Hedge Funds and the Eurocrisis: did they play any role?

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Abstract

In this paper we expose the misuse of bond yield spread as a unit of measurement for the past European debt crisis. We use Cointegration Analysis to dispel the idea that the crisis was caused by indiscriminate investments and speculation from hedge funds.

As a result, we uncover a long-term equilibrium among the price of gold, the Italian 10-year bond yield, retail sales and inflation, along with the 10-year bond yield in Greece. Once this relation is disturbed by some stochastic trends, each variable takes a while to restore to it. Finally, we provide the speed of adjustment of each variable to the long-run equilibrium.

Keywords: Financial crises, European Monetary Union, Hedge funds, Sovereign debt.

JEL classification: C3, D53, E44, F65, G01, G23, H63

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Introduction

The Euro crisis is a widely used term for the sovereign debt crisis which has spread among the southern European countries since late 2009 and has impacted on the Eurozone as a whole. The Euro has reacted to the turmoil occurred in the sovereign debt market with a strong decrease against dollar and one of the reasons has been the fear for debt monetization by the European Institution and the subsequent inflationary pressures in the Emu (Pagano, 2010).

We want to investigate the possible role that hedge funds have played in the process. The starting point of our analysis seems unusual, since it involves the public statement by Chancellor Angela Merkel, which has claimed since 2010 that Euro crisis was a consequence of indiscriminate and unregulated investments[1] held by hedge funds.

Looking back at the previous literature, in 1997 Prime Minister Mohamad Mahatir blamed speculators in the currency markets for the crash of the Malaysian Ringgit and subsequently Brown, Goetzmann and Park (2000) published a paper, with the purpose of contesting the Prime Minister public statement. The authors provided evidence that, although the sampled hedge funds had strong long and short exposures to the Asian and to other currency markets, those positions did not influence the fluctuations in the exchange rate; hence, they excluded the hypothesis that the speculative activities held by hedge funds had played any relevant role in the Asian Crisis.

We want to study the relation between hedge fund performances and the crisis of the European sovereign debt. To do so, we are using monthly hedge fund returns for a specific class of investment strategies, 10-year government bond yields of some of the most indebted countries in the European Monetary Union and a sample of macroeconomic data. We prefer to analyze bond yields for each government, rather than calculating the spreads of those with the German bond yields. In fact, we believe that the importance of the spread has been overestimated by the media and that this is also misleading in the scientific research. The spread is the difference between each government 10-year bond yield and the German 10-year bond yield: while the Portuguese, Greek, Italian and Spanish long -term interest rates have increased during the crisis (even though at different periods in time and for different reasons), the German 10-year bond yield has mostly followed a downward trend and has benefited from the increase of bond yields in the southern countries.

The challenge of this research was to find monthly data about hedge funds strategies and portfolio management, in order to understand how hedging on the European currency and fundamentals has changed in size during the time. Our intuition is that hedge funds did not play any crucial role in the crisis of sovereign debt and they did not contribute to increase the southern economies bond yields.

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[1] Reuters, May 6th, 2010 (Reporting by Sabine Siebold, writing by Dave Graham) "Merkel sais lack of Hedge Fund regulation a scandal". Die Handelsblatt, February 2nd, 2010 (von Sven Afhüppe und Michael Maisch) "Schäuble erwägt direkte Hilfe für Griechenland". Bloomberg, February 22nd, 2010 (By Patrick Donahue)," Merkel Slams Euro Speculation, Warns of 'Resentment".

In order to test our hypothesis, we have chosen to focus on the Italian bond yield from 2002 to 2012 and we have built a cointegration model, which aims at detecting the long-run equilibrium between the Italian yield and a list of other variables. As expected, our results do not assign any role to the hedge funds, neither on the long, nor on the short run.

The rest of this article proceeds as follows. Section I explores the previous research on hedge funds, with a focus on the analysis of their returns and on the influences that these investors have produced on the past financial crises. Section II includes the literature on the determinants of high yields and rising spreads, especially amongst the European countries, and provides some contributions about the sovereign default. Section III describes the empirical strategy chosen to conduct our research. Section III.I describes the data; section III.II establishes a preliminary assessment of the model; Section III.III mentions the endogeneity involved and suggests a solution. Section IV.I describes the empirical methodology and includes some theory about Vector Error Correction Models, section IV.II provides the results. Chapter IV concludes.

I. The literature about hedge funds

The definition we will use for Hedge Funds is the one adopted by Eurekahedge database: "Hedge funds are investment vehicles that explicitly pursue absolute returns on their underlying investments[2]". They hedge market risks through their trading strategies, which are often recognizable by absolute return objectives and short-selling tactics[3]. The manager of a hedge fund invests a prominent part of her personal assets in the fund itself. This aims at preventing the managers from taking excessive risks. The attention to hedge funds industry has dramatically increased since the collapse of Long Term Capital Management[4], occurred in 1998 (Fung, Hsieh 1999), which has required the prompt intervention of the Fed, in order to avoid a systemic crisis. Since then, hedge funds have been trading in more sophisticated instruments; a sizable number of those funds has shut down (especially after the financial crisis of 2008) and many have turned into funds of funds.

The literature on hedge funds is growing fast and involves many fields of the financial research. Park (1995), Fung and Hsieh (1997b, 2000, 2009), Liang (2000, 2001), Amin and Kat (2003), Malkiel and Saha (2005), and Lo (2010) present empirical evidence that hedge fund databases contain survivorship, backfilling and selection biases. Hedge fund managers have discretion whether to include the fund's information in a database or not. From the one hand, hedge fund managers could be concerned about

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[2] Eurekahedge, Glossary. www.eurekahedge.com

[3] Eureka Hedge Fund Key Factors, Glossary.

[4] Long Term Capital Management, managed since 1994 by John Meriwether and by a think tank including the two Nobel awarded in Economics Myron Scholes and Robert Merton, was a successful hedge fund, with investors earning two-digit returns until 1997. In 1998, following the default of Russia on its debt, LCTM's capital fell by 3.5 billion dollars. Several private financial institutions (supervised by the Federal Reserve Bank of New York) rescued LCTM by injecting 3,65 billion dollars into the fund (Stulz 2008).

showing their actual performances. On the other hand, the inclusion in a database is the most common way of advertising the fund itself and to attract potential investors (Fung and Hsieh, 2006).

Edwards and Caglayan (2001) Malkiel and Saha (2005), Viebig and Poddig (2010) follow the previous research about backfilling conducted by Park (1995) and claim that hedge fund are almost compelled to report excessive returns, in order to survive and attract new capitals. Furthermore, hedge funds report small gains more often than small losses (Bollen and Pool, 2009). Baquero, Horst, and Verbeek (2004) estimate liquidation probabilities of hedge funds and show that those are greatly dependent on past performances, on investment styles and on the fund's size, with surviving funds outperforming non-surviving funds by approximately 2.1% per year.

Edwards and Gaon (2003) identify almost 21 different investment strategies used by hedge funds and organize those, according to the type of security (equity or fixed-income) the fund usually invests on and the type of portfolio position (long or short) it totally holds. In particular about Global/Macro strategies, Fung and Hsieh (1997a) claim that those are used by the managers who primarily trade in the most liquid markets, such as currencies and government bonds; those managers typically bet on macroeconomic events such as changes in the interest rate policies or currency devaluations and mostly rely on their assessments about the economic fundamentals. Edwards and Gaon (2003) claim that hedge funds managers who use a Macro strategy hold either long or short positions, in order to bet on the future direction of equities, fixed income, or currency markets, both in the US and in the foreign markets. As such, those funds are particularly exposed to systematic risk. The authors remind that macro strategy consists in "taking leveraged bets on anticipated price movements of stock markets, interest rates, foreign exchange and physical commodities". Based upon the HFR database[5] definition, "macro activities" occur when investment managers trade using a broad range of strategies, in which the investment process is predicated on movements in the underlying economic variables and these have an impact on equity, fixed income, hard currency and commodity markets. For Asness, Krail and Liew (2001) Global Macro managers carry long and short positions in any of the world's major capital or derivative markets. These positions reflect their views on the overall market direction as it is influenced by major economic trends and/or events. The portfolios of these funds can include stocks, bonds, currencies, and commodities in the form of cash or derivatives instruments. The Fixed-Income High Yield Strategy, as depicted by Edwards and Gaon (2003), consists in betting on noninvestment-grade debt. The fixed income arbitrageur profits from price anomalies between related interest rate securities. This category includes arbitrage operations on interest rate swap, government bonds (especially on the non-investment grade), forward yield curve, mortgage-backed securities and credit default swaps.

Several authors provide evidence for hedge fund returns serial correlation. Among those, Getmansky, Lo and Makarov (2003) claim that in most cases, serial correlation in hedge fund returns is due to illiquid securities which are contained in the fund, such as securities that are not actively traded and for which market prices are not always readily available. In such cases, the reported returns of funds

[5] www.hedgefundresearch.com

containing illiquid securities will appear to be smoother than the "true economic returns"[6] and this, in turn, will impart a downward bias on the estimated return variance and yield positive serial return correlation. They find other sources of serial correlation in asset returns. That can result from market inefficiencies, from time-varying expected returns, time-varying leverage or from incentive fees with high-water marks[7]. Bollen and Pool (2008) claim that funds which have been investigated for fraud by the SEC usually show higher conditional serial correlations than the others.

Fung and Hsieh (1997a) and Schneeweis and Spurgin (1998) find that the returns of hedge funds have low correlation to standard asset indices. Li and Kazemi (2007) test correlation results between hedge fund returns and returns on stock and bond indexes, both in up and down markets. Using the symmetry tests documented in Ang and Chen (2002) and Hong et al. (2007), they formally test for asymmetry using monthly returns on CISDM[8] hedge fund indices during the period January 1990 to January 2006. They find that correlations between hedge fund returns and market returns are symmetric in rising and falling markets and conclude that there is no empirical evidence in support for contagion between hedge funds and traditional asset classes.

Boyson et al. (2008) analyze the possible contagion between different hedge fund styles. They find that extreme adverse movements in one hedge fund style index are contagious to the others and that performances in the currency market worsen when contagion within the hedge fund sector is high. Nevertheless, contagion within the hedge fund sector does not seem to impact on performances in the stock and bond markets.

Asness et al. (2001) show that on average hedge funds exhibit positive exposures to equity markets returns both in bull and in bear markets. Fung and Hsieh (2004a), Agarwal and Naik (2004), Brunnermeier and Nagel (2004), Capocci and Hübner (2004), and Kuenzi and Shi (2007) also present empirical evidence that diversified portfolios of hedge funds exhibit positive factor exposures to traditional asset classes.

Viebig and Podding (2010) conduct apply Vector Autoregressive (VAR) models, and confirm that a contagion effect exists between equity markets and several hedge fund strategies. They also find that on average hedge funds have suffered large losses in periods of equity markets distress and especially during the Financial Crisis in 2007-2009, as a result for increased contagion effect from the equity markets. Nevertheless, the impact of financial crises on hedge funds varies substantially across hedge fund styles and so does the dependence relation between equity and hedge fund returns.

Fung and Hsieh (2004a) and Fung et al. (2008) choose September 1998 and March 2000, which are usually associated with the LTCM crisis and the peak of the Internet Bubble, as two structural breaking points for hedge fund models.

