Volatility Analysis of REITS: Empirical Evidence for the EU Peripheral Countries

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Abstract: This study investigates the real estate stock market in Portugal, Italy, Ireland, Greece and Spain from the introduction of the REIT legislation in each country until April 2014. We examine their descriptive statistics and we use various GARCH and asymmetric EGARCH models to their daily returns. The results suggest that the general index of each stock market has a significant impact on real estate stock returns except of the Italian BNS REIT and the Irish GREEN REIT. Except Greece, the general indices tend to report lower standard deviations than the REIT companies. The asymmetry of the volatility response to news seems to be present due to the fact that Italian IGD and BNS, Irish HIBERNIA, Spanish AXIA, MERLIN and PROMORENT along with the Greek Grivalia and TRASTOR report asymmetric transition dynamics for positive and negative shocks.

Keywords: real estate investment trusts; GARCH; Asymmetry; returns.

Biographical notes: Kyriaki Begiazi has served as a doctoral researcher at the Hellenic Open University, where she has earned her PhD in Finance. She holds a Master's and diploma degree from the Athens University of Economics and Business. Her research focuses on time series analysis, REITs, applied econometrics and financial markets. She is a financial professional with a record of accomplishment in banking, consulting, destressed debt markets and financial analysis.

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1. Introduction

Real Estate Investment Trusts (REITs) exist since 1960 in the United States but in Europe their history is more recent. Every country has its own legislative framework and different introduction date. In our study we examine the REIT market in five Eurozone nations, which were consider weaker economically following the financial crisis: Portugal, Italy, Ireland, Greece and Spain, also known with the acronym PIIGS. Table 1 summarizes the most important introductory information about those REITs.

Country	REIT acronym	REIT legislation	First listed REIT
Portugal	SIPI	to be introduced in 2015	
Italy	SIIQ	December 2006	IGD SIIQ (April 2008)
Ireland	REIT	October 2013	Green REIT (Oct. 2013)
Greece	ΑΕΕΑΠ	December 1999	Trastor (June 2005)
Spain	SOCIMI	October 2009	Entercampos (Nov. 2013)

Portuguese REITs are set to be introduced in 2015 after the recently approved 2015 State Budget Law. The government has until the end of 2015 to establish the relative regime for SIPI (the acronym for Portuguese REITs). Due to this fact we have to eliminate Portuguese REITs from our later quantitative analysis.

Our study is the first to apply various GARCH models in the REIT market of Italy, Ireland, Greece and Spain. Four EU member states that failed to refinance their government debt during the debt crisis. Italy, Greece and Spain are also part of the southern Europe.

We investigated the best-fitted model using various GARCH models (GARCH, EGARCH). GARCH models are often much more parsimonious than ARCH models. GARCH models are better to capture the nature of volatility and incorporate much of the information than a much larger ARCH model with large numbers of lags. The exponential autoregressive conditional heteroskedastic (EGARCH) model allows market volatility to respond asymmetrically to positive and negative shocks and due to its additional leverage terms could capture asymmetries in volatility. Especially in asymmetric GARCH models due to the leverage effect with asset prices, a positive shock could have less effect on the conditional variance compared to a negative shock. The most interesting asymmetric effect is the leverage effect and it is related with the impact of news in volatility. This asymmetric adjustment is an important consideration with asset prices in order to understand what determines asset price movements. Investors and portfolio managers would be interested in learning how past returns are correlated with future volatility and how sensitive are REIT returns to information. This is very useful in order to improve the risk management of their portfolios.

We have also studied the relationship of each country's REIT with its general stock index. This is very useful in order to observe the effect that general market movements have on REIT returns. This interaction could affect the decisions of portfolio allocation having in mind any possible portfolio diversification possibilities.

The remainder of this paper is structured as follows: Section 2 briefly details the data set and the methodological approach of the study. Section 3 presents the empirical results and discusses the implications. The final section states the conclusions.

