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Analyzing dynamic causal linkages between developed stock markets of Spain and Canada

Felicia Ramona Birău, Ph.D.

Regional Public Finances General Directorate of Craiova, Romania

birauramona@yahoo.com

***Abstract*—The main objective of this research article involves analyzing dynamic causal linkages between developed stock markets of Spain and Canada. The long-run dynamic causal linkages between international stock markets highlight the importance of a functional and stable financial environment. Seemingly insignificant structural imbalances can easily generate dramatic consequences in the context of a globalized and integrated world wide perspective. The empirical analysis is based on daily returns of selected developed stock markets major indices during the period between June 1993 and December 2013. The financial econometrics empirical research is based on Unit Root Test, Augmented Dickey-Fuller stationary test, BDS test and Granger causality test. The final results provide a comprehensive perspective on international portfolio diversification and risk management.**

***Index Terms* — dynamic causal linkages, developed stock markets, international portfolio diversification, risk management, Granger causality, financial investment process**

I. INTRODUCTION

In the context of globalization, the long-run dynamic causal linkages between international stock markets, such as Spain and Canada functional and stable financial environment emphasize the major relevance of a functional and stable financial environment. Moreover, according to FTSE Country Classification issued on September 2013 based on the latest official report, Spain and Canada are included in the first most important category of countries, ie developed. Generally, there are the following four fundamental categories of countries : developed, advanced emerging, secondary emerging and frontier. If ranked by total land area, Canada is the largest country in North America and the second largest country in the world. Canada have also the longest coastlines in the world with the Pacific, Arctic and Atlantic Oceans. On the other hand, Spain is the second largest country in Western Europe and have both Atlantic and Mediterranean coastlines.

According to the Embassy of Canada to Spain : „Canada and Spain enjoy a close relationship of active cooperation and the bilateral relations

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between the two countries are increasingly dynamic, notably in the areas of education and business". It is also highlighted the importance of dynamic regional relationships between Canada and Spain.

II. METHODOLOGICAL APPROACH AND EMPIRICAL RESULTS

The empirical analysis is based on daily stock returns of selected developed stock markets major indices during the period between June 1993 and December 2013. The IBEX 35 index is a market capitalization weighted index and it is also the benchmark stock market index of the Bolsa de Madrid (Madrid Stock Exchange), ie the main stock exchange in Spain. The S&P TSX Composite Index is a capitalization-weighted index designed in order to measure market activity of the largest companies listed on the Toronto Stock Exchange.

The applied financial econometrics research methodology includes : Unit Root Test, Augmented Dickey-Fuller stationary test, BDS test and Granger causality test. The continuously-compounded daily returns are calculated using the log-difference of the closing prices of stock markets selected indices, ie IBEX 35 Index (Spain) and S&P TSX Composite Index (Canada), as follows :

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

where p is the daily closing price. Data series consists of the daily closing prices for each sample stock index during the period between June 1993 and December 2013. with the exception of legal holidays or other events when stock markets haven't performed transactions.

Fig. 1 : The trend of IBEX 35 Index (Spain) and S&P TSX Composite Index (Canada) - joint graphic - ***Source: Own computations based on selected financial data series***

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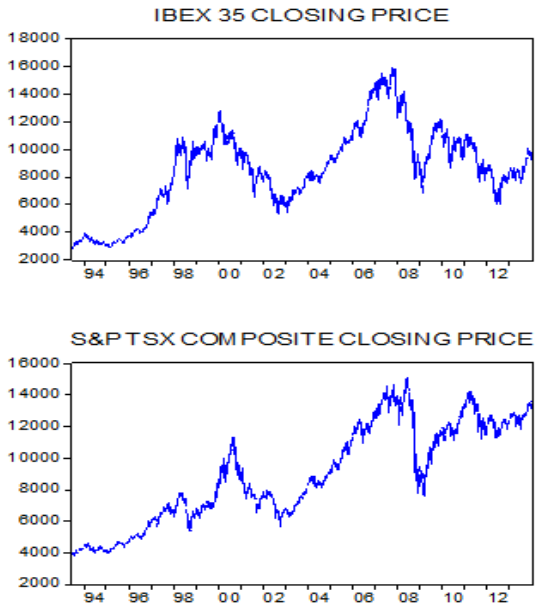