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[6] The authors define the "true economic returns" as "the returns that fully reflect all available market information concerning those securities"

[7] A water mark is the highest performance that a hedge fund manager has reached and is used as a benchmark to calculate her compensation.

[8] Center for International Securities and Derivatives Markets http://www.isenberg.umass.edu/cisdm/hedge_fundcta_indices/

Khandani and Lo (2007) find an increased correlation among hedge fund styles during crisis periods. Brunneimeier (2009) claims that hedge funds are vulnerable during financial crises, when market liquidity and hence funding opportunities evaporate. He adds that hedge funds could be impacted by financial crises through many mechanisms: by direct exposure, by funding or market liquidity, by loss and margin spirals, by runs on hedge funds or by aversion to Knightian[9] uncertainty.

Chan, Lo et al. (2005) state that investors might be mostly attracted by the relative uncorrelation between hedge fund returns and market indexes such as the S&P 500. By the way, this feature is seldom reversed, especially during market crashes or financial crises. For instance, that happened during the summer 1998, with the default of Russian government triggering a global "flight to quality", which changed many of those correlations overnight from 0 to 1, as a result for the "phase-locking behavior".

On the other hand, the role of hedge funds on the financial crises has been controversial over the last years. The literature provides several opinions about the topic. Brown, Goetzmann, and Park (2000) do not find any evidence that hedge fund managers have caused the Asian currency in 1997. Notwithstanding the both positive and negative exposure of hedge funds to Asian currencies before the crisis, this exposure has not shown any relations with the moves in exchange rates. They support the idea that the global markets can "absorb" consistent dollar positions put on by major currency funds, without suffering dramatic effects. Some authors have tried to assign a role to hedge funds in the different financial crises. Chan et al. (2006) develop a number of new risk measures about hedge fund investments and apply them to individual and aggregate hedge fund returns data, in order to quantify the potential impact of hedge funds on systemic risk. They find that innovations in the banking industry have coincided with the rapid growth of hedge funds. Brunneimer and Nagel (2004) analyze hedge fund stock holdings during the Dot-com Bubble occurred between 1998 and 2000. Their main findings are that neither hedge funds did exert any correcting actions, neither they were attacking the bubble itself. The authors consider hedge funds as some of the most sophisticated investors, probably the closest to the ideal of "rational arbitrageurs"; in their opinion hedge funds partially predicted the investor sentiment that was behind the wild fluctuations in valuations of technology stocks at the time and were exploiting that opportunity, by riding the bubble indeed. In fact, as soon as hedge funds understood that prices would eventually deflate, they reduced their technology stock holdings before those prices collapsed.

Brown et al. (1998) claim that part of the negative public perception of the role of hedge funds managers in Asia results from the very limited information available about their actual activity. Their study is particularly useful to our analysis, as they focus on the managers who adopt Global Macro strategies. The authors simplify the Sharpe (1992) procedure, in order to test for the covariance of hedge fund returns with exchange rate changes. Also, in order to test for the hypothesis that market manipulation was undertaken for profit, they regress the monthly percentage variation in the exchange rate on the hedge funds currency exposure. The authors also use a four-months window rolling

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[9] In the Economic jargon, Knightian uncertainty is unmeasurable risk.

correlation to show how, rather than hastening the crisis, hedge funds were unwinding their negative positions, by supplying liquidity to a rapidly falling market. In their opinion, hedge funds had no role in the volatility of the exchange rate, apart from cushioning the falling Ringgit. The authors claim that short sales of a currency, even if made by a big fund, could change its value only for a short period, such as one day. No evidence was provided that the hedge fund managers affected the Ringgit. They show that even during the most critical period of the Asian crisis (the Crash, occurred between June and October 1997) the fund returns were very volatile, showing both positive and negative values. Whether the hypothesis of an impact of hedge fund speculation on the Ringgit exchange rate vas valid, one would expect the hedge funds involved to register interesting profits. This did not happen.

Billio et al. (2012) apply principal-components analysis and Granger-causality tests to the monthly returns of hedge funds, banks, broker/dealers, and insurance companies. They find an increased interrelation among the four sectors over the last decade, with a likely higher systemic risk within those and with banks playing a much more important role in transmitting shocks than the other financial institutions.

II. Government Bond Yields, the Spreads and Default Risk

The financial literature has been investigating the government bond yield spread determinants starting from the Nineties. Alesina et al. (1992) assert that sovereign debt becomes riskier during periods of economic slowdown (see also Bernoth et al., 2004).

Favero et al. (1997) use interest rate swaps to measure two components of total yield differentials: the exchange rate factor, which is due to expectations of exchange rate depreciation, the market assessment of default risk and the different taxation of long-term yields.

Barrios et al. (2009) claim that credit risk[10], liquidity risk and risk aversion are the most common factors for high government bond yields.

Investors general risk aversion is considered by Bernoth, Von Hagen, Schucknecht (2004), Heppke-Falk and Huefner (2004). Beber et al (2006) analyze bond valuation and distinguish between normal times, where credit risk matters and times of financial distress, where liquidity gains a larger role. Bernoth et al. (2006), Haugh et al. (2009) underline the difference in market liquidity and the role for credit risk, measured by CDS spreads (ECB 2009a); Codogno, Favero, Missale (2003) state that international risk factors play a major role for high debt-to-gdp countries, together with liquidity and default risk. Favero, Pagano, Von Thadden, (2010) focus on the interaction between liquidity costs and aggregate risk: liquidity variables do not significantly impact on bond returns when considered in

[10] Credit Risk is the difference in creditworthiness, which is the risk that the Issuer fails to meet her own obligations. Liquidity Risk is the different ability of a Bond to be converted into cash quickly and without any price discount. Risk Aversion is the willingness of Investors to have Risk. This Risk aversion reflects the Price of the Risk itself (Barrios et al.).

isolation and the interaction of liquidity differentials with the risk factor is always negative, when significant.

Klepsch and Wollmershäuser (2011) investigate the interaction of risk aversion and credit risk, leaving liquidity risk aside, as it was considered irrelevant both prior and during the crisis. They point out a decrease in the differentials of 10-year EMU government bond yields after the introduction of the Euro in 1999 and a subsequent increase in 2007, with the beginning of the Subprime Crisis. Duffie, Pedersen, and Singleton (2003) show that both credit and liquidity concerns are critical components of bond yield spreads. Gonzales - Rozada and Levy Yeyati (2008) find that in addition to risk appetite, global liquidity and contagion from systemic events play a central role, especially in the emerging markets. On the same line, De Santis (2012) and Afonso et al. (2012) find that liquidity risk has played a role, mainly in the periphery economies during the later stages of the crisis.

While Manganelli and Wolswijk (2009) highlight a strong positive correlation between the short-term interest rates and the spreads, Caceres, Guzzo and Segoviano (2010) remind that this position doesn't account for endogeneity and has been overcome by the events occurred during the Subprime Crisis, when the spreads have kept widening, despite historically low interest rates. With the exception of lower rated, highly indebted countries, Caceres et al. (2010) depict a positive correlation between global risk aversion and swap spreads (with sovereign bond yields falling further below the swap yields after the increase of global risk aversion) and a Flight-to-Quality effect, with capitals shifting from risky securities to government bonds, which tend to do better than the swaps.

They also show that when public debt (expressed in percentage of GDP) rises or when the budget balances deteriorate, sovereign bond yields rise versus swap yields. Baldacci and Kumar (2010) find that in periods of financial distress, defined as periods of high levels of the VIX[11] index, high inflationary pressures, and more adverse global liquidity conditions, fiscal deterioration has a larger impact on bond yields.

Most studies about government bond yield spreads agree on the role of fiscal variables. For instance, Schucknecht et al. (2008) highlight the role of government debt and deficts, Sgherri and Zoli (2009) find that the sensitivity of government spreads to projected debt changes had significantly increased after September 2008. Based upon Barrios, Iversen et al. (2010), government debt has barely influenced government bond yields in Europe, with the exception of Ireland and Greece, which are considered as outsiders.

Barrios et al. (2010) point out that a combination of high risk aversion and large current account deficits have tended to increase the incidence of deteriorated public finances on the spreads.

For some authors such as Haugh, Ollivaud, Turner (2009) Barrios, Iversen et al. (2009) and Gerlach, Schulz, and Wolff (2010), this influence has increased if found in interaction with risk aversion.

Attinasi, Checherita and Nickel (2009) find that higher expected budget deficits and/or higher government debt ratios relative to Germany contributed to higher government bond yield spreads in

[11] VIX is the Volatility Index, Chicago Board Options Exchange (CBOE) Volatility Index, which shows the market's expectation of 30-day volatility. It is constructed using the implied volatilities of a wide range of S&P 500 index options and is widely used as a measure of market Risk.

the euro area during the crisis in 2007/2009. Furthermore, the announcements of bank rescue packages have led to a re-assessment of sovereign credit risk from the part of investors, with an increased transfer of risk from the private financial sector to the government.

A majority of studies finds that the effect of fiscal policy on interest rates is larger when the fiscal deficit[12] rather than public debt is included as an explanatory variable (Faini, 2006; Laubach, 2009). In addition, the effects of fiscal policy are larger when expectations of future fiscal policy rather than actual values are used and when single country studies rather than cross-country studies are performed. The estimated impact on interest rates of a change of one percent of GDP in the fiscal deficit ranges from 10 basis points to 60 basis points (Laubach, 2009). Reinhart and Rogoff (2009) claim that when debt ratios rise beyond a certain level, financial crises become both more likely and more severe. Baldacci and Kumar (2010) find that higher fiscal deficits and public debt raise long-term nominal bond yields in both advanced and emerging markets. They also find that countries with higher initial fiscal deficits and public debt experience larger increases in bond yields when the fiscal position deteriorates. Bernoth and Erdogan (2012) state that euro area spreads movements are linked to increased risk pricing. They also show that since the onset of the global financial crisis the market reactions to fiscal imbalances have increased considerably.

Attinasi et al. (2009b) claim that, together with credit, liquidity and international risk, the announcements of bank rescue packages have had some impacts on government bond yield spreads, by transferring the risk from the banking sector to the government.

Mody (2009) depicts the rescue of Bear Sterns in March 2008 as a turning point, with sovereign spreads widening after the worsening prospects of domestic financial sector.

Bolton and Jeanne (2011), and Gennaioli et al. (2014) show that in a number of countries (both advanced economies as well as emerging markets), banks hold significant amounts of public debt. Those authors stress the adverse effects that a sovereign default may have on the balance sheets of the domestic banking sector. Acharya et al. (2011) explain the crisis on the basis of a transfer of global financial risk to sovereign bonds through banking bailout schemes.

Mayer shows how bank credit risk may change the sovereign commitment to debt holders and discusses the relation between sovereign default costs due to banking sector fragility and other types of costs such as a decrease of foreign trade. The model predicts that a large financial sector affects sovereign risk in two ways: on the one hand, it lowers sovereign credit risk by committing the sovereign to servicing its debt. On the other hand, it raises sovereign risk by increasing the potential losses in the event of a banking crisis.

The quality of the financial system in terms of aggregate bank credit risk and the sovereign country's trade openness determine which one of the two effects dominates.

[12] Fiscal deficit happens when a government's total expenditures exceed the revenue that it generates (excluding money from borrowings). Public debt can refer to either 1) treasury securities held by institutions outside of the issuing country's government, or 2) total of government debt including intra-government obligations. Debt by governments are issued to compensate for a lack of tax revenues.