2. Literature review

The majority of real estate investment trust literature focuses on the United States as REITs are a more recent financial instrument in Europe. REITs have their own characteristics but usually seem to be unable to isolate their performance from the general stock market movements. Niskanen and Falkenbach (2010), consistent with other studies, found that equities, especially small cap and value stocks seem to affect European REIT returns. A positive correlation among them was observed. Any possible diversification benefits are very useful for investors and portfolio managers. Another study by Brounen and de Koning (2014) found that over the past decade European REIT stock outperformance was the highest and related positively to firm size, property type specialization and geographical specialization. Bond and Glascock (2006) concluded that European real estate due to its increasing return and decreasing risk could benefit the overall portfolio. Furthermore, real estate has a relatively low beta that performs well under periods of market adjustments.

Sotelo and McGreal (2013) examined the European REIT market including the history and regulation framework of each country's economics of REITs a theoretical overview. The REIT sector in Greece is relatively new and there are no extensive quantitative researches yet. Mitrakos et al. (2013) provided a theoretical overview of the REIT sector in Greece by presenting their characteristics (asset values, share prices and dividends yields). They found that Greek REITs show resilience in crisis because they perform better than the overall stock market and are able to distribute income to shareholders. Apergis (2012) investigated the relationship between the banking institutions and REITs in Greece using a GARCH methodology. The results show that the returns of REITs affect the stock returns of banking institutions involved in the real estate market and this impact is stronger after the recent international financial crisis. Additionally, there is a research in the Greek real estate market before the entrance of the Greek REITs in the Athens Stock Exchange by Kapopoulos and Siokis (2005). They found that the stock market and the housing market in Greece are integrated based on an investigation of the Greek Stock Exchange Index and the real estate prices in Athens and other urban areas in Greece. Gabrielli (2007) analyzed the Italian property funds before the entrance of the REIT legislation and observed strong positive returns in comparison to stocks after the 2003/2004 new laws to facilitate property investments. Gabrielli and Marella (2007) presented the advantages of the new Italian REIT legislation under a theoretical framework. Gimeno et al. (2012) studied the SOCIMI as a real estate investment vehicle competitive in terms of risk and profitability and argues that they are affected by the financial market as well as by their underlying assets. Therefore, our study constitutes a timely econometric approach of the new real estate investment trust regime in the European countries that suffer the most in the recent financial crisis.

We use the GARCH model introduced by Bollerslev (1986) and we examine any presence of asymmetry, using the exponential GARCH model by Nelson (1991). This attempt will help to further examine the real estate stock market in Greece in terms of returns and volatility. The theory of real estate and stock market co-integration assumes that capital gains and risk reduction are possible through holding assets in both markets. In the worldwide literature this issue has not produced unified results regarding the direction of integration between real estate and stock markets (Apergis and Lambrinidis, 2007). Petrova (2010) employed an OLS methodology in the Bulgarian financial market and its real estate market. The results show that changes in real estate and changes in stocks influence each other.

3. Data and methodology

The conducted empirical tests utilize daily returns of the main REIT stocks from Italy, Ireland, Greece and Spain. Table 1 summarizes the real estate investment trusts of each country under examination. The dataset comprises of daily data from the first IPO of each REIT through April 2015. Furthermore, we conduct a comparative econometric analysis for all of the above countries for the last year (March 2014 – April 2015). From the examined REIT universe we have excluded Uro Property, Mercal Inmuebles and Fidere Partimonio Spanish REITs and the Greek MIG REIT (that has been renamed to NGB PANGAEA REIT as a result of its merger by absorption in October 2015) due to their small market capitalization and their small transaction volume.

Table 1 REITs universe

REITS	Mkt cap	Div yield	Volume	Starting date
IGD SIIQ (Italy)	664.459 m euros	4.27%	732,597	April 2008
BNS SIIQ (Italy)	1.583 b euros	3.15%	1,260,930	Dec. 2010
HIBERNIA REIT (Ireland)	851.303 m euros	0.39%	152,340	Dec. 2013
GREEN REIT (Ireland)	963.424 m euros	1.13%	2,591,559	Oct. 2013
LAR SOCIMI (Spain)	530.140 m euros	0.33%	52,134	March 2014
AXIA SOCIMI (Spain)	876.875 m euros	0.32%	5,852	July 2014
MERLIN (Spain)	3.560 b euros	4.08%	969,796	June 2014
PROMORENT (Spain)	4.115 m euros	-	3,460	Dec. 2013
ENTERCAMPOS (Spain)	108.791 m euros	-	0	Nov. 2013
GRIVALIA (Greece)	831.345 m euros	3.70%	6,037	April 2006
TRASTOR (Greece)	71.355 m euros	-	0	July 2005

