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Introduction

One of the fastest growing areas in the economic sciences is broadly defined area of finance, with particular emphasis on the financial markets, financial institutions and risk management. Real world challenges stimulate the development of new theories and methods. A large part of the theoretical research concerns the analysis of the risk of not only economic entities, but also households.

The first Wrocław Conference in Finance WROFIN was held in Wrocław between 22nd and 24th of September 2015. The participants of the conference were the leading representatives of academia, practitioners at corporate finance, financial and insurance markets. The conference is a continuation of the two long-standing conferences: INVEST (Financial Investments and Insurance) and ZAFIN (Financial Management – Theory and Practice).

The Conference constitutes a vibrant forum for presenting scientific ideas and results of new research in the areas of investment theory, financial markets, banking, corporate finance, insurance and risk management. Much emphasis is put on practical issues within the fields of finance and insurance. The conference was organized by Finance Management Institute of the Wrocław University of Economics. Scientific Committee of the conference consisted of prof. Diarmuid Bradley, prof. dr hab. Jan Czekaj, prof. dr hab. Andrzej Gospodarowicz, prof. dr hab. Krzysztof Jajuga, prof. dr hab. Adam Kopiński, prof. dr. Hermann Locarek-Junge, prof. dr hab. Monika Marcinkowska, prof. dr hab. Paweł Miłobędzki, prof. dr hab. Jan Monkiewicz, prof. dr Lucjan T. Orłowski, prof. dr hab. Stanisław Owsiak, prof. dr hab. Wanda Ronka-Chmielowiec, prof. dr hab. Jerzy Różański, prof. dr hab. Andrzej Sławiński, dr hab. Tomasz Słoński, prof. Karsten Staehr, prof. dr hab. Jerzy Węcławski, prof. dr hab. Małgorzata Zaleska and prof. dr hab. Dariusz Zarzecki. The Committee on Financial Sciences of Polish Academy of Sciences held the patronage of content and the Rector of the University of Economics in Wroclaw, Prof. Andrzej Gospodarowicz, held the honorary patronage.

The conference was attended by about 120 persons representing the academic, financial and insurance sector, including several people from abroad. During the conference 45 papers on finance and insurance, all in English, were presented. There were also 26 posters.

This publication contains 27 articles. They are listed in alphabetical order. The editors of the book on behalf of the authors and themselves express their deep gratitude to the reviewers of articles – Professors: Jacek Batóg, Joanna Bruzda, Katarzyna Byrka-Kita, Jerzy Dzieża, Teresa Famulska, Piotr Fiszeder, Jerzy Gajdka, Marek Gruszczyński, Magdalena Jerzemowska, Jarosław Kubiak, Tadeusz Kufel, Jacek Li-

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Wanda Ronka-Chmielowiec, Krzysztof Jajuga

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DAILY CHANGES OF THE SOVEREIGN BOND YIELDS OF SOUTHERN EURO AREA COUNTRIES DURING THE RECENT CRISIS

DZIENNE ZMIANY RENTOWNOŚCI OBLIGACJI SKARBOWYCH POŁUDNIOWYCH KRAJÓW STREFY EURO PODCZAS OSTATNIEGO KRYZYSU ZADŁUŻENIOWEGO

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Abstract: The aim of the paper is to identify determinants of the sovereign bond yields of 4 southern euro area countries which were most severely hit by the sovereign debt crisis, i.e. Greece, Portugal, Spain and Italy. The sample, which covers the period 2009 Q4 – 2015 Q2, is divided by the date of 26th July 2012, when the announcement of the ECB's Outright Monetary Transactions programme took place, into two subsamples. The results of the estimation show that different factors determined the development of the yields in the countries under consideration in each subperiod. Moreover, in the first subperiod there was a contagion from Greece to the rest of the analysed countries, whereas in the second subperiod, sovereign bond markets were resistant to negative news and shocks originating in the Greek economy.

Keywords: VAR-DCC-GARCH, euro area sovereign debt crisis, OMT programme.