Mayer finds that in normal times a large financial sector is an asset to the sovereign. As soon as the risk of a banking crisis becomes imminent, this relation reverses. Furthermore the author predicts that a bank credit risk imposes a commitment effect on the sovereign, as an increased financial sector fragility makes the sovereign less inclined to default on its debt. In the same way, an increased amount of government bonds in the bank holdings raises the banking sector vulnerability with respect to sovereign default and commits the sovereign to repay bond holders. In his opinion, macroeconomic volatility also play a role.

The majority of early studies on the European debt crisis captures the structural instability in the relationship between spreads and their determinants by exogenously imposing some breakpoints on the data (those breakpoints are typically included between summer 2007 and autumn 2008), in order to disentangle a pre-crisis and a crisis period (see e.g. Barrios et al., 2009; Arghyrou and Kontonikas, 2012; Caggiano and Greco, 2012). More recent studies have provided evidence that structural instability is not restricted to a simple pre- versus post-crisis differentiation; it is a more complex process instead. In particular, Afonso et al. (2012) identify two breakingpoints, one in the summer 2007 and the other in the spring 2009.

Arghyrou and Kontonikas (2012) find that the set of financial and macro spreads determinants in the euro area is rather unstable but generally becomes richer and more significant as the crisis evolves. The authors claim that a significant heterogeneity exists across countries, especially about risk factors and their impact on national spreads.

Recent studies have investigated the impact of sovereign credit ratings on the EMU sovereign bond yields. Afonso et al. (2012) find notably significant responses of government bond yield spreads to changes in rating notations and outlook, especially in the case of negative announcements (notably, from Standard & Poor's, Moody's and Fitch). In addition, rating announcements in the so-called "event countries" impact sovereign yields in non-event countries when the latter have a better rating. Therefore, such spillover effects run from lower-rated to higher-rated countries. Similar findings are provided by Arezki et al. (2011) and De Santis (2012).

Arghyrou and Tsoukalas (2011) find the roots of the public debt crisis in the changing private expectations regarding the probability of default risk and/or the exit of a country from the Euro system (2011), leading to a shift in the market pricing behavior from a 'convergence-trade' model before August 2007, to a model driven by macro-fundamentals and international risk thereafter (Arghyrou and Kontonikas, 2012), to increased attention to fiscal developments (Afonso, 2010) and to contagion effects (De Santis, 2012).

Eichengreen and Mody (2000) show that changes in market sentiments influence the spreads. This thesis is also followed by De Grauwe at al. (2013). The authors claim that the surge in the Piigs yield spreads has been the result of negative market sentiments which have become very strong since the end of 2010. They also argue that the systematic mispricing of sovereign risk in the Eurozone has intensified macroeconomic instability, leading to bubbles in good years and excessive austerity in bad years.

Mohl and Sondermann (2013) find that the intensity of news agency reports (from Bloomberg, Dow Jones Newswire, Market News International and Reuters) for statements of European politicians about "restructuring", "bailout" and the "EFSF" has impacted bond spreads of the GIIPS vis-à-vis Germany between May 2010 and June 2011. In particular, statements from politicians from AAA-rated countries have had the strongest impact on the spreads. On the same topic, Beetsma et al. (2013) investigate how news affect domestic interest spreads in the Eurozone and how it has propagated to other countries during the recent crisis. More news in one of the GIIPS countries have led to an increased spread of the other GIIPS Countries. The magnitude of spillovers is strongly related to the size of the cross-border bank holdings and the spillovers between GIIPS countries are substantially larger than the spillovers from GIIPS to non-GIIPS.

Sinn and Wollmershäuser (2012) claim that the Euro crisis is a balance of payments crisis similar to the one occurred with the end of the Bretton Woods System. In their opinion TARGET[13], the European transaction settlement system through which the commercial banks of one country make payments to the commercial banks of another country, provide the most accurate signals of shocks that have been sent through the Eurozone during the global financial crisis.

Arghyrou and Kontonikas (2012) assess the determinants of long-term government bond yields in the Euro area, emphasizing their changing composition over the time. By employing a panel of monthly data for 10 Euro Area countries over the period from January 1999 to December 2010, they assess the role of an extended set of potential spread determinants, namely macroeconomic and expected fiscal fundamentals, international risk, crisis transmission risk, liquidity conditions and sovereign credit ratings. They distinguish three time periods. The first period precedes the global credit crunch (from January 1999 to July 2007); during the second one the global credit crunch has not mutated into a sovereign debt crisis yet (August 2007- February 2009). In the last period the global financial crisis has mutated into a sovereign debt crisis (from March 2009 to December 2010). The authors claim that European Yield Spreads are well explained by macroeconomic and financial factors and by the sovereign credit ratings.

The following literature underline the costs that the eventual sovereign default inflicts upon the financial system and is useful to our endogeneity considerations. In particular, Sturzenegger & Zettelmeyer (2007), Borensztein & Panizza (2009), and Panizza et al. (2009) suggest that sovereign defaults deepen economic crises through an exacerbated capital flight, the deterioration of domestic bank's balance sheets, collapsing investor confidence, increased legal risks and a higher likelihood of bank runs.

Borensztein & Panizza (2009) affirm that sovereign default increases the probability of a subsequent banking crisis.

[13] The acronym stands for *Trans-European Automated Real-Time Gross Settlement Express Transfer.* Target balances are claims and liabilities of the individual central banks of the Eurozone vis-à-vis the Eurosystem that are booked as such in the balance sheets of the NCBs. For each country, Target balances measure accumulated deficits and surpluses balance of payments with other euro countries.

A part of the literature investigates the default risk over various European countries by measuring the CDS Spreads. Among those, Beber, Brandt and Kavajecz (2009), Fontana and Schleicher (2010), Haizenman, Hutchinson, Jinjarak (2012). Nevertheless, we prefer to use southern economies 10-year bond yields, in order to compare homogeneous time-to-maturity instruments and to investigate the features for each one of those.

III. Empirical strategy

III.I. The dataset

In order to test whether the "unregulated" investments made by hedge funds have been one of the main causes for the so-called Euro crisis, we want to find a proxy for hedge funds performance in the Emu area. To do so, we take available hedge funds monthly returns from October 2002 to July 2012, sorted by primary and secondary strategies, by assets under management and by main geographical areas of investment. The data about returns are drawn from Eurekahedge, an up-to-date worldwide used database which company is based in Singapore.

We first weight these returns by the assets under management, as a proxy for the hedge fund size. We then analyze all the returns that hedge funds have earned from investments held in the EMU, focusing on the following strategies: Macro, Currency and Interest Rate Arbitrage, Fixed Income. According to the definitions provided by Fung and Hsieh (1997)[14], by Edward and Gaon[15] (2003) and by the Eureka Hedge Key Factors Section[16] the strategies above are the most significant and suitable to our case.

In order to proceed with our time series analysis, we calculate monthly averages for the aggregate hedge fund returns taken into consideration. Now we have one average return for each month, based on the subsample "returns from investments in the EMU", for the specific set of strategies we have taken into consideration. The dataset also contains funds of funds monthly returns, which we will not consider for the purpose of our analysis, since 81.73% of the funds of funds listed in our dataset use a multistrategy approach and we are only interested in a list of specific strategies.

We want to focus on the impact of the Euro crisis in Italy. Hence, we export the daily 10-year Italian bond yields (10 year Btp) from Trading Economics[17]. We also export the daily 10-year government

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[14] For further reference please see Section I.II.

[15] Edward and Gaon (2003) describe Macro Strategies as taking leveraged bets on anticipated price movements of Stock markets, Interest Rates, Foreign Exchange and physical Commodities

[16] Eureka Hedge describes Macro/Global as a top-down strategy that tracks and profits from global macro-economic directional shifts or changes in government policies. This, in turn, affects foreign currencies/economies, interest rates and commodities. Managers using this strategy are usually involved in all kinds of markets, such as equities, bonds, etc. The use of leverage (and derivatives, in particular) accentuates the impact of market movements on the fund performances.

[17] Trading Economics is an Economic and Financial database which company was founded in New York City in 2008

bond yields for Germany, Greece, Spain, Portugal from October 2002 to July 2012, from Monday through Friday.

Rather than calculating the Italian, Spanish, Greek, and Portuguese daily spreads, we prefer to work on the Government bond yields. Our impression is that the spreads are an artificial signal of a crisis and that they can be biased by the extraordinary low long-term interest rates that Germany has kept during the last few years.

In order to obtain monthly Italian government bond yields (and so forth for all the other countries), we calculate the geometric mean from the daily yields. This operation allows us to run a regression over the monthly hedge fund returns. We decide to exclude the Portuguese bond yields from our analysis, since at the time we drawn our daily time series this was missing a sizable number of observation.

We also use the data provided by Francese and Pace (2008) about the Italian public administration monthly gross nominal debt. The series is periodically updated by the authors. Furthermore, we export daily spot gold prices from Trading Economics[18] and calculate monthly values. As we are focusing on the possible impact of hedge funds on the Italian bond yield, we also add a series of Italian macroeconomic indicators. In particular, we find that monthly observations on Italian inflation rate and Italian retail sales year-on-year are useful to our analysis.

A first issue to face is the different currencies used to express prices. Most of our data are expressed in euros, hedge fund returns are all expressed into dollars. Hence, we convert all our data into euros.

Based upon the previous literature and on the observation of the major volatility involved, especially between the beginning of 2011 and the first half of 2012, we want to include monthly VIX[19] in our model, as a proxy for Global Market Default Risk[20]. The VIX is extensively used as an aggregate proxy for international risk in most studies on Euro-area government bond yield spreads (see e.g. Beber et al., 2009; Gerlach et al., 2010, Arghyrou and Kontonikas 2012). The Volatility Index basically serves as a Global Risk Factor (De Santis, 2012). From the Chicago Board Exchange website[21] we export daily VIX closing data, from October 2002 to July 2012. We then calculate a geometric mean for the daily VIX indices, in order to obtain one data for each month.

A second mismatch needs to be adjusted: hedge fund returns are monthly or be-weekly drawn, and mostly registered at the end of a monthly period. Also data about Italian public debt are monthly drawn, at the end of period as well. The government bond yields and the VIX index are the results of average monthly calculations from daily data. We are arbitrarily assigning those data to the end of the month.

[18] The data refer to the closing daily values for London Bullion Echange Market

[19] (log) change of the VIX index, which is based on the implied volatility of S&P 500 stock market index options.

[20] The CBOE Volatility Index® (VIX®) is a key indicator of market expectations of near-term volatility conveyed by S&P 500 stock index option prices. Since its introduction in 1993, VIX has been considered by many to be the world's premier barometer of investor sentiment and market volatility.
Originally introduced by Professor Robert Whaley in 1993, its method of calculation has been revised since 2003. It is now an up-to-the-minute market estimate of expected volatility and is calculated by using real-time S&P 500 Index (SPX) option bid/ask quotes. VIX uses near-term and next-term out-of-the money SPX options with at least 8 days left to expiration, and then weights them to yield a constant, 30-day measure of the expected volatility of the S&P 500 Index.

[21] http://www.cboe.com/micro/VIX/historical.aspx

III.II. The Model. Preliminary assessment

As we have several monthly data within the considered period (October 2002 – July 2012), we can now proceed with the time-series analysis.