The main modeling methodology in this study is the Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model by Bollerlev (1986) and it is specified as follows:

mean equation: $x_t = \beta_0 + \beta_1 x_{t-1} + \beta_2 GI_t + u_t$ (1)

variance equation: GARCH(1,1): $h_t = a_0 + a_1 h_{t-1} + a_2 u_{t-1}^2 + a_3 GI_t$ (2)

x_t denotes the dependent variable return series and x_{t-1} refers to its lagged 1-day return. In our study we use the daily REIT returns as dependent variables and the general index (GI) of each national stock market as an explanatory variable. Let u_t

denotes the error terms (return residuals, with respect to a mean process). Equation h_t refers to the conditional variance equation of each asset. In our analysis we tested all the possible GARCH(p,q) models with p=1,2 and q=1,2. GARCH(1,2) and GARCH(2,2) are two additional best-fitted GARCH models and their variances are presented below as:

$$\text{GARCH(1,2)}: h_t = a_0 + a_1 u_{t-1}^2 + a_2 h_{t-1} + a_3 h_{t-2} + a_4 GI_t \quad (3)$$

$$\text{GARCH(2,1)}: h_t = a_0 + a_1 u_{t-1}^2 + a_2 u_{t-2}^2 + a_3 h_{t-1} + a_4 GI_t \quad (4)$$

$$\text{GARCH(2,2)}: h_t = a_0 + a_1 u_{t-1}^2 + a_2 u_{t-2}^2 + a_3 h_{t-1} + a_4 h_{t-2} + a_5 GI_t \quad (5)$$

A major restriction of the GARCH specification is the fact that it is symmetric. By this we mean that what matters is only the absolute value of the innovation and not its sign (because the residual term is squared). Therefore, in these models a positive shock will have exactly the same effect on the volatility of the series as a negative shock of the same magnitude. However, for equities it has been observed that negative shocks (or ‘bad news’) in the market have a larger impact on volatility than positive shocks (or ‘good news’) of the same magnitude. The exponential GARCH or EGARCH model which was first developed by Nelson (1991), and the variance equation for the EGARCH(1,1) model is given by:

$$\log(h_t) = a_0 + a_1 \left|u_{t-1}/\sqrt{h_{t-1}}\right| + a_2 (u_{t-1}/\sqrt{h_{t-1}}) + a_3 \log(h_{t-1}) + a_4 GI_t \quad (6)$$

where a_0 is a constant. This model differs from the GARCH model in several ways. First of all it uses logged conditional variance to relax the positiveness constraint of model coefficients and enable the model to respond asymmetrically to positive and negative lagged values. On the left-hand side is the log of the variance series and this makes the leverage effect exponential instead of quadratic, therefore the estimates of the conditional variance are guaranteed to be non-negative. To test for asymmetries the parameter of importance is the α_2. If α_2=0, then the model is symmetric. When α_2 < 0, positive shocks (good news) generate less volatility than negative shocks (bad news). Additional best-fitted EGARCH variance representations include the following models:

$$\text{EGARCH(1,2)}: \log(h_t) = a_0 + a_1 \left|\frac{u_{t-1}^2}{\sqrt{h_{t-1}}}\right| + a_2 \left(\frac{u_{t-1}}{\sqrt{h_{t-1}}}\right)$$

$$+a_3 \log h_{t-1} + a_4 \log h_{t-2} + a_5 GI_t \tag{7}$$

$$\text{EGARCH(2,1)}: \log(h_t) = a_0 + a_1\left|u_{t-1}^2/\sqrt{h_{t-1}}\right| + a_2\left|u_{t-2}^2/\sqrt{h_{t-2}}\right| +$$

$$+a_3\left(\frac{u_{t-1}}{\sqrt{h_{t-1}}}\right) + a_4 \log h_{t-1} + a_5 GI_t \tag{8}$$

