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Dynamic Correlations of Sovereign Bond Yield Spreads in the Euro zone and the Role of Credit Rating Agencies' Downgrades

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Abstract

The European debt crisis that followed the global financial crisis, erupting first with Greece, then Ireland, Portugal, Italy and Spain, has threatened the very existence of the Euro zone. In this paper we examine the evolution of dynamic co-movements of sovereign bond yield spreads (BYS) in the Euro zone and the role of credit rating agency downgrades on those co-movements. Estimation results from a multivariate DCC-GARCH model on daily BYS data for nine Euro zone countries over the period 2007-2012 suggest an inverted U-shaped curve of BYS co-movements during the period of the financial and debt crisis. Credit rating downgrades by major rating agencies indicate rather idiosyncratic patterns of government bond yield spreads co-movements within and between the Euro zone periphery and the core.

Keywords: Government bond yield spreads, credit rating agencies, dynamic conditional correlations, Euro zone sovereign debt crisis

JEL codes: C32; E43; G12; G24

1. Introduction

Conventional wisdom suggests that the extent of the Euro zone bond markets' integration has been affected by the latest global financial crisis and Euro zone debt crisis. The dis-integration of the euro area bond markets during the financial and debt crisis has already been mentioned, for example, by Pozzi and Wolswijk (2012). A two-speed Euro zone seems to have been the result of the ongoing crisis, with the highly synchronized bond markets for countries in the Euro zone core on the one hand, and the decoupled bond markets for countries in the periphery on the other.

In addition, the Euro zone sovereign debt crisis has drawn considerable attention to the role of credit rating agencies. Sovereign ratings, especially for countries in the Euro zone periphery, became under persistent downgrade pressure, as a consequence of increased government deficits and debt levels, and sluggish economic growth. The role of credit rating agencies on government bond yields and on financial markets has been studied extensively (see, for instance Afonso et al., 2012; Alsakka and ap Gwilym, 2011; Chiang et al., 2007; Hull et al., 2004, and references therein).

However, empirically, little is known about the extent of government bond yield spreads co-movements in the Euro zone during the latest financial and debt crisis, and the role of credit rating agencies on those BYS co-movements. The extent of Euro zone bond market co-movements merits closer investigation, as it may have serious implications for the cost of financing fiscal deficits, bond portfolio diversification, the modelling and forecasting of long-term interest rates, and monetary policymaking independence.

Among the few relevant studies on BYS co-movements in the Euro zone during the latest crisis are those of Dias (2012), Gilmore et al. (2010) and Boysen-Hogrefe (2013). The former two studies use a minimum spanning tree approach to examine co-movements in government bond yields based on rolling windows. Gilmore et al. (2010) uses monthly data on 10-year government bond yields over the period July 1993 – September 2008 and find an increased correlation between EU bond markets. Dias (2012) examines co-movements of daily 10-year government bond yields between nineteen EU countries over the period of April 2007 – October 2010. The author finds evidence of asynchronization of bond yields in the Euro zone and the formation of two distinct groups of euro countries, namely, those in the periphery and those in the core, with the deepening of the government bond crisis. Boysen-Hogrefe (2013), using a dynamic factor model with time varying loadings over the period January 2007 – May 2012, finds that co-movements between euro zone bond returns in the core were highly synchronized, while bond markets in the periphery have decoupled. The result is attributed to the fact that the latter countries have received full assistance from rescue packages of the EU, European countries, and the IMF.

The aim of this paper is to contribute towards the study of government bond yield spreads synchronization dynamics during the latest financial and Euro zone debt crisis by using a more elaborate measure of government bond yield co-movements. To achieve that, we construct a time-varying measure of sovereign bond yield spread correlations based on the dynamic conditional correlation (DCC) model of Engle (2002), and extend the sample up to 2012. Taking into account both time variation and conditional heterogeneity in BYS correlations, this measure has several advantages compared to other commonly used measures. First, it is able to distinguish negative correlations due to episodes in single years, synchronous behavior during stable years and asynchronous behavior in turbulent years. Second, unlike rolling windows (an alternative way to capture time variability), the proposed measure does not suffer from the so called "ghost features", as the effects of a shock are not reflected in m consecutive periods, with m being the window span. Finally, under the proposed measure there is neither need to set a window span, nor loss of observations, nor subsample estimation required.

Our results are based on daily data over the period March 3, 2007 – June 18, 2012 and suggest an inverted U-shaped curve of sovereign bond yield spreads co-movements during the latest financial and Euro zone debt crisis. In addition, credit rating downgrades by the major credit rating agencies have a heterogenous pattern on sovereign bond yield spread correlations. Specifically, increased bond diversification benefits are evident within the core, and between the periphery and the core, while reduced bond diversification benefits are found within the periphery.

The remainder of the paper is organized as follows. Section 2 discusses the methodology and describes the data used. Section 3 presents the empirical findings, and Section 4 summarizes and concludes the paper.

2. Methodology and Data

Let $y_t = [y_{1t}, y_{2t}, ..., y_{9t}]'$ be a 9×1 vector of government bond yield spreads return series, defined as the first difference between the 10-year government bond yields of nine Euro zone countries, namely Austria, Belgium, France and the Netherlands (ABFN or Euro zone core, hereafter), and Greece, Ireland, Italy, Portugal and Spain (GIIPS or Euro zone periphery, henceforward), and the German government bond yields of the same maturity.[1] Data on sovereign bond yields (in basis points) are obtained from Bloomberg database and the sample ranges from March 3, 2007 to June 18, 2012 (1163 observations), thus covering the turbulent period during the global financial and Euro zone debt-crisis.