The monthly return series is representative for hedge fund performances held within the EMU, mostly with the supposed intention of speculating on the currency, commodity and government bond yield markets. If the hypothesis that unregulated activities by hedge funds in the last decade have impacted the PIIGS spreads held, the higher the performances, the higher and positive should be the impact produced by hedge fund investments on the crisis. We support a different hypothesis, which is the lack of a substantial role for hedge funds in the Euro crisis.

Following Arghyrou and Kontonikas (2012):

$$\text{Spread}_t = \alpha + \beta_1 \text{Spread}_{t-1} + \beta_2 q_t + \beta_3 Vix_t + \mu_t \quad (1)$$

Where Spread_t is the 10-year government bond yield spread relative to Germany, q_t is the logarithm of the real effective exchange rate (where an increase denotes real appreciation) Vix_t denotes the logarithm of the Volatility Index on the Chicago Board Options Exchange and μ_t is a random error term[22]; we want to modify their equation and test the validity of the following:

$$\text{It\_geomean\_yield}_t = \alpha + \beta_1 \text{It\_geomean\_yield}_{t-1} + \beta_2 \text{geogreek\_yield}_t + \beta_2 \text{geospain\_yield}_t + \beta_3 Vix_t + + \beta_4 Gold_t + \beta_4 HF_{t-1} + \mu_t \quad (2)$$

where $\text{It\_geomean\_yield}_t$ denotes the monthly Italian 10-years Government Bond Yield (*Buono Poliennale del Tesoro*), geogreek_yield_t is the monthly Greek 10-year bond yield, HF_{t-1} is the lagged monthly return for hedge funds which adopted the relevant strategies, Vix_t is the monthly average from daily CBOE Volatility Index and μ_t is an error term.

For a number of reasons related to data trends and structure that we will better explain in the methodology section, neither of the two models are suitable to explain our phenomenon.

[22] Arghyrou M.G., Kontonikas, A. (2012). *The EMU sovereign debt crisis: Fundamentals, expectations and contagion*. Journal of International Financial Markets, Institutions and Money, vol. 22, no. 4, pp. 658-677.

In fact, some of our series show a stochastic trend and it wouldn't be possible to explain our dependent variable by using Ordinary Least Squares methods. Furthermore, whether we used a linear regression, our equation would need to include the lagged dependent variable.
Last, but not least, we have to consider the endogeneity involved by the inclusion of the Spanish, Greek and Italian Bond yields in the same equation. Those are the main reasons why we choose to use a Cointegrated model.

III.III. Endogeneity issues

Our identification strategy is quite simple.
Following Beetsma et al. (2013) we want to take into consideration any possible spillover effects within the PIIGS (which in the authors opinion are much more significant than the ones occurring between the PIIGS and the rest of the European countries). Those contagion effects might play a role into our analysis and create endogeneity problems. In fact, the lagged Btp yield that we want to consider as a dependent variable might endogenously impact on the Greek and on the Spanish long term interest rates.
In order to solve this identification problem, we first run Granger Causality Test on our dataset. Since we find some causalities, then we build a Vector Error Correction Model, which automatically solves the endogeneity biases.
Table 2 provides results for Granger causality test.

IV.I Empirical methodology: The model and programming description

a. <u>Autocorrelation</u>

After drawing the correlogram, we notice a persistent positive autocorrelation for Italian Bond Yield time series, for up to 12 months. This result is the first signal of a scarce adequacy of Linear regression with Ordinary Least Squares (OLS) methods to our model. In fact, by observing the Italian yield series, we assert that the lagged 10 year Btp yields cannot be excluded from our model. OLS methods are not consistent when used to estimate autoregressive time series with a lagged dependent variable.
As we could expect, also monthly gold price on the level I(0) shows a strong autocorrelation, which decreases but is still strong up to the twelfth month (rho= 0,668); it decreases to 0,38 after 24 months and to 0,151 after 36 months.

Autocorrelation for the Greek Yield is less persistent over the time and disappears after 6 months from the considered observation (rho decreases from 0,83 on the first month, down to 0,25 on the sixth month).
Autocorrelation for the Spanish yield is high on the first lag (0,898) and still persists on the 15th month (rho=0,17).
Table 3 provides autocorrelation results for Italian bond yield, up to 30 lags

b. Phillips - Perron Test

The next step is to run Phillips Perron test , in order to check for data stationarity.
While monthly Italian retail sales, hedge fund returns and Vix index are stationary on the levels, Italian, Greek, Spanish and German 10-year bond yields, together with Italian inflation rate and gold price show unit root and can be hence defined as a stochastic process featured by a random walk.
Now we have another reason to exclude the use of OLS estimators. In fact, even by calculating first order differences I(1) for our observations, we would risk to get a spurious regression (Granger e Newbold, 1974[23]) Furthermore, by differencing the dependent variables we might not get white noise errors.

c. Granger Causality Test

We decide to model our data by using Cointegration methods. In order to test for any causality involved and to check for eventual endogeneity issues, we need to fulfill a preliminary stage by running Granger Causality Test.
Granger and Engle (1987) claim that, if cointegration exists between two variables, then either unidirectional or bi-directional Granger causality has to exist between those two variables.
The test results provided on table 2 denote a multiple Granger causality between Italian, spanish and greek bond yields.
At this stage we interpret this double causality as a signal of endogeneity. The endogeneity issue will be solved by running Vector Error Correction model (VECM) estimates with all the variables as endogenous. The Greek yields Granger cause the Spanish yields on the second lag, but this significance decreases on the third and disappears on the fourth lag. An interesting result is the causality between the monthly Italian retail sales (from now on: It_retail_sales) and the Italian 10-year Btp yields (It_geomean_yield). On this result we will further investigate and build our model. Also, the Granger test doesn't find any causality relationship between hedge fund returns and Italian bond yields, meaning that maybe HF did not play any relevant role in the increase of the long-term interest rate. No causality is found between HF and the Greek or Spanish yields either. The losses incurred by

[23] In their paper the authors show how the estimation of the differenced equation does not affect the significance of the test, even though the test results are not meaningful and cannot be interpreted.

hedge funds starting from early 2012 cannot be explained with the increase of long term interest rates in the three Southern European Countries.
For any given pairs, the software runs bivariate regressions on the form:

$$y_{t=} \alpha_0 + \alpha_1 y_{t-1} + \dots\dots\dots + \alpha_1 y_{t-1} + \beta_1 x_{t-1} + \dots\dots\dots + \beta_l x_{-l} + \varepsilon_t$$

$$y_{t=} \alpha_0 + \alpha_1 x_{t-1} + \dots\dots\dots + \alpha_1 x_{t-1} + \beta_1 y_{t-1} + \dots\dots\dots + \beta_l y_{-l} + \mu_t$$

(3)

where ε_t and μ_t are the white noises.

d. Cointegration models

In order to overcome estimation biases, we use Cointegration Analysis. This methodology is particularly useful to interpret Italian 10-year Btp yield variation over the time, because it allows us to disentangle a possible long-run relation from a short-run relation between our variables.
Granger (1986) claims that "certain pairs of economic variables should not diverge from each other by too great an extent, at least in the long run and that this belief lies at the least sophisticated level of economic theory". Hence, such variables may "drift apart in the short-run or according to seasonal factors, but if they continue to be too far apart in the long-run, then economic forces such as a market mechanism or government interventions will begin to bring them together again".
As it is well known, Engle and Granger (1987) state that cointegrated variables are in equilibrium when the stationary linear combination of their levels is at its unconditional mean (assumed equal to zero for simplicity). Most of the time, this combination of levels is not zero though, and the system is out of equilibrium; nevertheless, as the combination of levels is stationary, there is a tendency for the system to return to the equilibrium. The stationary combination of levels takes the name of "equilibrium error". We can think of an error-correction model as a description of the stochastic process by which in the long-run the economy eliminates or corrects the equilibrium error, provided by unspecified factors which cause the economy to slowly respond to random shocks.
Following Engle and Granger (1987), Campbell and Shiller (1988) define two variables as cointegrated (of order (1,1)) if each variable is individually stationary in first differences (integrated of order 1), but some linear combination of the variables is stationary in levels (integrated of order 0). Campbell and Shiller (1988) add that "economic theory is valid for describing the long-run equilibrium, but random shocks knock the economy away from equilibrium, which moves back only slowly".

Zivot (2006) claims that equilibrium relations implied by these economic theories are referred to as long-run equilibrium relations, because the economic forces that act in response to deviations from equilibrium may take a long time to restore the equilibrium itself. As a result, cointegration is modeled using long spans of low frequency time series data measured monthly, quarterly or annually.

Sørensen (1997) provides a general definition of co-integration (for the I(1) case):

A vector of I(1) variables y_t is said to be cointegrated if there exists a vector β_t such that $\beta_i' y_t$ is trend stationary. If there exist r of such linearly independent vectors β_i, i = 1,...,r, then y_t is said to be cointegrated with cointegrating rank r. The matrix β = ($\beta_{1,\dots\dots\dots}\beta_r$) is called the cointegrating matrix.

Cointegration analysis is possible and allows for integrating data until we get stationary observations. Our data are stationary in first difference I (1); hence, we can proceed with our methodology.

e. <u>Johansen Cointegration Test</u>

The Johansen Cointegration test (1988, 1991) methodology stems from the Vector Autoregression (VAR) of order p given by:

$$y_t = \mu + A_1\, y_{t-1} + \dots + A_p\, y_{t-p} + \varepsilon_t \qquad (4)$$

where y_t is an n x l vector of variables that are integrated of order one, commonly denoted 1(1) and ε_t is an n x l vector of innovations. This VAR can be re-written as:

$$\Delta \mathbf{y}_t = \mu + \Pi\, y_{t-1} + \sum_{i=1}^{p-1} \Gamma_i\ \Delta y_{t-1} + \varepsilon_t \qquad (5)$$

where:

$$\Pi = \sum_{i=1}^{p} A_i - I \quad \text{and} \quad \Gamma_i = -\sum_{j=p+1}^{p} A_j \qquad (6)$$

If the coefficient matrix Π has reduced rank r < n , then there exist n x r matrices α and β each with rank r such that Π = αβ' and β'y_t is stationary. r is the number of cointegrating relations, the elements of α are known as the adjustment parameters in the Vector Error Correction model (VECM) and each I column of β is a cointegrating vector. It can be shown that for a given r, the maximum likelihood estimator of β defines the combination of y_{t-1} that yields the r largest canonical correlations of Δy_t

with y_{t-1} after correcting for lagged differences and deterministic variables when present (Johansen, 1995).

Johansen proposes two different likelihood ratio tests of the significance of these canonical correlations and thereby the reduced rank of the Π matrix: the trace test and maximum eigenvalue test, shown in equations (7) and (8) respectively:

$$J_{Trace} = -T \sum_{i=r+t}^{n} \ln (1 - \boldsymbol{\lambda}_i) \qquad (7)$$

$$J_{Max} = -T \ln(1 - \boldsymbol{\lambda}_{r+1}) \qquad (8)$$

Where T is the sample size and $\boldsymbol{\lambda}_i$ is the *i*th largest canonical correlation. The Trace method tests the null hypothesis of *r* cointegrating vectors against the alternative hypothesis of *n* cointegrating vectors. The Maximum Eigenvalue test, on the other hand, tests the null hypothesis of *r* cointegrating vectors against the alternative hypothesis of *r* + 1 cointegrating vectors.