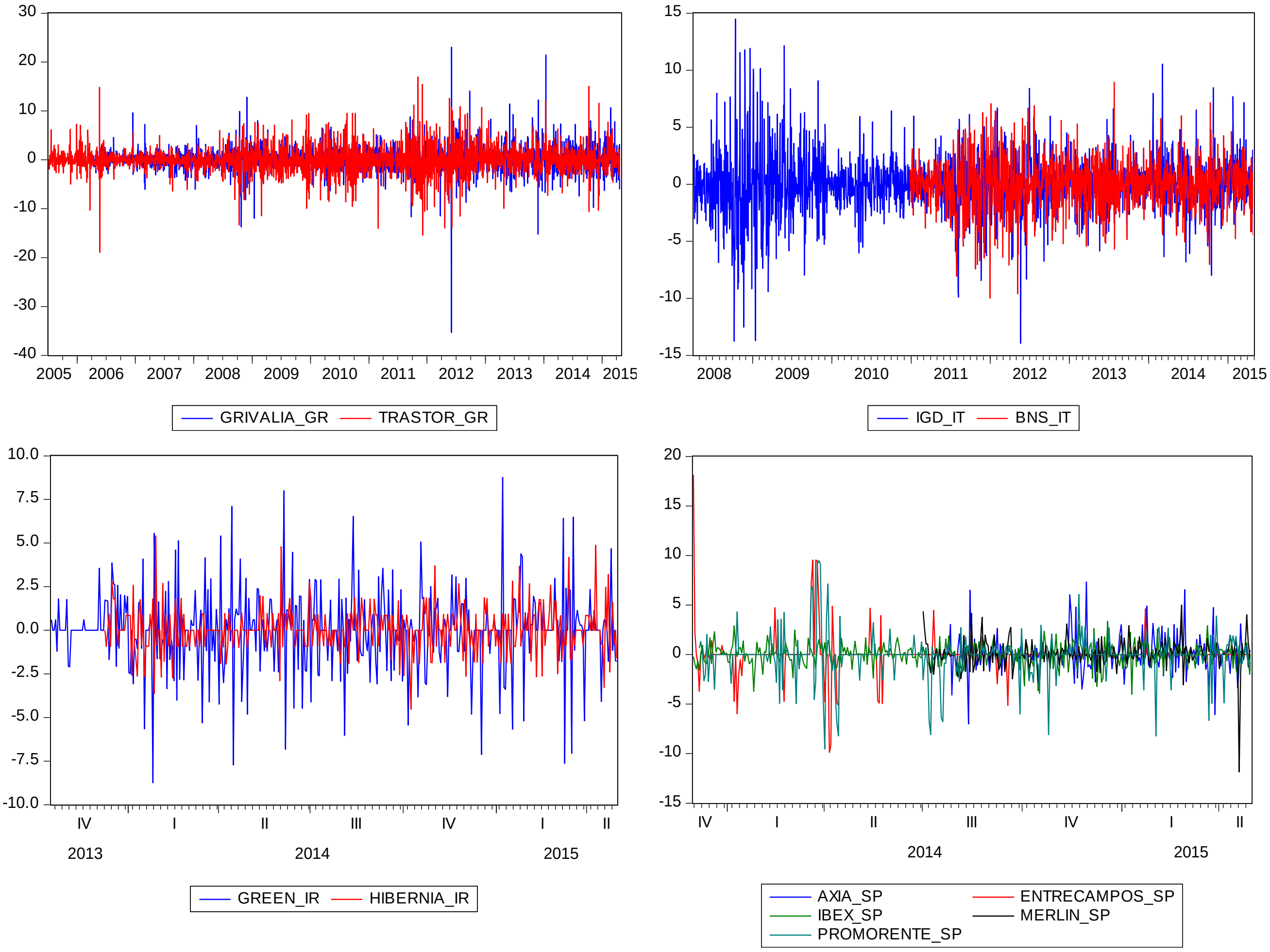
$$\text{EGARCH(2,2)}: \log(h_t) = a_0 + a_1\left|u_{t-1}^2/\sqrt{h_{t-2}}\right| + a_2\left|u_{t-2}^2/\sqrt{h_{t-2}}\right| +$$

$$+a_3\left(\frac{u_{t-1}}{\sqrt{h_{t-1}}}\right) + a_4 \log h_{t-1} + a_5 \log h_{t-2} + a_6 GI_t \tag{9}$$