Streszczenie: Celem artykułu jest identyfikacja determinant rentowności obligacji skarbowych 4 krajów Europy Południowej, które zostały poważnie dotknięte podczas ostatniego kryzysu zadłużeniowego. Próba obejmująca okres 2009 Q4-2015Q2 jest podzielona na dwie podpróby a datą graniczną jest 26 lipca 2012 roku, kiedy Europejski Bank Centralny zapowiedział program OMT. Wyniki estymacji parametrów wskazują, że czynniki wpływające na rentowności obligacji skarbowych peryferyjnych krajów strefy euro różniły się w podokresach. Co więcej, w pierwszym podokresie rynki obligacji skarbowych Włoch, Portugalii i Hiszpanii były wrażliwe na negatywne szoki pochodzące z Grecji, natomiast po ogłoszeniu programu OMT wrażliwość na szoki zdecydowanie spadła.

Słowa kluczowe: VAR-DCC-GARCH, kryzys strefy euro, program OMT.

1. Introduction

In the 2nd half of 2009, when the global economic recovery gained momentum, it seemed that the period of the most intense tensions associated with the global economic and financial crisis, initiated by the collapse of the US investment bank Lehman Brothers in September 2008, ended. However, the sense of calm in the financial markets proved to be short-lived. At the turn of 2009/2010, the epicentre of the crisis moved from the United States to the euro area, where it took the form of a debt crisis for some of its members. It was reflected in fiscal instability of the so-called peripheral countries of the Economic and Monetary Union (EMU), i.e. Greece, Ireland and Portugal, as well as, though to a lesser extent, Spain and Italy. In the years 2009-2013, those countries saw a sharp increase in the central and local government debt to GDP ratio.

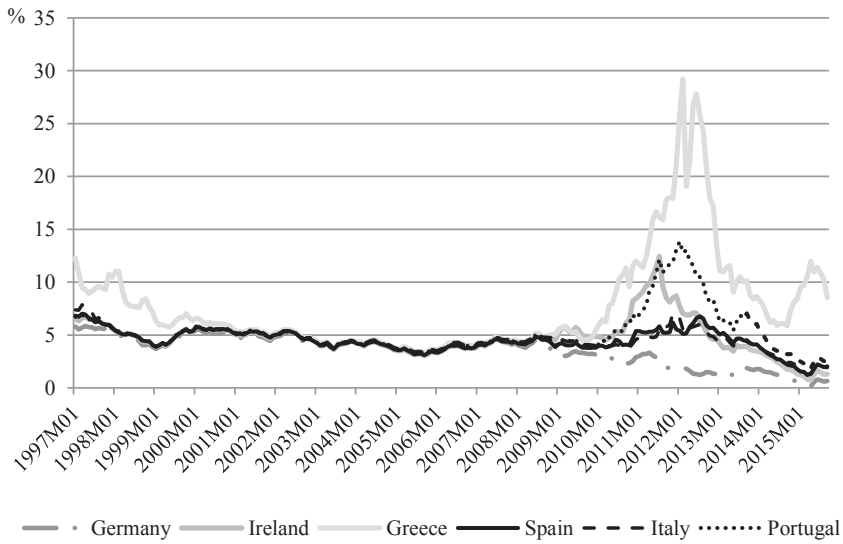

Figure 1. Performance of sovereign bond yields in selected euro area countries

Source: Eurostat.

In the situation of fiscal instability, treasury bond yields of the peripheral euro area countries rose significantly, reaching levels very high for these economies (Figure 1). Their sustained decline occurred only after the announcement by the European Central Bank (ECB) about the programme of Outright Monetary Transactions (OMT), allowing unlimited purchases on the secondary market of short-term treasury bonds, which took place in July 2012[1]. At the end of 2014,

[1] To be precise, the technical features of the OMT were communicated to the public in September 2012, though its announcement can be attributed to the speech by M. Draghi at the conference of inves-

Greece experienced renewed sovereign bond market tensions, which, however, have not moved to the bond markets of other peripheral euro area countries.