The existence of cointegration between two or more variables suggests that a long-run relation exists between these series.

In order to find possible cointegrated variables, we first proceed by running Johansen Cointegration tests on each pairs:

$$(Italian\_geomean\_yield_t \, , x_{n,t} \,) \qquad (9)$$

Based on our preliminary Johansen Cointegration tests, we do not find any evidence of cointegration between Italian 10 year Btp yield and with the German government bond yield. We do not find any cointegration between 10-year Btp yield and Italian Gross Domestic Product nor with the stock of Public Administration debt and deposits (which is our proxy for public debt). Cointegration between Btp yield and Italian Industrial Productivity index is uncertain: while Trace test recognizes some sort of relationship between the two variables, Max-Eigenvalue test denies any cointegration. We decide to rule Italian industrial productivity out of our equation.

Based upon the results of Johansen test on the pairs, we run the Cointegration test on a basket of variables, which have shown a cointegration relation also between themselves. Using Schwarz Criterion[24], we repeat the test until we choose the following variables:

[24] The Schwarz Criterion is a criterion for selecting among formal econometric models. The criterion is minimized over choices of K to form a tradeoff between the fit of the model (which lowers the sum of squared residuals) and

$$(Italian\_Geomean\_Yield, HF, Geospain\_Yield, It\_Infl\_Rate,$$
$$It\_Retail\_Sales, Geogreek\_Yield, Geogold\ ) \quad (10)$$

Based on the estimation results and on the Schwarz criterion, we decide to exclude Vixclose from our equation. This result is opposite to the findings of Whaley (2008) Beber et al. (2009), Arghyrou and Kontonikas (2012) which use Vix index as an explanatory variable for Southern Europe Government Bond Yields increase.

Both Trace and Max-Eigenvalue tests agree on the presence of 4 Cointegration equations at most.

f. <u>Estimate Vector Error Correction Model</u>

While estimating VAR on the above variables, we opt for Vector Error Correction Model. We specify the number of cointegrated equations found with the Trace and Max-Eigenvalue tests and edit all the variables as endogenous, in order to account for any endogeneity biases.

The VEC model of y and x in levels (after rearranging the short and long term models) yields the following:

$$\Delta y_t = y_0\, \Delta x_t - (1 - \alpha 1)[\, y_{t-1} - \beta_0 - \beta_1\, x_{t-1}\,] + \varepsilon_t \qquad (11)$$

$$\text{Where } \Delta y\ , \Delta x, [y_{t-1} - \beta_0 - \beta_1\, x_{t-1}] \qquad (12)$$

are all stationary variables and clear long-run component $[y - \beta_0 - \beta_1 x]$ if cointegration exist and (1 – α1) measures the speed of adjustement to long-run equilibrium. The error correction comes from the cointegration relationship. The betas contain the cointegration equation and the alphas denote the speeds of adjustment. If y and x are far from their equilibrium relation, either y or x or both must change: the alphas let the data choose.

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the model's complexity, which is measured by K. Thus an AR(K) model versus an AR(K+1) can be compared by this criterion for a given batch of data. The Schwarz Criterion is a number: T ln (RSS) + K ln(T). Eviews slightly modifies the calculation of Schwarz Criterion: SC 2 = – l T§ + ( ) k T log § T . For Schwarz criterion the following rule holds: the lower (and negative), the better. This criterion is valid and is preferred to Alkaike Criterion, which is better indeed on the selection of forecasting models.

In the case of multiple variables, there is a vector of error-correction terms, which length equals the number of cointegrating relationships, or cointegrating vectors, among the series.

According to the Granger Representation theorem (Granger, 1983, Engle and Granger, 1987), when variables are cointegrated, there must also be an error correction model (ECM) that describes the short-run dynamics or adjustments of the cointegrated variables towards their equilibrium values. ECM consists of one-period lagged cointegrating equation and on the lagged first differences of the endogenous variables. Using the Vector Autoregression (VAR) method, we have estimated the Error Correction Model.

After estimating VECM, we check the Schwarz criterion, which is significant.

As Johansen test has found 4 eventual Cointegration equation, we make a system of the equations, ordered by variables and then we estimate the first equation available in the order:

$$d\,(Italian\_Geomean\_yield\,) =$$

$$C(1) * (Italian\_Geomean\_yield\,(-1) + 0.677265410691 * It\_Retail\_Sales(-1) - 0.037706210779 * Geogreek\_Yield(-1) - 0.00175524554267 * Geogold(-1) - 3.08842356925\,) + C(2) * (\,HF\_Eeur(-1) - 0.59817544624 * IT\_Retail\_Sales(-1) - 0.125142097729 * Geogreek\_Yield(-1) + 0.0480475507678 * Geogold(-1) - 3.52545435169\,) + C(3) * (\,Geospain\_Yield(-1) + 0.879366224358 * It\_Retail\_Sales(-1) - 0.0545692585652 * Geogreek\_Yield(-1) - 0.020354318929 * Geogold(-1) - 2.72321760249\,) + C(4) * (\,It\_Infl\_Rate(-1) - 2.5358770832 * It\_Retail\_Sales(-1) - 0.202445489767 * Geogreek\_Yield(-1) + 0.00110405605182 * Geogold(-1) - 0.801696830223\,) + C(5) * d\,(Italian\_Geomean\_Yield(-1)) + C(6) * d\,(Italian\_Geomean\_yield(-2)) + C(7) * d\,(HF\_Eur\,(-1)) + C(8) * d\,(HF\_Eur(-2)) + C(9) * d\,(Geospain\_Yield(-1)) + C(10) * d\,(Geospain\_Yield(-2)) + C(11) * d\,(It\_Infl\_Rate(-1)) + C(12) * d\,(It\_Infl\_Rate(-2)) + C(13) * d\,(It\_Retail\_Sales(-1)) + C(14) * d\,(It\_Retail\_Sales(-2)) + C(15) * d\,(Geogreek\_Yield(-1)) + C(16) * d\,(Geogreek\_Yield(-2)) + C(17) * d\,(Geogold(-1)) + C(18) * d\,(Geogold(-2)) + C(19) \tag{13}$$

IV.II. The results

We estimate all the 19 coefficients and find that one of the 4 Cointegration equations coefficients is negative and significant; hence, we have found a long-run relationship between the Bond Yield spread and the rest of the equation:

$$Italian\_Geomean\_Yield = C(4) * [(\,It\_Infl\_Rate(-1) - 2.5358770832 * It\_Retail\_Sales(-1) - 0.202445489 * Geogreek\_Yield(-1) + 0.0110405605182 * Geogold(-1) - 0.801696830223\,)\,] \tag{14}$$

Where $C(4)$ equals the Vector of significant estimating coefficients calculated with the Vector Error Correction Models estimation.

This means that in the long run, the Italian 10-year Bond Yield shows to be in equilibrium with the second term of the equation above.

Nevertheless, the long-run equilibrium is disturbed by some short run stochastic trends which affect the variables detected by our model. In fact, our Vector Error Correction Model does find a list of 4 significant coefficients, which describe the speed of adjustement of each related variables towards a long-run equilibrium.

Engle and Granger (1987) explain that, if the series are cointegrated, we can exclude that the estimated regression is spurious for reasons such as omitted variable bias, autocorrelation and endogeneity.

Given negative coefficients and related p-values, the significant Vector Error Correction Estimates are:

$$c(10) * Geospain\_yield_{t-1}$$

$$c(15) * Geogreek\_yield_{t-1}$$

$$c(16) * Geogreek\_yield_{t-2}$$

$$c(17) * Geogold_{t-1} \tag{15}$$

	Coefficient	t-statistic	p-value
C(10)	-0,802866	-4,115365	0,0001
C(15)	-0,054517	-6,182841	0,0000
C(16)	-0,022814	-2,502583	0,0139
C(17)	-0,013780	-2,856581	0,0052

Those stochastic trends which disturb the equilibrium provided by Equation no. 14 gradually adjust to the equilibrium itself. In particular, the Spanish 10-year bond yield needs 2 months to adjust to the long-term equilibrium and to correct its own disequilibrium by 80%. Based upon those results, the Greek bond corrects 7,6% of its disequilibrium in 3 months, while gold price restores its equilibrium towards our cointegrated equation (namely with the Italian inflation rate, bond yield and retail sales and also with the Greek and Spanish bond yields) by 1,38% in one month. Gold spot price is considered as a safe-haven asset and as such, it reflects a great imbalance on the financial markets. Its speed of adjustment to the long-run equilibrium is pretty low, as it has to take into consideration other macroeconomic and financial variables. Also, when the equilibrium is disturbed, the gold price has to adjust to the rest of the equation as a whole and it might take a longer time, compared to the other variables.

IV. Conclusions

As we expected, the hedge funds performance from January 2002 to July 2012 did not show any impact on the Italian bond yields. It's quite obvious that macro strategists have found investment opportunities in the political and macroeconomic uncertainties surrounding the EMU. Nevertheless, the possible massive purchase of increased-yield bonds, as German Chancellor Angela Merkel has claimed, might have contributed to decrease the Italian bond yields, rather than hastening the upward trend. Chancellor Merkel is especially blaming hedge funds for speculating on the CDS sovereign market. Sovereign credit default swap is an insurance contract which provides protection against the occurrence of a credit event, namely a country default, involving the country which issued the underlying security. Hedge funds are often blamed for speculating in the Sovereign CDS markets. Despite consolidated opinions, they only represent a small fraction of all counterparties (Augustin, 2014). If we look at table no. 1, we find that in 2012 banks and other financial institutions[25] have been the most active traders of credit derivative swaps, while hedge funds have played a minor role[26]. The definition itself of hedge funds is quite clear: they seek for high returns. In this context, we assume that hedge funds are risk takers and, as such, they look for the riskiest and most profitable investments. Roughly 80% of hedge funds included in our dataset provide a performance-fee compensation and apply the high-water mark rule, under which bonuses are only paid on returns made in excess of the maximum cumulative return for a previous period of time. The high-water mark compensation structure compels managers to earn higher and higher returns.

For all those reasons, it is quite improbable that hedge funds invested on the Greek, Spanish or Italian bonds at the time when they recorded lower yields and were still considered as "safe".

Government bonds are typically preferred by conservative investors, at least when the markets are stable and there is no evidence for political crisis. Hedge funds might have rather contributed to decrease the yields, by buying riskier downgraded bonds and hence satisfying the national demand for debt financing.

While the Euro crisis was born as a sovereign debt crisis, the U.S. financial crisis has found its roots in the problematic lending practices of major banks and financial institutions. The bridge between the two crises has become inevitable also because many banks in Europe have held assets in the financially troubled American banks. The need to rescue the banks in distress has exacerbated the negative budget deficit condition for the European governments and requested a higher effort from the European Union, the European Central Bank and the International Monetary Fund (the "Troika"). The

[25] Reporting Dealers are basically banks or other financial services firms that report information about their market activities to a monetary authority or central bankhttp://glossary.reuters.com/

[26] The data are drawn from www.bis.org.

size of both government deficits and debt and growing fears about default has pushed investors to request higher interest rates, in order to buy the related securities. In addition to that, a wave of rate downgrading has invested several European countries and financial institutions and has further deteriorated the confidence in the European debt market.