4. Empirical Results

The returns of each country's REITs are calculated as the daily percentage change in price and they are illustrated in Picture 1.

Picture 1 REIT return series



The examined period in Greece covers the Greek government-debt crisis which started after the revelation of the Greek debt levels in 2010. The Greek real estate index (which was created in 2009) exceeded the general Greek stock market index throughout the whole period under examination. The price movements of the Greek real estate index constituents report high degree of differentiation. Of particular interest is the fact that Grivalia's prices after 2013 have surpassed the 2009 prices. In May 2012, we observed a structural break that is consistent to the unstable prevailing market sentiment due to the Greek financial crisis and the Greek early legislative election (6 May 2012). In mid-May 2012 the crisis and impossibility to form a new coalition government after elections, led to a strong belief that Greece may leave Eurozone. As was expected this potential exit disrupted the stock market and investors.

The first Italian REIT had been listed through the 2008 financial crisis. Italy, like many other European countries, experienced a sudden stop in private capital inflows due to the fear of the unstainable government debt. The highest variation in the return series was observed in 2008. The mid May 2012 crisis in Greece seems to also have an impact on the Italian market. This phenomenon, widely known as "Grexit" appears to navigate the international market behavior. In May 21, 2012 the Italian IGD REIT reported its lowest return (-13.9%). According to the Focus Economics report (2015) Italy suffered from a 5.5% GDP decrease and since then Italy has no clear trend of recovery. All these are constituent with the REIT market return series overview that reports relatively high instability up to 2015 (Picture 1).

In Ireland and Spain the REIT regime was introduced in 2013 and does not cover the early stages of the financial crisis. Ireland and Portugal are the first Eurozone members that have obtained to exit their bailout programs in July 2014. Spain never officially received a bailout program for the government itself but it received two rescue packages for the recapitalization banks in 2012 and 2013 from the ESM.

Subsequently, we have estimated various alternative GARCH models to find which one has the best fit and observe any asymmetries in our time series. Any possible asymmetry in the news is examined using the exponential GARCH approach. By including the general index of each stock market as a benchmark, we are able to draw conclusions about the general stock market effect on the REIT stock returns.

GARCH(p,q) and EGARCH(p,q) are the estimated GARCH models. Where we apply all the available combinations of p=1,2 and q=1,2. Table 2 contains the Akaike information criteria (AIC) and Schwartz information criteria (SIC). These information criteria are used in order to select the most suitable conditional variance model. Because of the heavier penalty, the best model according to BIC is the same as the one chosen by AIC, or the one with a fewer parameters. Many statisticians argue that AIC is best for prediction as it is asymptotical equivalent to cross-validation (Stone, 1977) and BIC is best for explanation.

