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Investigating Causality Effects in Return Volatility among Five Major Futures Markets in European Countries with a Mediterranean Connection

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Abstract

This study analyses daily data of the stock index futures markets of Turkey (BIST30) and four Eurozone countries – Italy (MIB30), France (CAC40), Spain (IBEX), Greece (ASE20) – spanning from March 2005 to March 2012. Using the GARCH model and Granger methodology, the study shows that bidirectional causality holds for futures return volatilities in these Eurozone areas, and it is only in the case of the Turkish BIST30 index futures returns that a weak unidirectional pattern can be identified. This provides empirical evidence that the Eurozone stock markets investigated in this study are highly integrated. Additionally, the spillover effect between the Turkish market and the other Eurozone stock markets in the Mediterranean is insignificant. These findings provide a better understanding of the inter-relations and volatility causality among these five financial markets and could better guide financial policy makers and investors in their efforts to maintain/regain stability in their financial system.

Keywords: Futures Markets, Return Volatility (GARCH), Granger Causality, Mediterranean, Stability.
JEL Codes: G15; G13; F36; C32; G11.

1 Introduction

Investors who are not satisfied with return opportunities in national markets usually invest in international financial markets. Markowitz (1952) argued that if portfolio diversification is performed, it can create an optimal risk-return relationship in the portfolio. However, in performing portfolio diversification, relationships between securities need to be investigated.

Increased trade, capital movements, co-culture and regional cooperations between countries which are in the process of globalization has increased the integration of financial markets. This has affected the benefits of portfolio diversification. Globalisation

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and an increased integration of financial markets have prompted analysts and academic researchers to examine how stock returns in one stock market influences another (Joshi, 2011). Sakthivel *et al.* (2012) argue that in order to design a well-diversified portfolio for investors, risk managers and policy makers need information regarding the relationships between stock markets and they need to continuously adjust their portfolios to reflect changes in patterns. Sakthivel *et al.* (2012) add that if volatility relationships among markets are significant, a shock originating from one market may have a destabilizing impact on the other markets. This could have serious implications for the stability of the global financial system. It is therefore crucial that policy makers understand the inter-relations and volatility relationships between financial markets.

Yang and Bessler (2004) posited that «the exploitation of international equity broad market relationships for the benefit of trading can be better served through stock index futures trading» (p. 371). In line with this argument, this study uses data from futures markets rather than from spot markets. Although most studies that carry out similar investigations use spot market data, replicating the spot stock market index involves a larger initial investment, a longer implementation time, higher transaction costs, and problems in tracking errors. Therefore, those investors engaged in speculative transactions will prefer stock index futures trading as this makes the international equity market price relationships, reflected by the stock index futures markets, more relevant to active traders. More relevant information on the analysis of international equity market linkages could be obtained from stock index futures markets' data since the prices of stock index futures, as also noted by Kawaller *et al.* (1987), almost always lead to stock index movements performing a better formational role. Moreover, Boudoukh *et al.* (1994) suggest that use of stock index futures can provide a cleaner test of international transmission of stock returns and volatility.

Various theoretical and empirical studies have examined the linkages among different country markets but few studies (at least to our knowledge) examined the return volatility relationship and causality between futures markets in European countries within the Mediterranean[1]. The latter is the main aim of the present study.

This study uses daily data of stock index futures markets of Italy (MIB30), France (CAC40), Spain (IBEX), Greece (ASE20) and Turkey (BIST30) for the period from March 21, 2005 to March 21, 2012. These indices contain the most valuable/significant shares on their respective national exchanges. The FTSE MIB 30 comprises the 40 most-traded stock classes on for the Borsa Italiana, with FIB representing futures on the FTSE MIB. The CAC 40 represents a capitalization-weighted measure of the 40 most significant values among the 100 highest market caps on Euronext Paris. The IBEX 35 is a market capitalization weighted index comprising the 35 most liquid Spanish stocks

[1] The Mediterranean Sea, which literally means «sea between lands», is located between the continents of Europe, Northern Africa and South-western Asia and stretches from Gibraltar to Israel. It borders 21 nations and has a total area of circa 2.5 million km^2. This region is known for a favourable climate, biological diversity, natural resources and its cuisine. It has been acknowledged as the cradle of civilization because it is the birthplace of some of the most deeply rooted cultures/civilizations such as the Egyptians, Greeks, Romans and Arabs and of three of the most influential global religions - Christianity, Islam and Judaism (FAO, 2003). The Mediterranean has provided routes for trade, colonization and war for various colonies (Abulafia, 2011). It attracts around one third of global tourism and the various crises (political, financial and economic) had no major impact on tourism growth, confirming the reliance of tourism in this region (Lanquar, 2011).

traded in the Madrid Stock Exchange General Index. The FTSE/ASE 20 is a composite index made up of the 20 largest companies by market capitalization listed on the ATHEX while the BIST30 contains the most valuable 30 shares on the Borsa İstanbul.