The massive information about rising spreads might also have contributed to increase the market instability. Our Btp yield has rapidly increased in 2011 for political reasons, such as rising uncertainties in governmental stability and under the Greek contagion. Rating agencies have had a significant role on those events. Apart for the high public debt and weak economic growth potential, Standard and Poor's has motivated the downgrade of the Italian rating on January 2012 with forecasts about political oppositions to the reform plans.[27]

Do any of those predictions contribute to restore the investors' confidence? Probably not.

All that said, the spread is basically a political unit of measurement for the stability of a country and we do not think it is correct to test the financial stability of a country based on the difference of a European country bond yield with that of Germany.

Our model did not find any relation between the Btp yield and the Italian GDP, but this does not mean that the growth doesn't need to be boosted. A reason why this relation is not found might be related to the historical and economic features of the 10-year time period which is considered into our dataset. Our time series is marked by two crises, which have followed a period of stagnation and for data availability constraints, our analysis cannot go back to the times when hedge funds were only a niche market and the amount of return observations was not sufficient to run any analysis. GDP is not significant, but retail sales partially represent GDP size.

Our model has found a cointegrated relation between the Italian 10 year Btp, the 10 year

Greek bond yield, the spot price of gold, the Italian monthly inflation rate and retail sales. This result can be interpreted as a long run equilibrium between those variables. To be more specific, in the long run 10-year Btp yield increases with inflationary pressures and as a result for increased volatility and uncertainties in the market (the spot price of gold here proxies the increased uncertainties on the financial markets and the search for a safe-haven asset).

Furthermore, only in the long run an increased Greek yield contributes to increase the Italian Btp yield, as a result for the "Flight-to-quality effect". Last, but not least, the Italian Btp yield and monthly retail sales follow the opposite patterns: when retail sales deteriorate, the Italian bond yield shows to increase. This happens only in the long-run equilibrium though. In the short run, the variables are disturbed by some stochastic trends, which push them far away. Those variables take a while to restore the equilibrium point and the related lags and coefficients for error correction estimates provide a

[27] "*We believe that plans to deregulate the labor market, including closed professions, could help to restore Italian competitiveness, potentially enabling Italy to operate steady current account surpluses in a shift that could strengthen Italy's creditworthiness. Nevertheless, we expect that there could be opposition to some of the current government's ambitious reforms. This, we believe, increases the uncertainty surrounding the outlook for growth and hence public finances, in the context of a more challenging funding environment for Italian banks and the Italian government*". January 13th 2013, Italy's Unsolicited Ratings Lowered To 'BBB+/A-2'; Outlook Negative. ? www.standardandpoors.com/ratings/articles/en/us/articleType=HTML&assetID=1245327296243

reasonable explanation for the contagion occurred between the Greek, the Spanish and the Italian yields.

Our model is not intended to find a responsible for what occurred until 2012. We all know (and the literatures confirms) that the crisis was a result for the increased budget deficits of Greece and some other European countries (Pagano, 2010). We all know that risky and opaque investment choices taken by some of the major financial institutions in Europe and the related need for bailout have contributed to decrease the investors' confidence towards the European financial markets (Acharya, 2011). We are aware of the role that rating agencies and political instability have played on the overall market conditions (De Santis, 2012).

Our model is intended to investigate whether hedge funds have played a role in the European crisis of debt and our results show that they have not, neither on the long, nor on the short run.

One limitation to our research is that returns are disclosed on a fund-by-fund basis: hedge fund managers do not provide detailed information about the returns they have earned for each particular set of traded instruments. For instance, a manager that uses a Fixed-Income Arbitrage strategy might be trading on a number of different securities, such as government bonds and credit default swaps, but also on corporate or municipal bonds. Arbitrage strategies include swap-spread arbitrage, yield curve arbitrage, but also capital structure arbitrage. The same happens with the macro strategist: those funds invest in Europe and try to anticipate macroeconomic trends or political events, but they trade commodities, currencies, interest rates and government bonds as well as equities and we do not have a specific return for each traded instrument.

All we have is a single aggregate return for that particular fund, that its manager invests in Europe, on currencies, interest rates, government bonds and sovereign credit default swaps, but which might operate on other markets such as commodities or corporate securities and we are not able to disentangle the impact of each specific instrument on the return. The availability of more detailed information depends on hedge funds disclosure to data vendors and for business reasons they will hardly be provided.

A suggestion for the future research would be to find a proxy, in order to estimate the exact amount of returns that a hedge fund earns on a specific class of securities.

On the sovereign debt crisis, research is never ending. It would be interesting to explore any interactions with precious metals other than gold and also the impact of European turmoil on the spread of complementary currency systems.

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Figures

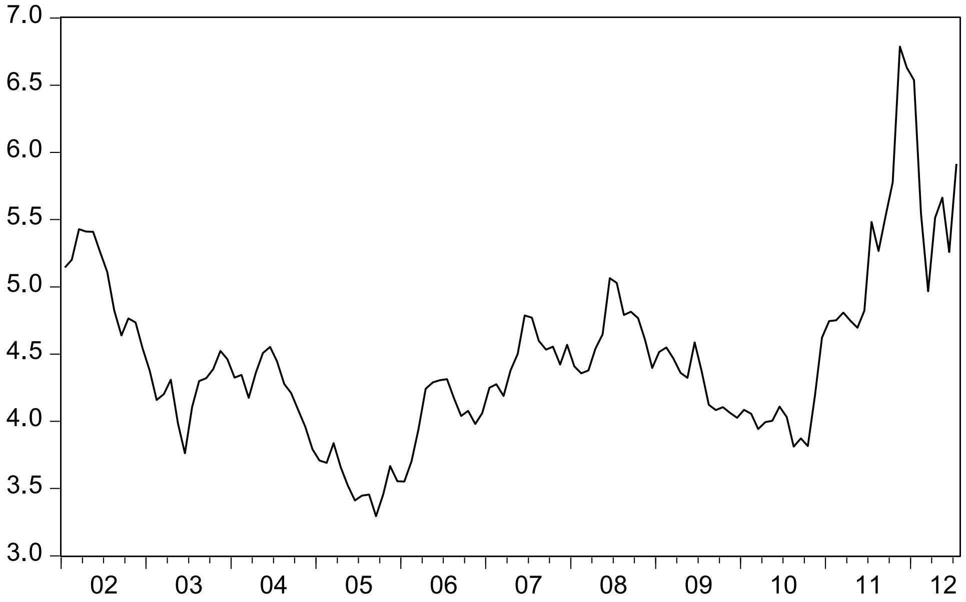

Figure 1: Italian 10-year Government Bond yield from January 2002 to July 2012. Range: 300 to 700 basis points.

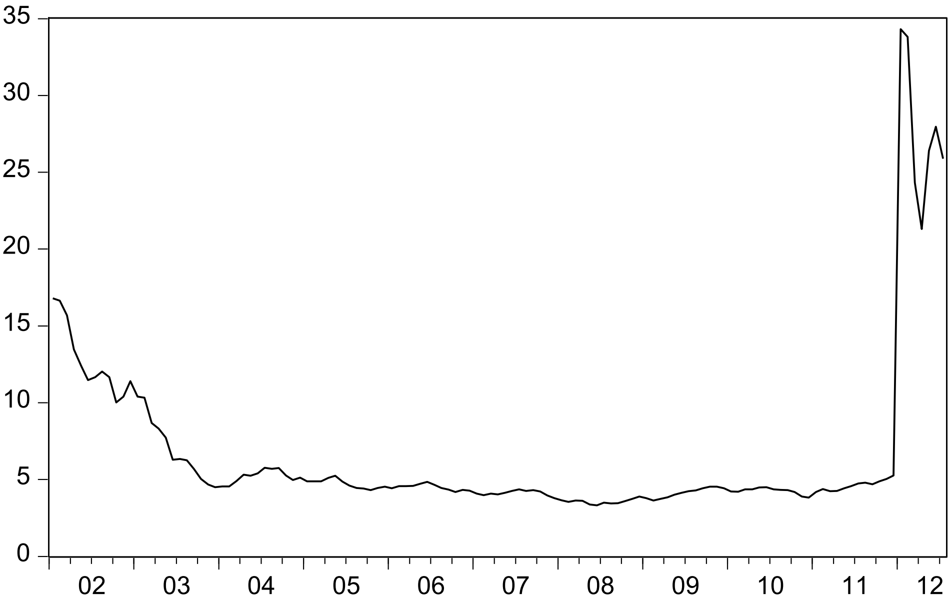

Figure 2: Greek 10-year Government Bond yield from January 2002 to July 2012. Range: 0 to 3500 basis points.

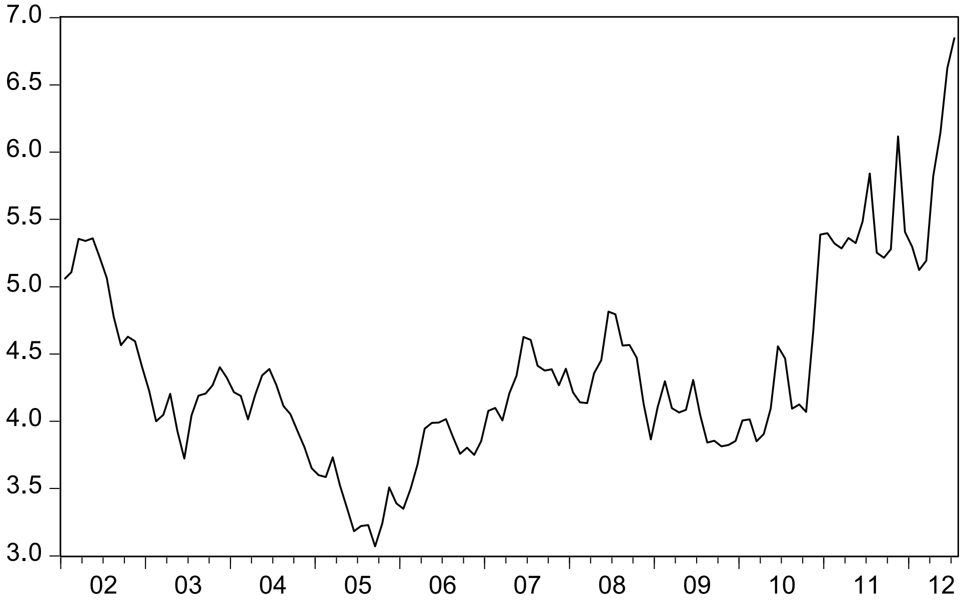

Figure 3: Spanish 10-year Government Bond yield from January 2002 to July 2012. Range: 300 to 700 basis points

Figure 4: German 10-year Government Bond yield from January 2002 to July 2012. Range: 100 to 600 basis points.