Table 2 GARCH model selection

	GARCH(1,1)		GARCH(1,2)		GARCH(2,1)		GARCH(2,2)		EGARCH(1,1)		EGARCH(1,2)		EGARCH(2,1)		EGARCH(2,2)	
	AIC	BIC	AIC	BIC	AIC	BIC	AIC	BIC	AIC	BIC	AIC	BIC	AIC	BIC	AIC	BIC
IGD_IT	-4.849	-4.828	-4.851	-4.827	-4.864	-4.840	-4.867	-4.840	-4.845	-4.821	-4.852	-4.825	-4.865	-4.838	**-4.874**	**-4.845**
BNS_IT	-4.864	-4.833	-4.865	-4.829	-4.875	-4.839	-4.874	-4.834	-4.873	-4.838	-4.873	-4.833	-4.884	-4.844	**-4.883**	**-4.839**
HIBERNIA_IR	-5.922	-5.847	-5.942	-5.856	-5.932	-5.846	-5.927	-5.830	-5.930	-5.844	**-5.986**	**-5.890**	-5.936	-5.840	-5.981	-5.874
GREEN_IR	**-4.876**	**-4.806**	-4.835	-4.755	-4.612	-4.532	-4.870	-4.798	-4.867	-4.787	-4.840	-4.750	-4.874	-4.784	-4.847	-4.747
LAR_SP	**-6.293**	**-6.197**	-6.292	-6.194	-6.278	-6.179	-6.287	-6.175	-6.285	-6.187	-6.292	-6.184	-6.280	-6.169	-6.292	-6.169
AXIA_SP	-5.402	-5.291	-5.404	-5.276	-5.397	-5.270	-5.395	-5.251	-5.414	-5.287	-5.412	-5.269	**-5.419**	**-5.276**	-5.406	-5.247
MERLIN_SP	-5.738	-5.629	-5.753	-5.629	-5.751	-5.627	-5.810	-5.670	-5.846	-5.722	-5.866	-5.726	**-5.928**	**-5.788**	-5.926	-5.770
PROMORENT_SP	-5.132	-5.057	-5.149	-5.063	-5.135	-5.050	-5.130	-5.034	-5.117	-5.032	-5.113	-5.017	-5.120	-5.024	**-5.180**	**-5.073**
ENTRECAMPOS_SP	**-6.237**	**-6.163**	-6.218	-6.133	-5.892	-5.808	-6.037	-5.942	-6.204	-6.120	-6.170	-6.075	-6.221	-6.125	-6.223	-6.117
GRIVALIA_GR	-4.836	-4.819	-4.839	-4.820	-4.725	-4.705	-4.850	-4.828	-4.840	-4.821	-4.845	-4.823	**-4.862**	**-4.840**	-4.861	-4.836
TRASTOR_GR	-4.680	-4.664	-4.679	-4.661	-4.679	-4.661	-4.683	-4.663	-4.697	-4.678	-4.702	-4.681	**-4.715**	**-4.694**	-4.698	-4.675

Note: The underlined values indicate the greater Schwarz number in absolute value and suggest the best fitted model.

Table 3 summarizes the best model selection based on the Schwarz and Akaike information criteria including the analytical presentation of each model's regression coefficients. This led us to conduct our main conclusions about the relationship of the examined variables. Italian IGD and BNS, Irish HIBERNIA, Spanish AXIA, MERLIN and PROMORENT along with the Greek Grivalia and TRASTOR report asymmetric transition dynamics for positive and negative shocks.