Fig. 2 : The trend of IBEX 35 Index (Spain) and S&P TSX Composite Index (Canada) - individual graphics -
Source: Own computations based on selected financial data series

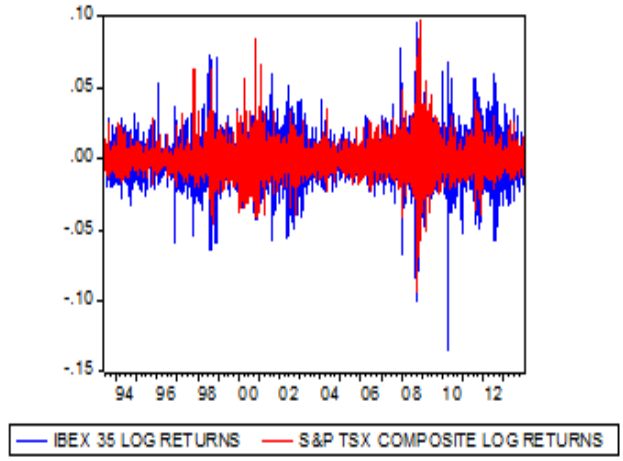

Fig. 3 : The log-returns of IBEX 35 Index (Spain) and S&P TSX Composite Index (Canada) - joint graphic -
Source: Own computations based on selected financial data series

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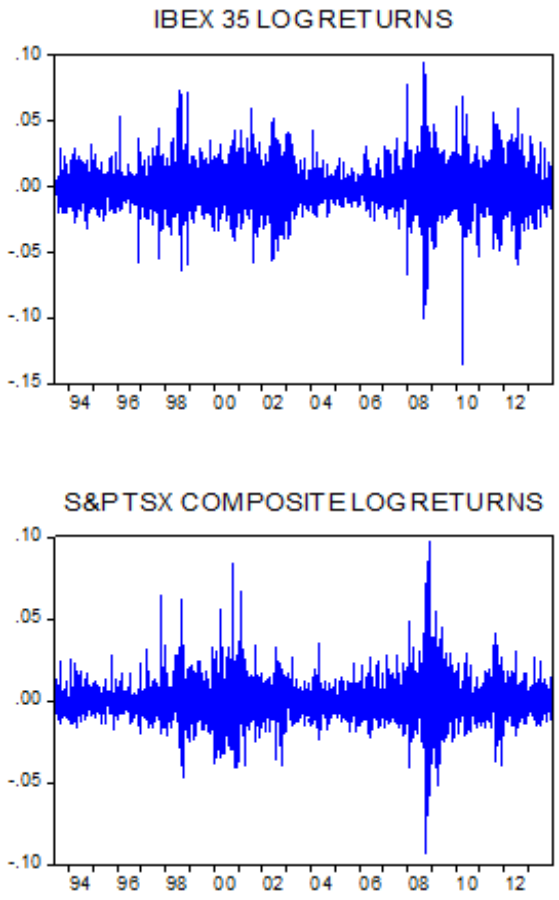

Fig.4 : The log-returns of IBEX 35 Index (Spain) and S&P TSX Composite Index (Canada) - individual graphics -

Source: Own computations based on selected financial data series

The basic statistical characteristics of selected indices, ie IBEX 35 Index (Spain) and S&P TSX Composite Index (Canada) are analyzed based on the following : Jarque-Bera test's statistic whose importance derives from the fact that it 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 or leptokurtic distribution.