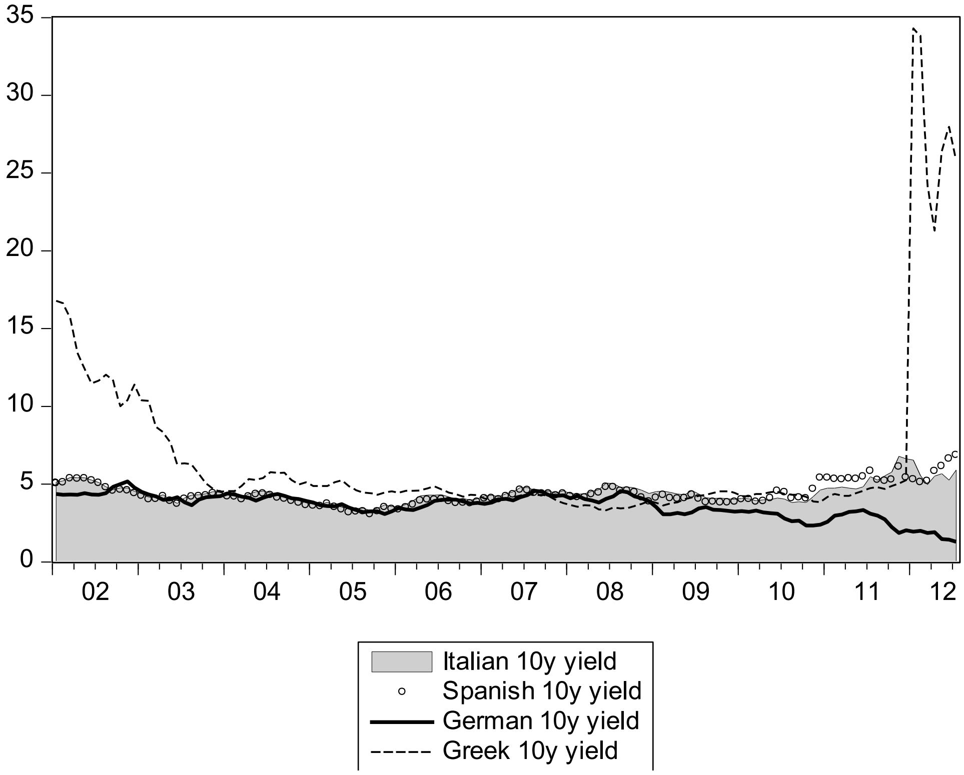

Figure 5: 10-year bond yields. Comparison.

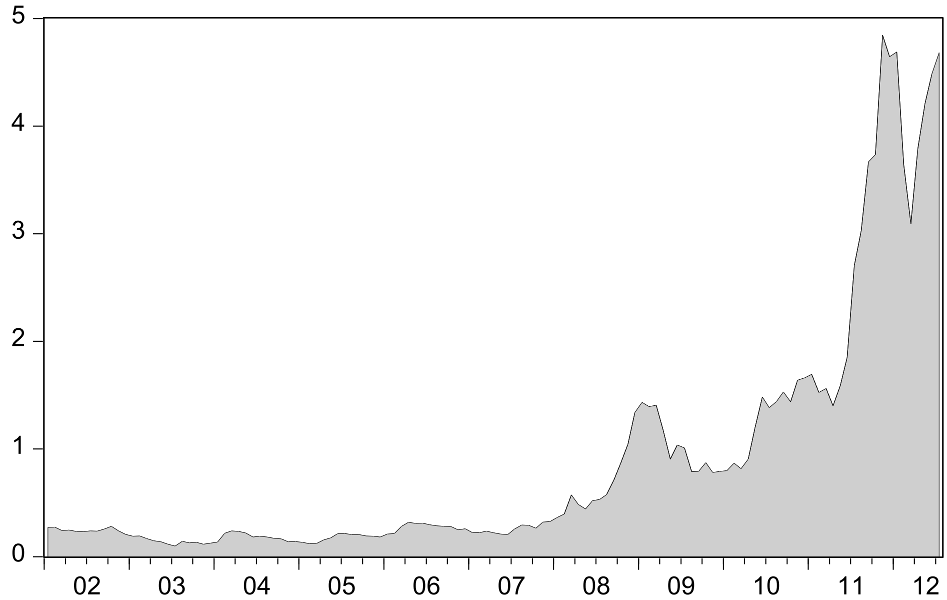

Figure 6: Italian 10-year Government Bond spread from January 2002 to July 2012.

Tables

	Total		Sovereigns	
	H1 2012	H2 2012	H2 2011	H1 2012
Total contracts	26,931	25,069	2,986	2,941
With reporting dealers	15,747	14,149	2,123	2,114
With other financial institutions	10,997	10,720	841	807
Central counterparties	5,209	4,891	118	121
Banks and security firms	2,919	2,963	390	414
Insurance firms	278	258	14	14
SPVs, SPCs and SPEs	458	587	35	29
Hedge funds	1,008	957	155	119
Other financial customers	1,125	1,063	129	111
With non-financial customers	187	200	21	20

Table (1)

Credit default Swaps. Amount outstanding, in billions US dollars.
Source: Bank for International Settlements.

A DOES NOT GRANGER CAUSE B	Lag 2		Lag 3		Lag 4	
	F-statistic	p-value	F-statistic	p-value	F-statistic	p-value
Italiangeomean Geogreek	11,6001	2.E-05	15,4591	2.E-08	12,2156	3.E-08
Geogreek Italiangeomean	13,2128	7.E-06	8,79253	3.E-05	7,77425	1.E-05
Geospain Geogreek	8,86735	0,0003	12,9494	2.E-07	10,4628	3.E-07
Geogreek Geospain	4,02061	0,0204	2,53897	**0,0599**	1.81914	**0.1299**
Italiangeomean Geospain	5,09205	0,0075	3,52108	0,0173	2,86605	0,0264
Geospain Italiangeomean	6,26472	0,0026	4,10120	0,0083	5,40019	0,0005
Geogold Italiangeomean	5,58432	0,0048	5,46761	0,0015	6,28454	0,0001
Geogold Geogreek	11,6821	2.E-05	3,57685	0,0161	11,4273	8.E-08
Geogreek Geogold	5,61981	0,0046	6,88052	0,0003	2,73750	0,0322
Geogold Geospain	6,91743	0,0014	7,06554	0,0002	6,03257	0,0002
It_retail_sales Italiangeomean	5,67666	0,0044	4,68184	0,0040	4,78406	0,0013

Table (2): Granger Causality Test

The test is based on the Null Hypothesis that "A does not Granger Cause B".
Characters in bold show that Granger causality from Greek to Spanish yield loses significance from the 3rd lag on.

Sample: 2002M01 2012M07
Included observations: 127

<table>
<tr><th>Autocorrelation</th><th>Partial Correlation</th><th></th><th>AC</th><th>PAC</th><th>Q-Stat</th><th>Prob</th></tr>
<tr><td>.|*******</td><td>.|*******</td><td>1</td><td>0.911</td><td>0.911</td><td>107.91</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>2</td><td>0.823</td><td>-0.039</td><td>196.74</td><td>0.000</td></tr>
<tr><td>.|***** |</td><td>.|. |</td><td>3</td><td>0.733</td><td>-0.064</td><td>267.69</td><td>0.000</td></tr>
<tr><td>.|***** |</td><td>.|. |</td><td>4</td><td>0.659</td><td>0.046</td><td>325.54</td><td>0.000</td></tr>
<tr><td>.|**** |</td><td>.|. |</td><td>5</td><td>0.603</td><td>0.060</td><td>374.33</td><td>0.000</td></tr>
<tr><td>.|**** |</td><td>.|. |</td><td>6</td><td>0.543</td><td>-0.059</td><td>414.27</td><td>0.000</td></tr>
<tr><td>.|*** |</td><td>**|. |</td><td>7</td><td>0.454</td><td>-0.214</td><td>442.38</td><td>0.000</td></tr>
<tr><td>.|*** |</td><td>.|. |</td><td>8</td><td>0.381</td><td>0.058</td><td>462.35</td><td>0.000</td></tr>
<tr><td>.|** |</td><td>*|. |</td><td>9</td><td>0.300</td><td>-0.084</td><td>474.84</td><td>0.000</td></tr>
<tr><td>.|** |</td><td>.|. |</td><td>10</td><td>0.236</td><td>0.003</td><td>482.62</td><td>0.000</td></tr>
<tr><td>.|* |</td><td>*|. |</td><td>11</td><td>0.165</td><td>-0.109</td><td>486.48</td><td>0.000</td></tr>
<tr><td>.|* |</td><td>.|. |</td><td>12</td><td>0.110</td><td>0.050</td><td>488.19</td><td>0.000</td></tr>
<tr><td>.|. |</td><td>*|. |</td><td>13</td><td>0.034</td><td>-0.150</td><td>488.36</td><td>0.000</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>14</td><td>-0.017</td><td>0.060</td><td>488.40</td><td>0.000</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>15</td><td>-0.053</td><td>0.070</td><td>488.81</td><td>0.000</td></tr>
<tr><td>*|. |</td><td>.|. |</td><td>16</td><td>-0.071</td><td>0.033</td><td>489.55</td><td>0.000</td></tr>
<tr><td>*|. |</td><td>.|. |</td><td>17</td><td>-0.079</td><td>0.035</td><td>490.48</td><td>0.000</td></tr>
<tr><td>*|. |</td><td>.|. |</td><td>18</td><td>-0.089</td><td>-0.038</td><td>491.67</td><td>0.000</td></tr>
<tr><td>*|. |</td><td>.|. |</td><td>19</td><td>-0.108</td><td>-0.002</td><td>493.45</td><td>0.000</td></tr>
<tr><td>*|. |</td><td>*|. |</td><td>20</td><td>-0.132</td><td>-0.123</td><td>496.12</td><td>0.000</td></tr>
<tr><td>*|. |</td><td>.|* |</td><td>21</td><td>-0.143</td><td>0.080</td><td>499.27</td><td>0.000</td></tr>
<tr><td>*|. |</td><td>.|. |</td><td>22</td><td>-0.134</td><td>0.031</td><td>502.07</td><td>0.000</td></tr>
<tr><td>*|. |</td><td>.|. |</td><td>23</td><td>-0.127</td><td>-0.023</td><td>504.59</td><td>0.000</td></tr>
<tr><td>*|. |</td><td>.|. |</td><td>24</td><td>-0.116</td><td>-0.023</td><td>506.74</td><td>0.000</td></tr>
<tr><td>*|. |</td><td>.|. |</td><td>25</td><td>-0.114</td><td>-0.001</td><td>508.85</td><td>0.000</td></tr>
<tr><td>*|. |</td><td>.|. |</td><td>26</td><td>-0.118</td><td>-0.038</td><td>511.11</td><td>0.000</td></tr>
<tr><td>*|. |</td><td>.|. |</td><td>27</td><td>-0.111</td><td>-0.002</td><td>513.15</td><td>0.000</td></tr>
<tr><td>*|. |</td><td>.|. |</td><td>28</td><td>-0.106</td><td>-0.006</td><td>515.00</td><td>0.000</td></tr>
<tr><td>*|. |</td><td>.|. |</td><td>29</td><td>-0.097</td><td>0.012</td><td>516.56</td><td>0.000</td></tr>
<tr><td>*|. |</td><td>.|. |</td><td>30</td><td>-0.097</td><td>-0.049</td><td>518.14</td><td>0.000</td></tr>
</table>

Table (3): Correlogram for Italian_geomean_yield from January 2002 to July 2012. 30 lags.