Table 3 GARCH coefficients

Variable	**IGD_IT**	**BNS_IT**	**HIBERNIA_IR**	**GREEN_IR**	**LAR_SP**	**AXIA_SP**	**MERLIN_SP**	**PROMORENT _SP**	**ENTRECAMPOS _SP**	**GRIVALIA_GR**	**TRASTOR_GR**
best model	**EGARCH(2,2)**	**EGARCH(2,2)**	**EGARCH(1,2)**	**GARCH(1,1)**	**GARCH(1,1)**	**EGARCH(2,1)**	**EGARCH(2,1)**	**EGARCH(2,2)**	**GARCH(1,1)**	**EGARCH(2,1)**	**EGARCH(2,1)**
Mean equation											
β₀	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.000	0.000	0.000
	-0.328	*0.206*	*0.391*	*0.255*	*0.033*	*0.479*	*1.387*	*1.723*	*-0.004*	*-0.648*	*1.192*
β₁	0.049 *	0.014	-0.185 *	-0.321 *	0.010	-0.256 *	0.107 *	0.171 *	0.247 *	-0.094 *	-0.146 *
	2.056	*0.406*	*-3.921*	*-7.983*	*0.140*	*-2.535*	*2.730*	*5.601*	*7.946*	*-4.399*	*-7.758*
β₂	0.583 *	-0.034	0.156 *	0.124	0.181 *	0.168	0.373 *	0.312 *	-0.005	0.376 *	0.383 *
	20.983	*-0.842*	*2.835*	*1.159*	*2.908*	*1.475*	*8.576*	*6.379*	*-0.203*	*20.027*	*22.329*
Variance equation											
α₀	-0.028 *	-0.068 *	-2.047 *	0.000 *	0.000 *	-1.440 *	-11.789 *	-16.007 *	0.000 *	-0.039 *	-0.083 *
	-4.046	*-7.625*	*-2.646*	*10.235*	*3.893*	*-3.319*	*-14.293*	*-35.796*	*9.019*	*-8.865*	*-10.843*
α₁	0.352 *	0.275 *	0.299 *	-0.038 *	0.128 *	0.436 *	0.778 *	0.731 *	0.328 *	0.269 *	0.299 *
	12.391	*4.609*	*5.988*	*-11.065*	*2.676*	*2.507*	*5.159*	*10.494*	*3.994*	*10.084*	*11.183*
α₂	-0.338 *	-0.247 *	-0.091 *	1.017 *	0.592 *	-0.260	1.382 *	0.566 *	0.502 *	-0.236 *	-0.246 *
	-12.151	*-4.086*	*-2.615*	*508.448*	*6.555*	*-1.671*	*11.651*	*8.203*	*10.708*	*-8.929*	*-9.067*
α₃	-0.004	-0.026 *	-0.036	0.000	-0.001 *	0.027	-0.034	-0.036	0.002 *	-0.017 *	0.016 *
	-1.755	*-2.544*	*-0.875*	*-0.107*	*-2.893*	*0.420*	*-0.417*	*-1.235*	*15.542*	*-5.373*	*3.481*
α₄	1.655 *	1.302 *	0.831 *			0.841 *	-0.153	-0.287 *		0.998 *	0.994 *
	30.470	*204.035*	*16.593*			*17.429*	*-1.636*	*-6.214*		*2160.888*	*1451.459*
α₅	-0.658 *	-0.308 *	14.930 *			19.032 *	23.898 *	-0.589 *		-1.273 *	-2.150 *
	-12.202	*-46.945*	*4.260*			*2.697*	*3.677*	*-18.971*		*-12.275*	*-12.764*
α₆	-1.064 *	-0.400						-15.774 *			
	-5.164	*-0.505*						*-8.895*			

Note: * indicates significance at the 5 percent level or higher

The parameter estimation for the EGARCH models confirms the leverage effect because the a_3 coefficient is negative and statistically significant. Positive shocks (good news) generate less volatility than negative shocks (bad news). The GI_t

coefficient in relation to the mean equation is significant positive for Italian IGD, Irish HIBERNIA, Spanish LAR, MERLIN, PROMORENT and Greek GRIVALIA and TRASTOR. It is worth mentioning that GI_t has a negative effect on the variance equation of IGD_IT, LAR_SP, PROMORENT_SP, GRIVALIA_GR and TRASTOR_GR. Respectively each stock market general index has a significant positive effect on the variance equation of HIBERNIA_IR, AXIA_SP, MERLIN_SP and ENTERCAMPOS_SP. Therefore, BNS_IT and GREEN_IR seem not to be affected for their general stock market movements.

Subsequently, we investigate the REIT market as a whole in Italy, Ireland, Greece and Spain for a year, from March 2014 to April 2015. Table 4 summarizes the main descriptive statistics for each country daily REIT returns compared to the general index of the respective stock market.