Given the current economic situation in the countries investigated and the fear of contagion within the Mediterranean and with other European countries, the research findings of this study may be useful for financial policy makers, decision makers and investors interested in these areas, particularly if they need to strengthen, maintain or regain stability in their financial system. It is important to understand whether the situation in these countries may have mushroomed because of the effect of spillovers within these markets or whether this is a Mediterranean phenomenon or other. The findings would allow market investors to better understand the sources of risks and price volatility spillovers between the markets investigated. They also allow policymakers to better manage volatility spillovers between the markets, mitigating or managing risks and improving the efficiency of the economy.

Much has been written about the fact that the volatility of stock returns plays an essential role in portfolio management, decision making, policy-making and capital budgeting. It is a well known fact that volatility is also an important element for the choice of risk hedging strategies. The Mediterranean stock market has over the last two decades, become an important area for global investors to benefit from international diversification (Lagoarde-Segot & Lucey, 2007; Driessen & Laeven, 2008). However, to the best of our knowledge, not much has been written on linkages between these Mediterranean countries. Hence, financial policy makers may be faced with a lack of information when taking important and significant decisions which can affect a Mediterranean country's financial future and stability.

2 Literature Review

Few studies have investigated relationships among return volatilities in futures markets. Such studies have generally focused on stock futures markets, currency futures markets and commodity futures markets and have shown that there is Granger causality between the US futures markets and other markets.

Aggarwal and Park (1994) investigated the daily and overnight transmission of prices between the US and Japanese equity markets, using daily opening and closing prices for the Nikkei 225 Index, Futures on this Nikkei Index, S&P500, and the S&P futures contracts between April 1 of 1987 and March 29 of 1991. They found that the US equity prices led the Japanese equity prices. Contrary to the behaviour of spot returns, future returns behaviour was consistent with market integration; information flowed both from Japan to the U.S and vice-versa.

Booth *et al.* (1997) investigated the international transmission of intraday volatility movements in the US, UK, and Japanese stock index futures markets between 1988 and 1994. The results of this study show that the US and the UK stock index futures markets volatilities affect each other. However, the Japanese market volatilities depend more strongly on their past values and do not exhibit any spillover effects.

Sim and Zurbreugg (1999) used futures data from July 24 to October 24 of 1997 of both Australian and Japanese stock markets to examine volatility and price relationship between them. Using the ARCH process, the authors found that Australian markets are far more susceptible to Japanese price movements. Moreover, they showed that there were volatility spillover effects from the Japanese futures to Australian markets. However, this was not found to be reciprocal. Yang and Bessler (2004) investigated price relationship among nine major stock index futures markets (Australia, Japan, Hong Kong, Germany, France, United Kingdom, Switzerland, United States and Canada) over the period ranging from January 1 of 1994 to December 31 of 2000. They found that the US had a significant influence on most European markets such as the UK, France and Switzerland, but not Germany. Also, the US affected other world markets while the Japanese futures market was affected by other markets. While Japan, France and Canada produced little effect on other markets, the Swiss market did not produce any effect on others.

Gannon (2005) used GARCH methods to investigate the volatility spillover between US S&P500 index futures and Hong Kong index futures. He found that there was volatility spillover from the overnight US market to the Hong Kong market for index futures. Marcelo *et al.* (2007) investigated the information spillover from the US to the Spanish stock index futures markets. Using daily stock index futures data which covered the period from January 2 of 1998 to April 28 of 2006, they found that there was a significant and positive spillover effect from the DOW index upon the IBEX overnight return, but the influence from the IBEX was negative.