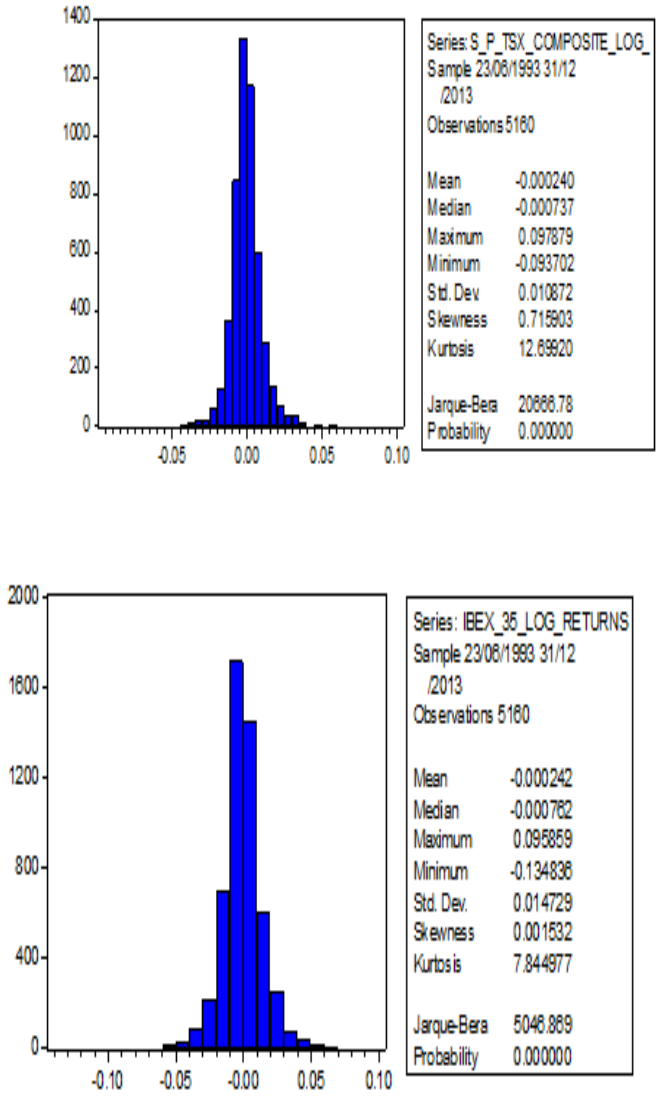

Fig. 5 : Basic statistical characteristics of selected indices

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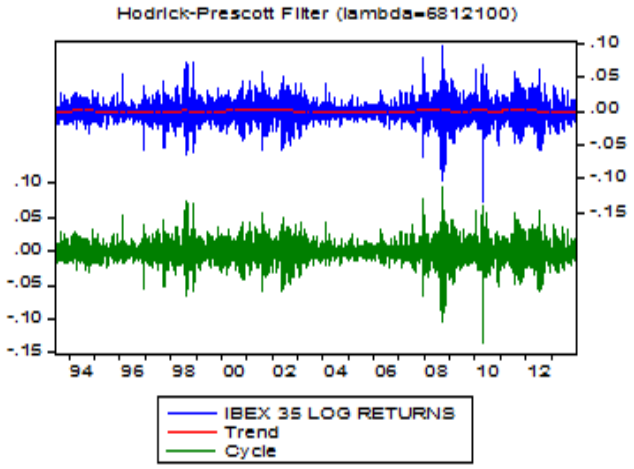
Source: Own computations based on selected financial data series

The empirical analysis also includes the use of Hodrick-Prescott (HP) filter which is a specialized filter for trend and business cycle estimation decomposing the series into a trend component and a residual component, which may or may not include a cyclical component.



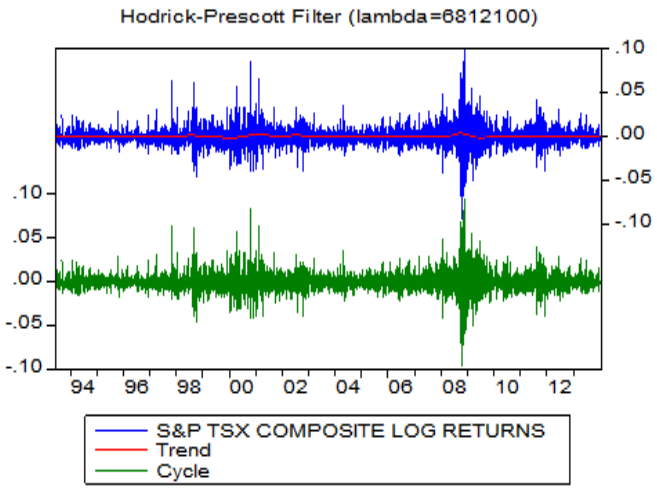
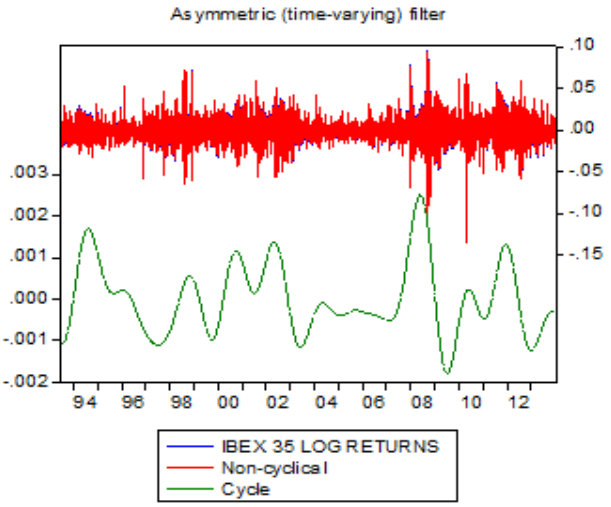