Cointegrating Eq:	CointEq1	CointEq2	CointEq3	CointEq4
ITALIAN_GEOMEAN_YIELD(-1)	1.000000	0.000000	0.000000	0.000000
HF_EUR(-1)	0.000000	1.000000	0.000000	0.000000
GEOSPAIN_YIELD(-1)	0.000000	0.000000	1.000000	0.000000
IT_INFL_RATE(-1)	0.000000	0.000000	0.000000	1.000000
IT_RETAIL_SALES(-1)	0.677265	-0.598175	0.879366	-2.535877
	(0.09909)	(0.20081)	(0.12299)	(0.33742)
	[6.83459]	[-2.97888]	[7.15009]	[-7.51545]
GEOGREEK_YIELD(-1)	-0.037706	-0.125142	-0.054569	-0.202445
	(0.04577)	(0.09274)	(0.05680)	(0.15584)
	[-0.82390]	[-1.34938]	[-0.96072]	[-1.29910]
GEOGOLD(-1)	-0.001755	0.004805	-0.002035	0.001104
	(0.00046)	(0.00093)	(0.00057)	(0.00156)
	[-3.83365]	[5.17864]	[-3.58194]	[0.70817]
C	-3.088424	-3.525454	-2.723218	-0.801697

Table (4) . VECM: Vector of Cointegrated Coefficients

Error Correction:	D(ITALIAN_GEOMEAN_YIELD)	D(HF_EUR)	D(GEOSPAIN_YIELD)	D(IT_INFL_RATE)	D(IT_RETAIL_SALES)	D(GEOGREEK_YIELD)	D(GEOGOLD)
CointEq1	-0.188809	-1.394273	-0.168505	0.150952	-2.200670	3.143119	-36.25181
	(0.06918)	(0.86734)	(0.07378)	(0.08725)	(1.05390)	(0.83804)	(14.6047)
	[-2.72927]	[-1.60752]	[-2.28378]	[1.73011]	[-2.08812]	[3.75056]	[-2.48221]
CointEq2	0.009933	-0.469486	0.006703	0.009215	-0.171711	0.403508	3.469771
	(0.01078)	(0.13517)	(0.01150)	(0.01360)	(0.16425)	(0.13061)	(2.27612)
	[0.92129]	[-3.47319]	[0.58293]	[0.67769]	[-1.04543]	[3.08947]	[1.52442]
CointEq3	0.040331	-0.224195	-0.034300	-0.190810	1.039599	-2.954347	35.27724
	(0.05534)	(0.69386)	(0.05903)	(0.06980)	(0.84310)	(0.67041)	(11.6834)
	[0.72877]	[-0.32311]	[-0.58111]	[-2.73374]	[1.23307]	[-4.40675]	[3.01943]
CointEq4	-0.044489	-0.341924	-0.065757	-0.021140	0.176289	-0.234040	1.816965
	(0.01345)	(0.16859)	(0.01434)	(0.01696)	(0.20485)	(0.16289)	(2.83876)
	[-3.30856]	[-2.02815]	[-4.58505]	[-1.24654]	[0.86058]	[-1.43677]	[0.64006]
D(ITALIAN_GEOMEAN_YIELD(-1))	-0.146566	2.939186	-0.802462	0.111486	-1.832594	6.112827	85.41376
	(0.20608)	(2.58381)	(0.21980)	(0.25992)	(3.13955)	(2.49651)	(43.5071)
	[-0.71120]	[1.13754]	[-3.65088]	[0.42893]	[-0.58371]	[2.44855]	[1.96321]
D(ITALIAN_GEOMEAN_YIELD(-2))	0.885561	4.067871	1.028518	0.030117	5.066427	1.176711	-33.79770
	(0.22733)	(2.85022)	(0.24246)	(0.28672)	(3.46327)	(2.75393)	(47.9931)
	[3.89544]	[1.42721]	[4.24195]	[0.10504]	[1.46290]	[0.42728]	[-0.70422]

D(HF_EUR(-1))	-0.009439	-0.273710	-0.012359	-0.016406	0.201157	-0.346033	3.269036
	(0.01019)	(0.12770)	(0.01086)	(0.01285)	(0.15517)	(0.12339)	(2.15034)
	[-0.92668]	[-2.14331]	[-1.13764]	[-1.27708]	[1.29635]	[-2.80439]	[1.52024]
D(HF_EUR(-2))	0.010688	-0.115912	0.013669	-0.016087	0.398860	-0.268297	1.286628
	(0.00870)	(0.10913)	(0.00928)	(0.01098)	(0.13260)	(0.10544)	(1.83756)
	[1.22788]	[-1.06215]	[1.47237]	[-1.46537]	[3.00796]	[-2.54449]	[0.70018]
D(GEOSPAIN_YIELD(-1))	0.275325	-2.098666	0.791756	-0.137939	2.873363	-8.148666	-96.92732
	(0.18448)	(2.31294)	(0.19676)	(0.23267)	(2.81043)	(2.23480)	(38.9462)
	[1.49245]	[-0.90736]	[4.02402]	[-0.59286]	[1.02239]	[-3.64627]	[-2.48875]
D(GEOSPAIN_YIELD(-2))	-0.877766	-2.809780	-1.004454	0.180778	-2.796749	3.347879	-0.795947
	(0.19251)	(2.41362)	(0.20532)	(0.24280)	(2.93276)	(2.33207)	(40.6414)
	[-4.55960]	[-1.16414]	[-4.89209]	[0.74457]	[-0.95362]	[1.43558]	[-0.01958]
D(IT_INFL_RATE(-1))	0.005302	0.498605	-0.004607	0.160122	-0.759470	-0.319106	-14.05244
	(0.07744)	(0.97091)	(0.08259)	(0.09767)	(1.17974)	(0.93810)	(16.3485)
	[0.06847]	[0.51355]	[-0.05578]	[1.63945]	[-0.64376]	[-0.34016]	[-0.85956]
D(IT_INFL_RATE(-2))	5.42E-05	-0.119640	0.034617	0.317488	-1.239410	0.381196	-14.76313
	(0.07777)	(0.97506)	(0.08295)	(0.09809)	(1.18478)	(0.94211)	(16.4184)
	[0.00070]	[-0.12270]	[0.41735]	[3.23685]	[-1.04611]	[0.40462]	[-0.89918]
D(IT_RETAIL_SALES(-1))	-0.012959	0.059389	-0.016019	0.017077	0.135388	0.119007	-1.164700
	(0.00839)	(0.10522)	(0.00895)	(0.01058)	(0.12785)	(0.10167)	(1.77176)
	[-1.54408]	[0.56442]	[-1.78962]	[1.61338]	[1.05893]	[1.17056]	[-0.65737]
D(IT_RETAIL_SALES(-2))	0.001641	0.125271	-0.004527	0.008051	0.159087	0.079170	-1.944599
	(0.00649)	(0.08137)	(0.00692)	(0.00819)	(0.09887)	(0.07862)	(1.37008)
	[0.25289]	[1.53959]	[-0.65397]	[0.98365]	[1.60909]	[1.00702]	[-1.41933]
D(GEOGREEK_YIELD(-1))	-0.055263	-0.072772	-0.035810	-0.016255	0.087563	-0.109569	3.452545
	(0.00860)	(0.10785)	(0.00917)	(0.01085)	(0.13105)	(0.10421)	(1.81606)
	[-6.42423]	[-0.67474]	[-3.90303]	[-1.49824]	[0.66816]	[-1.05144]	[1.90111]
D(GEOGREEK_YIELD(-2))	-0.031569	-0.031581	-0.040800	-0.010182	0.027854	-0.291104	1.485099
	(0.00954)	(0.11960)	(0.01017)	(0.01203)	(0.14532)	(0.11556)	(2.01382)
	[-3.30950]	[-0.26406]	[-4.01027]	[-0.84631]	[0.19167]	[-2.51915]	[0.73745]
D(GEOGOLD(-1))	-0.001727	-0.005782	-0.002048	-0.000278	-0.001988	-0.016059	-0.029985
	(0.00049)	(0.00618)	(0.00053)	(0.00062)	(0.00750)	(0.00597)	(0.10398)
	[-3.50731]	[-0.93634]	[-3.89933]	[-0.44750]	[-0.26493]	[-2.69140]	[-0.28837]
D(GEOGOLD(-2))	0.000529	0.001350	0.000786	0.000299	0.017953	0.000424	-0.090746
	(0.00048)	(0.00597)	(0.00051)	(0.00060)	(0.00726)	(0.00577)	(0.10055)
	[1.11010]	[0.22610]	[1.54678]	[0.49756]	[2.47430]	[0.07352]	[-0.90248]
C	0.020465	0.041305	0.024714	0.005727	-0.231794	0.306363	12.17726
	(0.01687)	(0.21151)	(0.01799)	(0.02128)	(0.25700)	(0.20436)	(3.56146)
	[1.21309]	[0.19529]	[1.37355]	[0.26919]	[-0.90192]	[1.49912]	[3.41918]

Table (5) VECM: Error Correction estimates

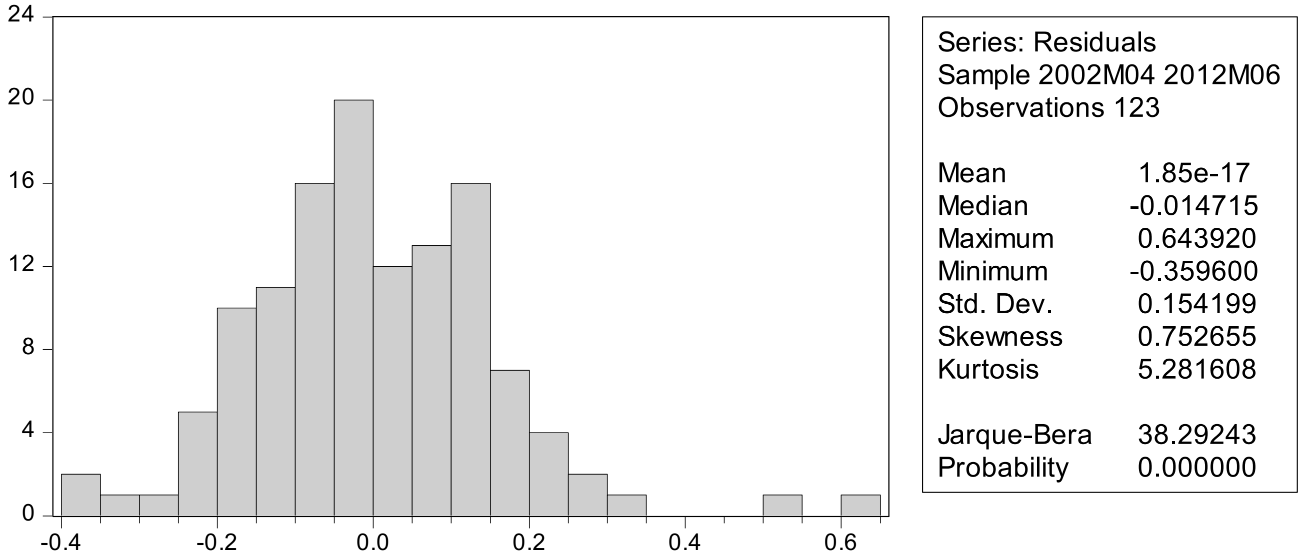

Table (6) Normality Test on residuals

Heteroskedasticity Test: White

F-statistic	1.240144	Prob. F(18,104)	0.2442
Obs*R-squared	21.73545	Prob. Chi-Square(18)	0.2439
Scaled explained SS	33.26611	Prob. Chi-Square(18)	0.0155

Table (7)

H_0 : Residuals are homoscedastic

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.902262	Prob. F(36,68)	0.6252
Obs*R-squared	39.76075	Prob. Chi-Square(36)	0.3062

Table (8)

H_0 : Residuals are not serially correlated