Some studies such as those of He (2009), Mahmood (2007) and Han *et al.* (2012) examined exchange futures markets. He (2009) examined the long-term and dynamic relationship between the Shanghai and London Futures Exchange for the period from January 2003 to December 2007. This study reported that there was a two-way causal relationship between the prices of the Shangai and London Futures Exchanges. Mahmood (2007) examined volatility transmission between the International Monetary Market (IMM) and the Singapore Exchange (SIMEX), using daily futures prices of the German Mark and the Japanese Yen for the period from November 1 of 1993 to June 24 of 1996. The results showed strong volatility transmission from the IMM to the SIMEX for both the German Mark and the Japanese Yen futures contracts, while there was no transmission from SIMEX to IMM. Han *et al.* (2012) examined the volatility transmission processes between the Singapore Exchange and the China Financial Futures Exchange. Using one-minute and five-minute high-frequency data from May to November 2011, they found that China's CSI 300 index futures dominated Singapore's A50 index futures in terms of the price discovery process. However, A50 futures contracts also made an important contribution to the price discovery process. The CSI 300 futures market also affected the Singapore index futures in the intraday volatility transmission process.

In their study, Asimakopoulos *et al.* (2000) used daily currency futures prices for the British Pound (BP), the Deutsche Mark (DM), the Japanese Yen (JY) and the Swiss Franc (SF) between January 1986 and April 1997. They found unidirectional causality from JY to DM, BP to DM, BP to SF and DM to SF. However, they found that the currency futures returns have a weak predictive power for one another when the volatility effects are taken into consideration.

Booth *et al.* (1998) investigated the relationship between US and Canadian wheat futures prices, using daily futures prices data from January 2 of 1980 to December 31 of 1994. The results showed that there was a unidirectional causality from the US to the Canadian wheat futures markets. Lin *et al.* (2008) examined the dynamic relationships between COMEX and TOCOM gold futures markets. The time period used in this study spans over 17 years, from January 1990 to July 2006. The results showed that volatility transmission effects exist in both COMEX and TOCOM.

Kumar and Pandey (2011) examined return and volatility relationships between Indian commodity futures markets and nine commodities futures markets outside India. They found that the futures prices of agricultural commodities traded at «National Commodities and Derivatives Exchange» (NCDEX) and «Chicago Board of Trade» (CBOT), the prices of precious metals traded at «Merchant Customer Exchange» (MCX) and «New York Mercantile Exchange» (NYMEX), the prices of industrial metals traded at MCX and the «London Metal Exchange» (LME) and the prices of energy commodities traded at MCX and NYMEX were co-integrated. In the case of commodities, they found that world markets have a unidirectional impact on Indian markets. Moreover, they found that there are bi-directional return spillover effects between MCX and LME markets. However, the effect of LME on MCX was stronger than the effect of MCX on LME. The results of return and volatility spillovers indicate that the Indian commodity futures markets are also affected by the world market. Finally, Ji and Fan (2012) examined weekly data over the period from October 22 of 2004 to August 19 of 2011 and found that China's fuel oil futures market Granger causes the Singapore fuel oil futures market.

Studies that examined volatility behaviour in Mediterranean stock markets and linkages between Mediterranean stock markets are sparse. Kenourgios and Samitas (2011) examined the potential of regime shifts in stock market returns of two Mediterranean countries, Turkey and Greece. Their findings provide evidence of time varying return dependence and volatility regime linkages between Balkan and developed stock markets. Kouki (2012) showed that the stock markets of Eastern and Southern Mediterranean are partially integrated with European stock markets but not well integrated amongst themselves or with the European markets, while the Turkish and Moroccan market have a good interaction with the European stock markets. Moreover, he showed that stock markets become more volatile following financial integration but these tend to stabilize over time. Chkili and Nguyen (2011) used the Markov regime-switching model to investigate the volatility behaviour of six Mediterranean stock markets (France, Spain, Greece, Egypt, Tunisia, and Turkey) over the turbulent period between 1995 and 2010. Their results show strong evidence of regime shifts in each of these markets. They also find that the Mediterranean developed markets are less affected by international market events such as Asian and Russian financial crisis than emerging markets.