Fig. 6 : Hodrick – Prescott Filter

Source: Own computations based on selected financial data series



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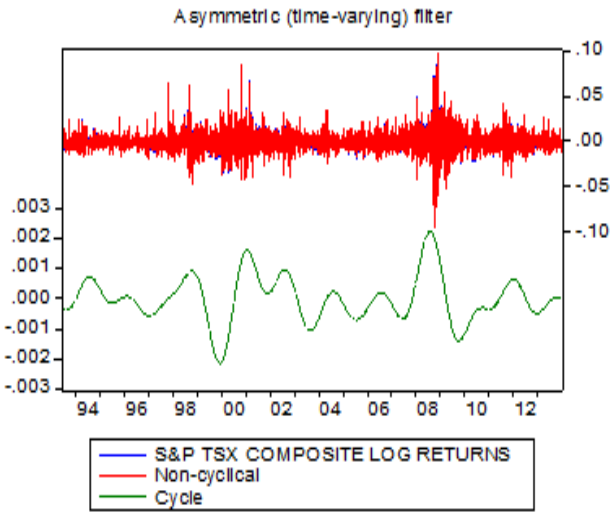

Fig. 7 : Asymmetric time-varying filter

Source: Own computations based on selected financial data series

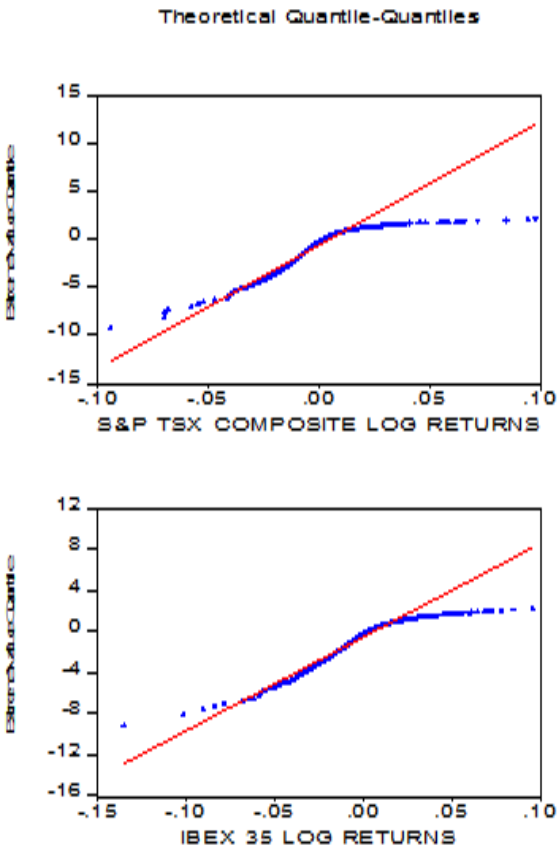

Fig.8 : Theoretical Quantile-Quantile Plots

(Extreme values)

Source: Own computations based on selected financial data series

The Augmented Dickey-Fuller (ADF) test was

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applied for the sample period in order to determine the stationarity of the analyzed time series. The null hypothesis suggests that the analyzed time series contains a unit root and consequently it is 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 H_0 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.