The paper aims to identify determinants of the sovereign bond yields of 4 Southern euro area countries, i.e. Greece, Portugal, Spain and Italy[2]. Daily data covering the period 2009 Q4 – 2015 Q2 is used. Since the situation in the euro area bond market improved significantly after the announcement of the OMT programme, the sample is divided into 2 subperiods, i.e. before the OMT announcement and after it. We estimate the parameters of the VECM-MGARCH model. Based on this method, we analyse the co-movements between the treasury bond yields in the countries under consideration and evaluate relations between the shocks.

The remainder of the paper is as follows. Section 2 presents the literature review and variables used in the model. Section 3 provides the specification of the econometric model and the results of the empirical research. Section 4 concludes the paper.

2. Literature review

Determinants of treasury bond yields in the euro area during the recent debt crisis were broadly studied in the literature. All the research can be divided into certain groups. Firstly, some authors concentrate on the role of macroeconomic fundamentals (e.g. the rate of growth of real GDP, ratio of debt and deficit to GDP, current account balance to GDP, inflation, real effective exchange rate) and non-fundamental variables. According to the research results, the role of macroeconomic fundamentals – which was negligible in the pre-crisis period – increased substantially after 2008 (see: e.g. De Grauwe and Ji [2013]).

Secondly, a great deal of attention is devoted to the impact of the anti-crisis policy implemented by the institutions of the European Union during the euro area sovereign debt crisis, with particular focus on the ECB's measures. In particular, the impact of two asset purchase programmes – Securities Markets Programme (SMP) and the OMT is analysed. According to the results of empirical investigations, the announcement of the SMP led to a decrease in treasury bond yields, however, effects of the programme lasted for a short period of time (see: e.g. Kilponen et al. [2015]; Falagiarda and Reitz [2015]; Grabowski and Stawasz [2013]). This could be due to a limited scale of the purchases conducted under the SMP programme. In the case of the OMT, its announcement, as well as its introduction, led to a decrease in treasury bond yields in the analysed group of countries (see: e.g. Falagiarda and Reitz [2015]; Kilponen et al. [2015]).

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tors in July 2012. On the 26th of July he pledged that the ECB – within its mandate – was "ready to do whatever it takes to preserve the euro" [Draghi 2012].

[2] We omit Ireland due to gaps in data (see: e.g. Bhanot et al. [2014])

Another group of research concerns the sensitivity of yields of the crisis-affected countries to credit rating announcements as well as macroeconomic and political news. Numerous analyses indicate that:

- rating downgrades and negative news had a stronger impact on yields than rating upgrades and positive news (see: e.g. Alsaaka and Gwilym [2013]; Beetsma et al. [2013]);
- during the euro area sovereign debt crisis, rating downgrades and negative news from Greece had a negative impact on the treasury bond yields in other crisis-affected countries (see: e.g. Aizenman et al. [2013]).

In this paper we evaluate the impact of the potential determinants (as listed in Table 1) on the sovereign bond yields of Greece, Italy, Portugal and Spain in both subperiods. We aim to contribute to the existing literature by analysing how the spill-over effects, which were present in the bond markets of the euro area's peripheral countries before the OMT announcement, have changed after 26 July 2012.

Table 1. Dummy variables used in the model

Variable	Type of variable	Definition	Source
D	Macroeconomic news	News about the condition of public finance	Eurointelligence
MA	Macroeconomic news	Data releases concerning real economy other than fiscal data	Eurointelligence
SU	Political news	News about protests against anti-crisis policies/ collapses of governments	Eurointelligence
RES	Political news	News about the Greek debt restructuring	Eurointelligence
AU	Political news	News about austerity programmes undertaken by the governments	Eurointelligence
LTRO	Anti-crisis measure of the ECB	Decisions about conducting longer term refinancing operations by the ECB	www.ecb.europa.eu
CO	Anti-crisis measure of the ECB	Decisions about loosening or tightening the quality standards for assets eligible as collateral for Eurosystem credit operations	www.ecb.europa.eu
SMP	Anti-crisis measure of the ECB	Decision about implementation of the SMP programme	www.ecb.europa.eu
OMT[I]	Anti-crisis measure of the ECB	Communication of the technical features of the OMT to the public	www.ecb.europa.eu
RT	Decision of credit rating agencies	Decisions undertaken by three main rating agencies, i.e. S&P, Fitch Ratings and Moody's (downgrades, upgrades)	Web pages of rating agencies

Source: Authors' own study.