Table 4 Descriptive statistics of daily REIT returns

	Mean	Max	Min	Std. Dev.	Skewness	Kurtosis	Jarque-Bera
IGD_IT	-0.046	8.465	-7.977	2.207	0.048	4.767	39.261
BNS_IT	0.049	7.156	-7.040	1.879	-0.151	4.611	33.708
MIB_IT(GI)	0.035	3.807	-5.049	1.423	-0.128	3.691	6.802
HIBERNIA_IR	0.046	4.879	-4.526	1.242	0.341	5.058	58.941
GREEN_IR	-0.011	8.760	-7.719	2.396	-0.132	4.970	49.561
ISEQ_IR(GI)	0.056	3.167	-3.331	1.015	-0.114	3.527	4.133
LAR_SP	0.008	5.017	-5.603	1.090	0.240	8.062	324.273
PROMORENTE_SP	-0.081	9.475	-9.531	2.240	-0.368	9.580	549.746
ENTRECAMPOS_SP	0.022	9.531	-9.870	1.641	0.680	23.271	5176.948
IBEX_SP(GI)	0.036	3.345	-3.994	1.138	-0.279	3.734	10.677
GRIVALIA_GR	-0.050	10.660	-9.761	2.625	0.315	4.686	40.618
TRASTOR_GR	0.060	15.028	-10.622	2.552	0.635	9.440	540.332
GD_GR(GI)	-0.157	10.681	-13.669	2.562	-0.136	7.252	227.704

The mean is close to zero for all the time series. The Spanish Promorente and the Greek general index report the most negative mean returns among the REIT companies and the general indices respectively. The greatest standard deviation is observed in the Greek market. The general indices tend to report lower standard deviations than the REIT companies except Greece. The only exception is the Spanish LAR REIT standard deviation which is lower than the Spanish general index.

The large Jarque-Bera statistic leads to the rejection of the null hypothesis of a normal distribution. The Jarque - Bera statistic can be used to test a null hypothesis where each variable is considered to have a normal distribution. The null hypothesis that each variable has a normal distribution is rejected based on its zero p-value. This test is based on the fact that the skewness and kurtosis of normal distribution equal to zero. Skewness gives a measure of whether the observations are skewed to the left or to the right of the mean. A positive (negative) skewness indicates a right (left) skewed distribution. Skewness is very common in time series that the data are not normally distributed. Kurtosis on the other hand gives a measure of thickness in the tails of a probability density function (for a normal distribution the kurtosis is 3). All our time series have fat tailed distributions because kurtosis is greater than 3. These results verify once more the adoption of the GARCH methodology in our main time series modelling approach.

5. Conclusions

This is the first quantitative study that comprises an overview of the real estate investments Trusts in Italy, Ireland, Greece and Spain. These are four of the EU member states that failed to refinance their government debt during the debt crisis.

The results generally suggest that the general index of each stock market has a significant impact on real estate stock returns except of the Italian BNS REIT and the Irish GREEN REIT. The significant impact of its stock market general index is positive on the mean equations. A negative effect on the variance equation is reported for the Greek REITs, the Spanish REITs LAR and PROMORENT as well as for the Italian IGD. The most negative effect was reported on the Spanish PROMORENT. In addition the general index has fairly positive impact on the variance equations of the Irish HIBERNIA REIT, the Spanish AXIA and Merlin. MERLIN and AXIA are the most recent Spanish REITS (June, July 2014 respectively).

Moreover, the asymmetry of the volatility response to news seems to be present due to the fact that Italian IGD and BNS, Irish HIBERNIA, Spanish AXIA, MERLIN and PROMORENT along with the Greek Grivalia and TRASTOR report asymmetric transition dynamics for positive and negative shocks. Specifically, bad news has larger effects on volatility of the above listed series. EGARCH models show that the negative shocks at time t-1 have a greater impact in the variance at time t than positive shocks. This asymmetry is called leverage effect and its parameter is negative and statistically significant.

By creating a common sample, we investigate the REIT market as a whole in Italy, Ireland, Greece and Spain during a year, from March 2014 to April 2015. The mean is close to zero for all the time series. The Spanish Promorente and the Greek general index report the most negative mean returns among the REIT companies and the general indices respectively. The greatest standard deviation is observed in the Greek market and except Greece the general indices tend to report lower standard deviations than the REIT companies.

In the examined countries, REITs are a new investment tool under recent development and due to this the econometric modeling is a useful tool in the observation and understanding of their behavior and characteristics. Moreover, the relationship between the general index and the specific real estate trusts has a practical implication in terms of asset allocation of a portfolio in the stock market in terms of diversification potentials between general stocks and real estate companies' stocks.

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