Null Hypothesis: S_P_TSX_COMPOSITE_LOG_RE has a unit root
Exogenous: Constant
Lag Length: 28 (Automatic based on Modified HQ, MAXLAG=32)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-11.86166	0.0000
Test critical values:	1% level	-3.431443	
	5% level	-2.861908	
	10% level	-2.567008	

Source: Own computations based on selected financial data series

Table 1: Augmented Dickey-Fuller Test

Null Hypothesis: IBEX_35_LOG_RETURNS has a unit root

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-15.88440	0.0000
Test critical values:	1% level	-3.431440	
	5% level	-2.861907	
	10% level	-2.567008	

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 $|V_{m,\varepsilon}| > 1{,}96$ 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., ie the financial time series is non-linearly dependent if first differences of the natural logarithm have been calculated. The null hypothesis was rejected in both sample cases.

Table 2 : BDS Test

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BDS Test for IBEX_35_LOG_RETURNS
Sample: 23/06/1993 31/12/2013
Included observations: 5161

Dimension	BDS Statistic	Std. Error	z-Statistic	Prob.
2	0.017540	0.001233	14.22686	0.0000
3	0.040075	0.001955	20.49507	0.0000
4	0.058114	0.002324	25.00711	0.0000
5	0.070682	0.002418	29.23761	0.0000
6	0.077025	0.002327	33.10128	0.0000

BDS Test for S_P_TSX_COMPOSITE_LOG_RE
Sample: 23/06/1993 31/12/2013
Included observations: 5161

Dimension	BDS Statistic	Std. Error	z-Statistic	Prob.
2	0.023252	0.001328	17.50768	0.0000
3	0.049417	0.002108	23.44760	0.0000
4	0.069399	0.002506	27.68813	0.0000
5	0.082330	0.002609	31.55291	0.0000
6	0.088476	0.002513	35.20169	0.0000

Source: Own computations based on selected financial data series

According to Granger (1969), if some other time series Y_t contains informations regarding the past periods which are useful in the prediction X_t and in addition this informations are included in no other series used in the predictor, then this implies that Y_t caused X_t. 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 $\forall t, s$. The assumption 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 "feedback relationship between X_t and Y_t".

According to Granger causality test, based on the Probability values included in the tables below, empirical analysis provides significant information on dynamic causal linkages between developed stock markets of Spain and Canada. 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.

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Table 3 : Granger Causality tests

Pairwise Granger Causality Tests
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Probability
IBEX_35_LOG_RETURNS does not Granger Cause S_P_TSX_COMPOSITE_LOG_RE	5158	6.33709	0.00178
S_P_TSX_COMPOSITE_LOG_RE does not Granger Cause IBEX_35_LOG_RETURNS		4.79032	0.00835

Pairwise Granger Causality Tests
Lags: 1

Null Hypothesis:	Obs	F-Statistic	Probability
IBEX_35_LOG_RETURNS does not Granger Cause S_P_TSX_COMPOSITE_LOG_RE	5159	5.86835	0.01545
S_P_TSX_COMPOSITE_LOG_RE does not Granger Cause IBEX_35_LOG_RETURNS		10.1684	0.00144

Source: Own computations based on selected financial data series

III. CONCLUSIONS

This research article provides additional empirical evidence regarding dynamic causal linkages between international developed stock markets such as Spain and Canada. The results of Granger causality tests among developed stock markets of Spain and Canada highlights significant investment opportunities based on international portfolio diversification and risk management. Granger causality runs simultaneously in both directions for Spain and Canada (feedback relationship). Empirical analysis included the calculation for both lags=1 and lags=2, so the results are quite different considering the behavior of causal relationships. The impulse response under the sample period of time is very relevant in the context of globalization.

IV. REFERENCES

1. Granger C.W.J., "Developments in the Study of Cointegrated Economic Variables", Oxford Bulletin of Economics and Statistics, 48, 1986
2. Granger, C., Morgenstern, O., Predictability of stock market prices, MA: Lexington, Heath Lexington Books, 1970
3. Granger, C.W.J., "Investigating Causal Relations by Econometric Models and Cross-spectral Methods", Econometrica 37 (3): 424–438, 1969
4. Gujarati, D.N., "Basic Econometrics", Fourth Edition, United States Military Academy, West Point, McGraw-Hill Higher Education, 2003
5. Harris, R. and R. Sollis, Applied Time Series Modelling and Forecasting, John Wiley&Sons, 2003

*** - http://www.canadainternational.gc.ca/spain-espagne/index.aspx?lang=eng