Table 1 presents definitions of dummy variables associated with macroeconomic and political news, credit rating announcements and ECB's unconventional monetary

policies, which are considered in the empirical investigation. Sources of data are given as well.

3. Methodology and empirical results

In order to analyse the co-integration and co-movements between the treasury bond yields and dynamic correlations between shocks stemming from different bond markets, we suggest the estimation of the parameters of the following VECM-MGARCH:

$$\Delta \mathbf{r}_t = \mathbf{\Pi} \mathbf{r}_{t-1} + \sum_{i=1}^{p} \mathbf{\Gamma}_i \Delta \mathbf{r}_{t-i} + \mathbf{\Lambda} \mathbf{W}_t + \boldsymbol{\varepsilon}_t, E(\boldsymbol{\varepsilon}_t) = \mathbf{0}, \quad E\left(\boldsymbol{\varepsilon}_t \boldsymbol{\varepsilon}_t^T\right) = \mathbf{H}_t. \tag{1}$$

In equation (1) $\mathbf{r}_t$ denotes the vector of daily yields on treasury bonds of a 10-year maturity. According to the co-integration theory (see: Johansen [1988]), if non-stationary variables co-integrate, then matrix $\mathbf{\Pi}$ is decomposed into matrix of co-integrating vectors $\mathbf{B}$ and matrix of weights $\mathbf{A}$. Matrices $\mathbf{\Gamma}_1, \ldots, \mathbf{\Gamma}_p$ consist of short-run coefficients, $\mathbf{W}_t$ consists of variables associated with credit rating announcements, the anti-crisis measures of the European Central Bank, political and macroeconomic news. Control variables, among which we consider the rate of return on European main stock index (EUROSTOXX50) *(rs50$_t$)* and the rate of return on the exchange rate USD/EUR (*rex$_t$*). *p* are chosen on the basis of the Akaike Information Criteria. Conditional covariance matrix of the disturbances[3] ($\mathbf{H}_t$) is, according to VCC-MGARCH [Tse and Tsui 2002], decomposed in the following way:

$$\mathbf{H}_t = \mathbf{D}_t^{1/2} \mathbf{R}_t \mathbf{D}_t^{1/2}, \tag{2}$$

$$\mathbf{R}_t = \left(1 - \lambda_1 - \lambda_2\right) \mathbf{R} + \lambda_1 \mathbf{\Psi}_{t-1} + \lambda_2 \mathbf{R}_{t-1}. \tag{3}$$

In equation (3) $\mathbf{D}_t$ is a diagonal matrix of conditional variances, which evolve according to a univariate GARCH model, $\mathbf{R}$ is the matrix of means to which the dynamic process of (3) reverts and $\mathbf{R}_t$ is a matrix of conditional correlations. $\mathbf{\Psi}_t$ is the rolling estimator of the correlation matrix of disturbances and λ_1, λ_2 are parameters that govern the dynamics of the conditional correlations, which satisfy the following condition: $0 \le \lambda_1 + \lambda_2 < 1$.

Since in the aftermath of the OMT announcement, an important change in the performance of treasury bond yields of the countries under consideration has been noticed, empirical analysis is conducted in 2 subperiods (from the beginning of the euro area sovereign debt crisis to the announcement of the OMT programme

[3] After using multivariate extension of the Mann-Wolfowitz test (see [Friedman, Rafsky 1979]), it turned out that disturbances follow multivariate t-student distribution with 4 degrees of freedom.

and after the OMT announcement). Table 2 presents the results of testing order of integration of the treasury bond yields using ADF-GLS test (see: Elliott et al. [1996]) and the co-integration rank using Johansen [1988] test for both subperiods. From the results in Table 2, we see that the treasury bond yields are integrated of order 1 for both subperiods for all the countries. There exists 1 co-integrating vector for the first subperiod and 2 co-integrating vectors for the second one.

