and Italy highlight significant investment opportunities based on international portfolio diversification and risk management strategies. Technically, 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, so there is no particular causality between Italy and Spain, Romania and Italy and not even between Romania and Spain in the sample period, ie the period between January 2007 and April 2013. Consequently, it appears that the null hypothesis of no Granger causality is not rejected, so there is no causal relationship between analyzed stock markets. International portofolio diversification benefits in globalized stock markets highlight the opportunity of investing in various categories of financial assets across national (local) stock markets with lower correlations in order to achieve high returns.

References

1. Abimanyu, Y., et. all, (2008) "International Linkages to the Indonesian Capital Market: Cointegration Test", Jakarta, Capital Market and Financial Institution Supervisory Agency, Ministry of Finance of Indonesia
2. Balios, D., Xanthakis, M. (2003) "International interdependence and dinamic linkages between developed stock markets", South Eastern Journal of Economics, pp. 105-130
3. Birău, F.R (2014a) "Investigating Long-Term Behavior Of Milan Stock Exchange: An Empirical Analysis" Journal of Management and Social Science (JOMASS), Volume 1, Issue 2, © Blue Square Publishing House, pp. 29-37, ISSN 2348-6317,
4. Birău, F.R (2014b) "Analyzing Dynamic Causal Linkages Between Developed Stock Markets Of Spain And Canada", International Journal Of Core Engineering & Management (IJCEM), Volume 1, Issue 2, pp. 1-9, ISSN: 2348 9510
5. Birău, F.R, Trivedi, J. (2013) "Analyzing cointegration and international linkage between Bucharest stock exchange and European developed stock markets", NAUN International Journal of Economics and Statistics, Issue 4, Volume 1, pg. 237-246, ISSN: 2309-0685
6. Brock, W.A., W.D. Dechert and J.A. Scheinkman (1987) "A Test for Independence Based on the Correlation Dimension", Department of Economics, University of Wisconsin at Madison, University of Houston, and University of Chicago
7. Dickey, D.A., Fuller, W. A., (1981) "Likelihood Ratio Statistics for Autoregressive Time Series with a Unit Root", Econometrica, pp. 1057-1072
8. Engle R. F., Granger C. W. J., (1987) "Cointegration and Error Correction: Representation, Estimation and Testing", Econometrica, 55, pp. 251-76
9. Eun, C.S., Shim, S. (1989) "International Transmission of Stock Market Movements", Journal of Financial and Quantitative Analysis, pp. 241-256
10. Granger, C. W. J. (1969) "Investigating Causal Relations by Econometric Models and Cross-spectral Methods", Econometrica 37 (3): 424–438
11. Khan, T.A (2011) "Cointegration of International Stock Markets: An Investigation of Diversification Opportunities", Undergraduate Economic Review, Volume 8, Issue 1,
12. Singh, G.S.P. (2010) "Chinese and Indian Stock Market Linkages with Developed Stock Markets", Asian Journal of Finance & Accounting, Vol. 2, No. 2: E2
13. *** - http://data.worldbank.org/