3 Data and Preliminary Analysis

This study investigates daily data of stock index futures markets of Italy (MIB30), France (CAC40), Spain (IBEX), Greece (ASE20) and Turkey (BIST30) for the period

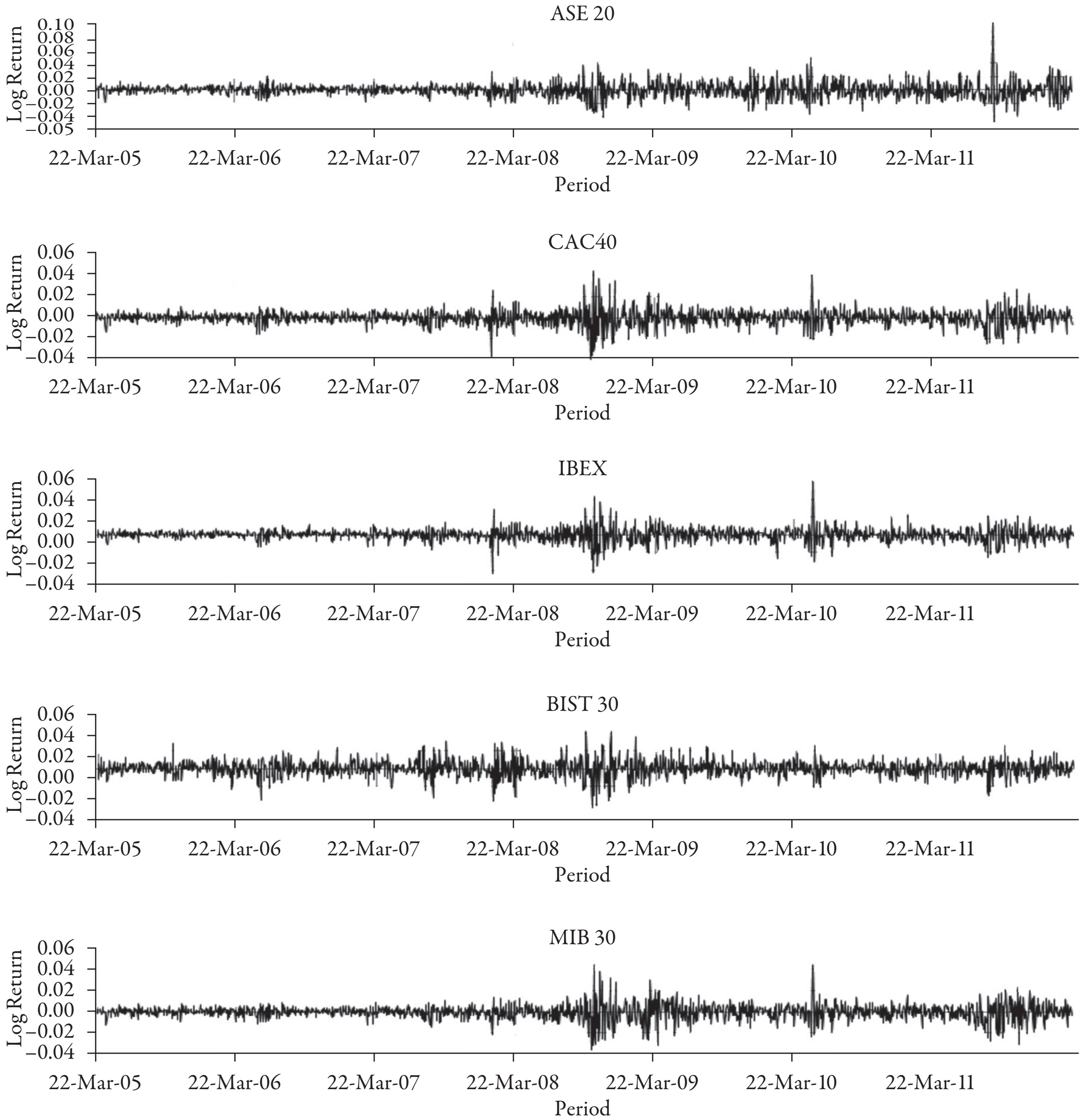

Figure 1: Logarithmic Return Values of Stock Index Futures Markets.

from March 21, 2005 to March 21, 2012. Logarithmic return values were calculated using the following formula:

$$r_t = \ln(P_t/P_{t-1})$$

While P_t represents the end of day closing values, P_{t-1} represents the one day prior closing values. This analysis was carried out in the E-views 5.1 programme.

The logarithmic return values of stock index futures markets of MIB30, CAC40, IBEX, ASE20 and BIST30 during the period March 21, 2005 to March 21, 2012 are depicted in Figure 1.