Table 2. Results of testing the order of integration and co-integration rank

Country	Testing stationarity of levels		Testing stationarity of first differences		Rank	Trace statistic	
	Sub. 1	Sub. 2	Sub. 1	Sub. 2	H0	Sub. 1	Sub. 2
Greece	–2.62 (–2.86)	0.09 (–2.83)	–15.60 (–1.97)	–2.75 (–1.96)	*0*	75.55 (62.99)	83.02 (62.99)
Portugal	–1.49 (–2.83)	–0.84 (–2.84)	–8.62 (–1.96)	–2.99 (–1.96)	*<=1*	40.61 (42.44)	48.13 (42.44)
Italy	–2.28 (–2.84)	–1.06 (–2.85)	–7.11 (–1.96)	–2.04 (–1.97)	*<=2*	18.73 (25.32)	21.04 (25.32)
Spain	–2.51 (–2.86)	–1.33 (–2.86)	–11.93 (–1.97)	–2.94 (–1.97)	*<=3*	5.28 (12.25)	5.43 (12.25)

Note: Critical values (for 0.05 level of significance) are given in brackets.

Source: Authors' own study.

Estimates of the parameters of the model (1) – (3) for both subperiods with co-integrating relations and the results of testing validity of assumptions concerning error term are presented in Table 3.

Based on the results of the estimation, we notice that there exist long-run co-integrating relations between the treasury bond yields for the analysed group of countries. When we analyse the pair Spain-Italy, the long-run stability condition is satisfied (see: Grabowski and Welfe [2011]). It may imply that sovereign bonds of these two countries are treated as close substitutes by investors.

Table 3. Results of the estimation of parameters of the VECM-MGARCH

Sub.	Subperiod 1				Subperiod 2			
Var.	$\Delta r_{G,t}$	$\Delta r_{P,t}$	$\Delta r_{I,t}$	$\Delta r_{S,t}$	$\Delta r_{G,t}$	$\Delta r_{P,t}$	$\Delta r_{I,t}$	$\Delta r_{S,t}$
1	2	3	4	5	6	7	8	9
$CE1_{t-1}$	–0.44**	–0.03	–0.01	–0.02**	–0.04	0.07**	–0.08*	–0.03*
$CE2_{t-1}$	–	–	–	–	0.12**	–0.08**	–0.00	0.03*
$\Delta r_{G,t-1}$	0.03	0.01	0.00	0.00	0.13**	–0.00	0.01	0.01
$\Delta r_{P,t-1}$	0.06	0.16**	–0.02	0.03**	–0.01	0.06	–0.00	–0.04
$\Delta r_{I,t-1}$	–0.12	0.12	0.08	0.23**	–0.03	–0.04	0.08*	0.17*

1	2	3	4	5	6	7	8	9
$\Delta r_{S,t-1}$	0.76	0.04	0.10*	0.41**	0.20	0.21**	0.06	0.24**
RES	–18.05**							
$rs50_t$	–7.59**	–0.84*		–0.76**	–10.27**			
rex_t						1.56*	0.86*	
RT_G^D	0.11*	0.08*		0.03*				
RT_P^D		0.09*						
RT_P^U						–0.06**		
D_G^N	0.07*		0.03**	0.03**				
D_P^N			0.04*					
SU_G^N	0.08**				0.03*			
SU_I^N			0.08**				0.02*	
MA_P^N						0.07*		
MA_I^N			0.06*					
MA_S^N								0.01**
AU_G^N		0.10***			0.04*			
AU_I^P			–0.14**					
AU_P^P						–0.04*		
AU_S^P								–0.03*
CO_G^N	0.51**				0.44*			
CO_P^N					–1.17**			
CO_S^P								–0.08**
CO_P^P		–0.75**						
LTRO	–0.17*	–0.10*		–0.03*				
SMP	–1.33**	–0.60**	–0.34**	–0.42**				
OMT^I						*–0.31***	–0.11*	*–0.21***
EQUATIONS OF COVARIANCES								
Cons	0.0005	0.0001	0.0001	0.0001	0.0001	*0.0001*	0.0000	*0.0000*
ε_{t-1}^2	0.06**	0.12**	0.11**	0.07**	0.03**	*0.05***	0.03**	*0.03***
σ_{t-1}^2	0.87**	0.86**	0.85**	0.88**	0.91**	*0.90***	0.94**	*0.93***
$\rho(\varepsilon_G,\varepsilon_P)$	0.30**				0.16			
$\rho(\varepsilon_G,\varepsilon_I)$	0.22				0.04			