From the graphs, one can observe that high volatilities occur at similar times for all indexes. BIST30 and ASE20 appear to be more volatile, while the MIB30 is more simi-

Table 1: Descriptive Statistics

Statistic	MIB30	CAC40	IBEX	ASE20	BIST30
Mean	−0.000153	−3.28E-05	−1.97E-05	−0.000397	0.000204
Median	0.000221	0.000194	0.000260	0.000000	0.000000
Maximum	0.044387	0.044365	0.059880	0.103288	0.041940
Minimum	−0.035870	−0.038310	−0.044330	−0.053860	−0.043309
Std. Dev.	0.006940	0.006807	0.006972	0.010138	0.008661
Skewness	−0.200666	−0.088099	0.016610	0.514333	−0.098635
Kurtosis	8.24846	8.795052	10.66950	11.21336	5.695016
Jarque-Bera P-Value	0.000000	0.000000	0.000000	0.000000	0.000000

Table 2: Unit Root Tests

Series	ADF	PP
MIB30	−41.89581(0)***	−41.89480(3)***
CAC40	−44.07231(0)***	−44.36973(8)***
IBEX	−41.97032(0)***	−42.27859(21)***
ASE20	−32.08606(0)***	−42.67947(16)***
BIST30	−40.97937(0)***	−40.96081(16)***

Note: ***, ** and * indicate rejection of the null hypothesis of non-stationarity at the 1%, 5% and 10% levels respectively.
ADF test critical values: 1% level -3,433799, 5% level -2,862950, 10% level -2,567568.
The proper lag order for ADF test is chosen by considering Schwarz Information Criteria (SIC), represented in parenthesis. For PP tests, the bandwidth is chosen using Newey-West method and spectral estimation uses Bartlett kernel, represented in parenthesis.

lar to the CAC40 with respect to the volatility trends. Table 1 exhibits a summary of descriptive statistics relating to the variables of return.

Table 1 shows that while the IBEX and ASE20 series produced a positively skewed distribution, other series produced a negatively skewed distribution. Moreover, the kurtosis parameters have values which are greater than three and the significant Jarque-Bera statistics of series indicate a significant departure from normality, rejecting the null hypothesis of a symmetric distribution.

When the data is not stationary, the result of the regression analysis does not reflect the real relationship (Gujarati, 2009). To test the null hypothesis of the non-stationarity of the return series, the Augmented Dickey-Fuller (ADF) and the Phillips-Perron (PP) unit root tests were employed. Table 2 exhibits the results of both the ADF and PP tests. Both these tests rejected the null hypothesis of non-stationarity (p = 0.01) and hence, it could be concluded that the five series are all stationary.

4 Method

4.1 Conditional Volatility

The ARCH model developed by Engle (1982) is used to better understand the dynamic property of the financial assets and to estimate the time-varying variance. In most of the ARCH models applications, lags must be quite large in order to identify the conditional variance equation. In this regard, Bollerslev (1986) developed the generalized ARCH model (GARCH) which has a more flexible lag structure than the ARCH model.

In GARCH models, the volatility is thought of as «conditional variance». It depends on the lagged values of the squares of the error terms and on the values of its own lagged values (Johnston and Scott, 2000). The conditional variance of the GARCH (p,q) process is specified as follows (Enders, 1995): In GARCH models, as in the case of ARCH models, there are some restrictions on the parameters. In GARCH models q > 0, p ≥ 0, $\alpha_0 > 0$, $\alpha_i \geq 0$ ($i = 1,2,3,\ldots,q$) and $\beta_i \geq 0$ ($i = 1,2,3,\ldots,p$) conditions should be provided.

In addition to these constraints, the sum of the α_i and β_i parameters should be smaller than «1». Meeting these constraints suggests that the process has a stable structure. If the sum of the α_i and β_i parameters is greater than or equal to 1, it would not be possible to estimate the volatility statistically (Engle, 2001).

In the GARCH(p,q) model, «p» is the order for the autoregressive term and «q» is the order for the moving average term; «p» lags for the autoregressive term and «q» lags for the moving average term.

4.2 Causal Relationships

Granger (1969) developed a methodology to examine whether changes in one series cause changes to another. If the current value of *Y* can be predicted by using the past values of *X* and considering other relevant information including past values of *Y*, it may be concluded that *X* Granger-causes *Y*. Similarly, if the current values of *X* can be predicted by considering past values of *Y* and past values of *X*, it is concluded *Y* Granger-causes *X*. The following two ordinary least squares regressions used in the Granger causality test explain the above concept (Gujarati, 2009):

$$Y_t = \alpha_0 + \sum_{i=1}^{m} \alpha_i Y_{t-1} + \sum_{j=1}^{m} \beta_j X_{t-j} + u_{1t}$$

$$X_t = \alpha_0 + \sum_{i=1}^{m} \lambda_i X_{t-1} + \sum_{j=1}^{m} \delta_j Y_{t-j} + u_{2t}$$

X and *Y* are the stationary variables, m is the lag length for *X* and *Y*, while u_{1t} and u_{2t} are the random error terms. H_0 in the Granger causality test is that *X* does not Granger-cause *Y*, which is represented by:

$$H_0 = \beta_1 = \beta_2 = \ldots = 0$$

The alternative hypothesis is represented as follows:

$$H1 = \beta_j \neq 0 \text{ for at least one } j.$$

If the null hypothesis is rejected, it can be concluded that $\beta_j \neq 0$ for at least one *j*. This means *X* Granger-causes *Y* and hence there is Granger causality.

5 Empirical Findings

After determining that the return series was stationary, the ARCH-LM (ARCH, Lagrange Multiple) test was applied to test the existence of an ARCH effect in the series.

Table 3: Test Results of GARCH

	MIB30 GARCH(1,1)	CAC40 GARCH(2,1)	IBEX GARCH(1,1)	ASE20 GARCH(2,1)	BIST30 GARCH(1,1)
C	3.92E-07***	9.39E-07***	6.06E-07***	2.49E-07**	1.70E-06***
α_1	0.091821***	0.014303***	0.128061***	0.035599**	0.075739***
α_2	–	0.119481***	–	0.056920***	–
β_1	0.900361***	0.847118***	0.866650***	0.913763***	0.901814***
AIC	–7.563078	–7.523225	–7.483024	–6.705553	–6.817710
SIBC	–7.553885	–7.510957	–7.473831	–6.693296	–6.808509
Log likelihood	6779.518	6737.286	6707.790	6012.175	6104.850

Note: ***, and ** and * indicate rejection of the null hypothesis of non-stationarity at the 1%, 5% and 10% levels of significance respectively.

The first step in the ARCH-LM test is to decide on the conditional mean equation. Since it is intended to conform to the parsimony, the ARMA(p,q), was estimated using time series models based on Box-Jenkins methodology. In determining the conditional mean equation, we tested the ARMA (3,3) models, as recommended by Kanalıcı Akay and Nargeleçekenler (2006). ARMA models were evaluated according to the criteria of the coefficient of determination (R^2), the Akaike Information Criterion (AIC), the Schwarz Bayesian Information Criterion (SBIC) and the Likelihood Ratio (LR).

This investigation revealed that the most appropriate models for the MIB30, CAC40, IBEX, ASE20 and BIST30 series were the ARMA (1,3), ARMA (3,3), ARMA (1,3), ARMA (1,3) and ARMA (3,3) models respectively. Residuals (error terms) of the conditional mean equation are used in the determination of the volatile structure of financial return series. Therefore, in order to find out whether there is an ARCH effect, the ARCH-LM test was applied to the residual of the conditional mean equation.

As a result of ARCH-LM testing, the presence of ARCH effects in all the return series was identified. Therefore, ARCH-GARCH-type modelling was adopted for the disappearance of the ARCH effect. ARCH and GARCH models were tested for all return series. The most appropriate models for the series were chosen on the basis of the AIC, SBIC and Log Likelihood criteria.

As indicated by Table 3, the most appropriate models for the MIB30, CAC40, IBEX, ASE20 and BIST30 series according to AIC, SBIC and Log likelihood criteria were the GARCH (1,1), GARCH (2,1), GARCH (1,1), GARCH (2,1) and GARCH (1,1) models respectively.

The ARCH LM test was applied on GARCH residuals in order to test whether an ARCH series was obtained in these models and it was determined that the whole series of ARCH effects disappeared. After applying GARCH models, the GARCH residual series were used as a measure of the volatility in our series. ADF and PP unit root tests were applied to check the stationarity of the return volatility residual series. ADF and PP unit root test results are exhibited in Table 4.