Tabela 3, cont.

$\rho(\varepsilon_G,\varepsilon_S)$	0.31**	0.06
$\rho(\varepsilon_P,\varepsilon_I)$	0.28**	0.82**
$\rho(\varepsilon_P,\varepsilon_S)$	0.38**	0.80**
$\rho(\varepsilon_S,\varepsilon_I)$	0.90**	0.94**
λ_1	0.02**	0.01**
λ_2	0.97**	0.98**
LONG-RUN COINTEGRATING EQUATIONS (z-statistics in brackets)		
Eq. 1	$CE1_t=r_{S,t}-r_{I,t}-0.12(r_{G,t}+r_{P,t})-0.007t-0.70$ (–9.27) (–8.54)	$CE1_t=r_{S,t}-r_{I,t}-0.07r_{G,t}+0.22r_{P,t}+0.003t-1.64$ (-6.26) (4.35) (5.57)
Eq. 2	–	$CE2_t=r_{P,t}-1.53r_{I,t}-0.08\ r_{G,t}+0.001t+1.29$ (–8.31) (–4.36) (0.58)
HYPOTHESES TESTING (p-values in brackets)		
Validity of restrictions	$\chi^2 = 0.23$ (0.89)	$\chi^2 = 0.55$ (0.76)
Autocorrelation	$\chi^2 = 21.73$ (0.15)	$\chi^2 = 19.63$ (0.24)
VCC outperforms DCC	z = 0.78 (0.44)	z = 1.03 (0.30)

Note: *, ** denote respectively significance at 0.1 and 0.05 level of significance. Letters G,I,P,S in lower indices denote Greece, Ireland, Portugal and Spain respectively. Letters P and N in upper indices refer to positive and negative news respectively, while letters D and U in upper indices refer to rating downgrades and upgrades respectively.

Source: Authors' own study.

Analysing the country-specific short-term relations, we start with the news releases and decisions of rating agencies. In the case of Greece, the decision about debt restructuring resulted in a decrease in the 10-year government bond yields of about 18 percentage points. Nevertheless, the effect turned out to be short-lived A similar result was obtained, among others, by Kilponen et al. [2015]. A negative impact on the Greek government bond market was exerted by bad news concerning Greek public finance, rating downgrades and socio-political tensions. As far as Italy is concerned, higher yields reflected bad macroeconomic news (including news about public finance), as well as socio-political tensions. Negative macroeconomic news turned out to be also significant for Portugal and Spain (but only in the second subperiod).

Referring to the ECB's anti-crisis monetary policies, the following conclusions can be drawn. The ECB's decisions to tighten collateral rules for the Greek debt led to an increase in the country's bond yields. On the other hand, the extension of the list of eligible collateral alleviated tensions in the Portuguese and Spanish bond markets. We found a positive role of the supplementary LTROs for Greece, Portugal and Spain. When it comes to the SMP and the OMT (communication of technical

features of the OMT), both programmes contributed to a decrease in sovereign bond yields for all the countries under consideration. Our results are in line with Falagiarda and Reitz [2015] and Kilponen et al. [2015].

In terms of assessment of the co-movements of sovereign bond yields, negative macroeconomic news about Greece and downgrades of its credit rating led to an increase in the bond yields in the rest of the analysed countries before the announcement of the OMT programme. An analogous conclusion results, among others, from the paper of Beetsma et al. [2013]. In contrast, the spill-over effects were not found in the second subperiod. Moreover, the correlations between the shocks for the pairs Greece-Italy, Greece-Spain and Greece-Portugal, which were high in the first subperiod, turned out to be insignificant in the second subperiod (Table 3). It may imply that the OMT announcement contributed to reducing the contagion in the euro area.

4. Conclusions

The results of the conducted study indicate that the long-term treasury bond yields of the peripheral euro area countries are co-integrated. In particular, the global stability condition is satisfied for the pair Italy-Spain, which may imply that the sovereign bonds of those two countries are treated as close substitutes by investors.

Analysing short-term determinants of sovereign bond yields, a significant impact of macroeconomic and political news, as well as of announcements of credit rating agencies, can be noticed. While in the case of Spain, Italy and Portugal, negative news in one country led to deterioration of bond market in the same country, a significant spill-over of negative news from Greece to the rest of the markets was observed before the OMT announcement.

When it comes to the anti-crisis measures of the ECB, the extension of the list of eligible collateral, the supplementary LTROs and the SMP programme alleviated tensions in the treasury bond markets in the short term, while the influence of the announcement of the OMT programme turned out to have a long term impact. Not only did the negative trends in the bond markets revert, but the sensitivity of the bond markets in Italy, Portugal and Spain declined substantially.

References

Aizenmann J., Binici M., Hutchison, M., 2013, *Credit ratings and the pricing of sovereign debt during the euro crisis*, Oxford Review of Economic Policy, vol. 29, pp. 582-609.

Alsaaka R., Gwilym O., 2013, *Rating agencies' signals during the European sovereign debt crisis. Market impact and spillovers*, Journal of Economic Behavior and Organization, vol. 85, pp. 144-162.

Beetsma R., Giuliodori M., De Jong F., Widijanto D., 2013, *Spread the news: The impact of news on the European sovereign bond markets during the crisis*, Journal of International Money and Finance, vol. 34, pp. 83-101.

Bhanot K., Burns N., Hunter D., Williams M., 2014, *News spillovers from the Greek debt crisis: Impact on the Eurozone financial sector*, Journal of Banking and Finance, vol. 38, pp. 51-63.

De Grauwe P., Ji Y., 2013, *Self-fulfilling crises in the Eurozone: An empirical test*, Journal of International Money and Finance, pp. 15-36.

Draghi M., 2012, *Verbatim of the remarks made by Mario Draghi*, Speech by Mario Draghi, President of the European Central Bank at the Global Investment Conference in London, 26 July 2012.

Elliott G., Rothenberg T.J., Stock J.H., 1996, *Efficient Tests for an Autoregressive Unit Root*, Econometrica, vol. 64, pp. 813-836.

Falagiarda M., Reitz S., 2015, *Announcements of ECB Unconventional Programs: Implications for the sovereign spreads of the stressed euro area countries*, Journal of International Money and Finance, vol. 53, pp. 276-295.

Friedman J.H., Rafsky L.C., 1979, *Multivariate generalizations of the Wald-Wolfowitz and Smirnov two-sample tests*, Annals of Statistics, vol. 7, pp. 697-717.

Grabowski W., Welfe A., 2011, *Global stability of dynamic models*, Economic Modelling, vol. 28, pp. 782-784.

Grabowski W., Stawasz E., 2013, *Programy skupu aktywów Europejskiego Banku Centralnego w dobie kryzysu zadłużeniowego w strefie euro*, Ekonomia Międzynarodowa, vol. 4, pp. 5-21.

Johansen S., 1988, *Statistical analysis of cointegrating vectors*, Journal of Economic Dynamics and Control, vol. 12, pp. 231-254.

Kilponen J., Laakonnen H., Vilmunen J., 2015, *Sovereign Risk, European Crisis Resolution Policies and Bond Spreads*, International Journal of Central Banking, vol. 11, pp. 285-323.

Tse Y.K., Tsui A.K.C., 2002, *A multivariate GARCH Model with Time-Varying Correlations*, Journal of Business and Economic Statistics, vol. 20, pp. 351-362.