Table 4 shows that the volatility series are stationary. The Granger causality test was applied to investigate the relationship between the return volatility of futures markets. The most important condition established by the Granger causality model is an accurate estimate of the lag length. Within the framework of a VAR model, the proper lag order for the Granger causality test, after considering the Schwarz information criteria (SIC), was fixed at 3.

Table 4: Unit Root Tests

Series	ADF	PP
MIB30 Volatility (MIB30V)	−4.375985(12)***	−4.661699(10)***
CAC40 Volatility (CAC40V)	−5.037947(0)***	−5.138477(2)***
IBEX Volatility (IBEXV)	−6.141515(4)***	−5.716858(1)***
ASE20 Volatility (ASE20V)	−5.161605(4)***	−5.205432(10)***
BIST30 Volatility (BIST30V)	−4.616654(0)***	−4.704457(14)***

Note: ***, ** and * indicate rejection of the null hypothesis of non-stationarity at the 1%, 5% and 10% levels of significance respectively.
ADF test critical values: 1% level -3,433807, 5% level -2,862954, 10% level -2,567570.
The proper lag order for ADF test is chosen by considering Schwarz Information Criteria (SIC), represented in parenthesis. For PP tests, the bandwidth is chosen using Newey-West method and spectral estimation uses Bartlett kernel, represented in parenthesis.

Table 5: Results of VAR Granger Causality Tests

Variables	Direction Of Causality	F Statistic	p-value
CAC40V-ASE20V	→	20.1773***	7.E-13
ASE20V-CAC40V		11.5307***	2.E-07
IBEXV-ASE20V	→	34.3251***	1.E-21
ASE20V-IBEXV		3.55379**	0.0139
BIST30V-ASE20V	→	8.51278***	1.E-05
ASE20V-BIST30V		1.53281	0.2041
MIB30V-ASE20V	→	26.1240***	2.E-16
ASE20V-MIB30V		16.2150***	2.E-10
IBEXV-CAC40V	→	1095.60***	0.0000
CAC40V-IBEXV		7.16124***	9.E-05
BIST 30V-CAC40V	→	130.521***	2.E-76
CAC40V-BIST30V		9.27992***	4.E-06
MIB30V-CAC40V	→	30.3555***	4.E-19
CAC40V-MIB30V		40.3329***	3.E-25
BIST 30V-IBEXV	→	0.33681	0.7987
IBEXV- BIST30V		7.56264***	5.E-05
MIB30V-IBEXV	→	4.45304***	0.0040
IBEXV-MIB30V		891.500***	0.0000
MIB30V- BIST30V	→	5.89174***	0.0005
BIST30V-MIB30V		63.5320***	5.E-39

Note: ***, ** and * indicate rejection of the null hypothesis of non-stationarity at the 1%, 5% and 10% levels of significance respectively
→ Denotes the causality.
The proper lag order for Granger causality test was fixed at 3, after considering Schwarz Information Criteria (SIC),

Table 5 shows the results of the Granger causality test between the return volatility of future markets in Spain, France, Italy, Greece and Turkey.

Results of the analysis show that there is a bidirectional causality relationship between the following futures markets: *a*) CAC40 and ASE20, *b*) IBEX and ASE20, *c*) MIB30 and ASE20, *d*) IBEX and CAC40, *e*) BIST30 and CAC40, *f*) MIB30 and CAC40, *g*) MIB30 and IBEX, and *h*) MIB30 and BIST30. In addition, the analysis shows there is a unidirectional causality relationship between the BIST30 and ASE20, and the IBEX and BIST30 futures markets. The direction of causality between Turkey and Greece futures markets is from Turkey futures market to Greece futures market. Besides this, the direction of causality between Turkey and Spain futures markets is from Spain to Turkey.

6 Conclusion

This study set out to investigate causality effects in return volatility across five futures markets with a Mediterranean connection – namely, Italy (MIB30), France (CAC40),

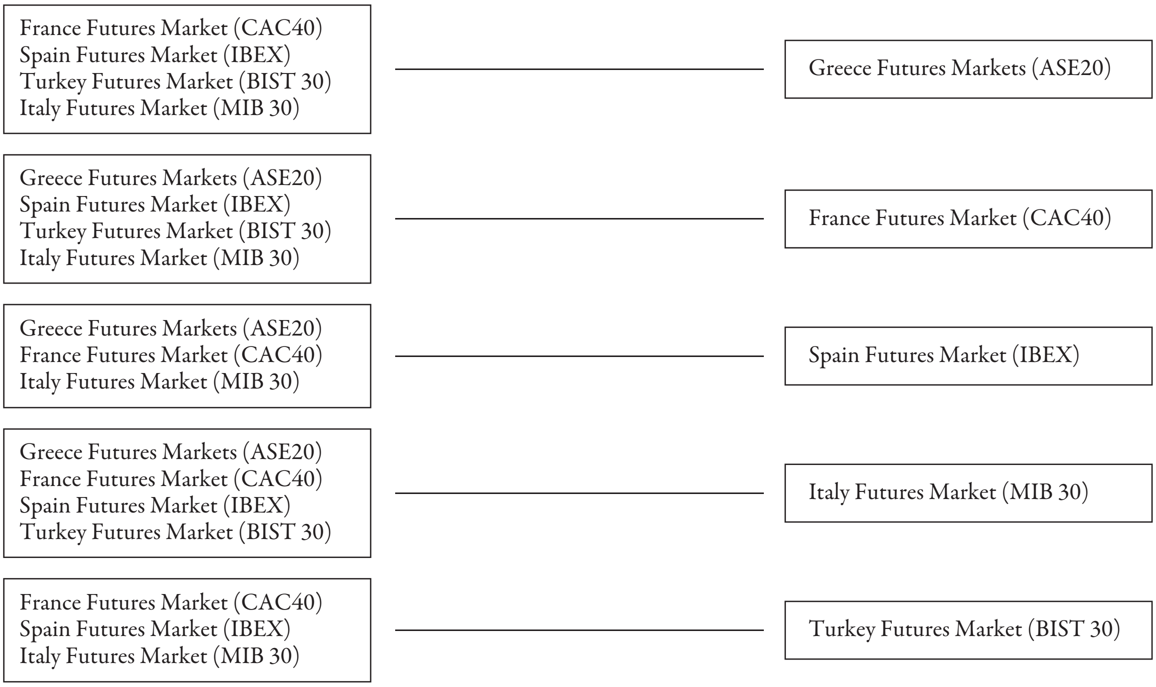

Figure 2: Summary of Causality effects in Return Volatility among five Futures Markets.

Spain (IBEX), Greece (ASE20) and Turkey (BIST30) – using daily data for the period March 21, 2005 to March 21, 2012. A summary of the major findings that emerged from this study are exhibited in Figure 2.

The study provides empirical evidence that the Granger bidirectional causality systematically holds with only two exceptions which involve the Turkish stock index futures returns. These results may be explained by the fact that the stock markets of the Eurozone countries are highly integrated and that they react similarly to financial and monetary shocks. The findings also suggest that Turkish financial policy makers and investors need not give much importance to the market linkages with Mediterranean countries in the Eurozone. However, such findings warrant further investigation. For instance, could it be that the lack of Granger bi-directional causality could be explained by the one hour difference in time zone between Turkey and three (France, Spain and Italy) of four Eurozone countries investigated? Additionally, what is the impact of the current political tension between Turkey and Greece on the research findings of this study? Further research is required before any strong conclusions may be drawn to explain these phenomena.

There are some limitations to the findings that should be noted. First, the data spans two momentous financial crises which may cause regime shifts in the return data generation processes. This could be investigated in future research by determining whether the same results would emerge if the data set is divided into sub periods. Second, this study revealed that the conditional second moment of returns are highly interrelated. Further investigation could determine whether the use of a multivariate GARCH approach[2]

[2] Multivariate GARCH models extend univariate GARCH models since they also specify equations for how the covariances move over time (Brooks, 2008). Some traditional multivariate GARCH formulations include VECH, BEKK, Factor GARCH, Orthogonal Factor GARCH and CCC (see Bauwens *et al.*, 2006) while more recent

rather than univariate GARCH parameterizations would have been more informative and efficient. Thirdly, this study does not investigate spillover from major future markets outside the Mediterranean. Studies could be conducted to determine whether the five markets investigated in this study react similarly to events/shocks/news from other major markets or whether they react differently and what impact this would have on portfolio composition or portfolio alignment.

To conclude, the findings of this study provide useful information that could help financial policy makers in better understanding inter-relations and volatility causality among these five Mediterranean futures markets and to better diversify their international portfolio. It could also better guide them in their quest to maintain or regain stability in their financial system.

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