Figure 1 shows the evolution of the 10-year government bond yield spreads (raw series) in the ABFN (upper panel) and the GIIPS (middle panel), along with the actual credit rating downgrade events (lower panel) by the three major rating agencies (Standard & Poor's, Moody's and Fitch Rating). According to this figure, an increasing trend emerges until the beginning of 2009 followed by a declining trend till the end of 2009. Thereafter, deteriorating macroeconomic fundamentals in the peripheral countries led to increasing government bond yields spreads in both the peripherals and the core Euro zone countries. In addition, spreads

[1]In this paper, use the terms government bond yield spreads and government bond yield spreads returns interchangeably, unless explicitly mentioned otherwise.

in the Euro zone periphery are, on average, tenfold those found in the Euro zone core. Interestingly, credit rating agencies downgrades seem to be associated with simultaneous increases in BYS in both the periphery and the core Euro zone, a point that we explore further below.

Table 1 presents descriptive statistics of the government BYS series and their first differences in each country. Results for the raw series in Panel A indicate that, on average, BYS are higher in the periphery compared to those in the Euro zone core. The maximum value government bond yield spreads reached was 31.9 basis points in Greece, followed by Portugal (14.81), Ireland (12.16), Spain (5.71) and Italy (5.51). In the remaining countries (the ABFN), BYS did not exceed the 3.55 basis point threshold on any given day during our sample. Moreover, the raw series are found to be non-stationary for each country as the ADF test cannot reject the null hypothesis of a unit root.

Turning to the results obtained for the (stationary) first difference of BYS series in each country, the picture remains qualitatively similar. That is, the Euro zone periphery is experiencing substantially larger changes in BYS than the Eurozone core. Looking at the unconditional correlations of BYS returns we observe that pairwise correlations are higher for countries within each group, that is, within the periphery and within the core than for countries between these two groups. For instance, the highest correlations exist between Italy and Spain (0.8041), Austria and France (0.7357) and Belgium and France (0.7009), while the lowest exist between Greece and the Netherlands (0.1276) and Greece and France (0.1484), suggesting two distinct groups: the one consisting of the countries in the periphery and the other comprising the countries in the Euro zone core.[2]

In order to examine the evolution of co-movement of sovereign government bond yield

[2]However, the correlation between Italy and Spain seem to be an outlier, as the average correlation within the periphery is 0.625, and the respective figure within the core is 0.408.

spreads within and between the periphery and the core, we obtain a time-varying measure of BYS correlations based on the DCC model of Engle (2002). The estimation of the DCC model involves two steps: first, each conditional variance is specified as a univariate Generalized Autoregressive Conditional Heteroskedasticity (GARCH) process and second, the standardized residuals from the first step are used to construct the conditional correlation matrix.

The conditional mean equations are represented by the following reduced-form VAR:

$$A(L)y_t = \varepsilon_t, \quad \text{where} \quad \varepsilon_t|\Omega_{t-1} \sim N(0, H_t), \quad \text{and} \quad t = 1, ..., T \tag{1}$$

where A is a matrix, L the lag operator and ε_t is the vector of innovations based on the information set, Ω, available at time $t-1$. The ε_t vector has the following conditional variance-covariance matrix:

$$H_t = D_t R_t D_t, \tag{2}$$

where $D_t = diag\sqrt{h_{it}}$ is a 9×9 matrix containing the time-varying standard deviations obtained from univariate GARCH models and $R_t = \rho_{ij_t}$ where $i, j = 1, 2, ..., 9$ is the 9×9 matrix comprising the conditional correlations. The standard deviations in matrix D_t follow a univariate process of:

$$h_{it} = \omega_i + \sum_{p=1}^{P_i} \alpha_{ip} \varepsilon_{it-p}^2 + \sum_{q=1}^{Q_i} \beta_{iq} h_{it-q}, \quad \text{for} \quad i = 1, 2, ..., 9. \tag{3}$$

The DCC model of Engle (2002) has the following structure:

$$R_t = Q_t^{*-1} Q_t Q_t^{*-1}, \tag{4}$$

where

$$Q_t = (1 - \sum_{k=1}^{K} a_k - \sum_{l=1}^{L} b_l)\bar{Q} + \sum_{k=1}^{K} a_k(\varepsilon_{t-k}\varepsilon_{t-k}) + \sum_{l=1}^{L} b_l Q_{t-l}, \tag{5}$$

$\bar{Q}$ is the unconditional variance-covariance matrix from estimating the model in equation 3, and Q_t^* is a 9×9 diagonal matrix containing the square root of the diagonal elements of Q_t. Our main focus is on the time-varying conditional correlations $\rho_{ij} = \frac{q_{ij,t}}{\sqrt{q_{ii,t}q_{jj,t}}}$, where $i, j = 1, 2, ..., 9$, in matrix R_t.

The DCC model is estimated using the quasi-maximum likelihood estimator under the multivariate student's t distribution as the normality assumption of the residuals is rejected.

3. Estimation Results

Table 2 reports the results of the DCC model. According to this table, all dynamic conditional correlations are highly significant. Interestingly, the estimated correlations are larger within the core Euro zone (ABFN) countries compared to the countries within the periphery (GIIPS). For example, estimated government bond yield spreads correlations within the core range between 0.63 (Austria and Belgium) and 0.83 (Netherlands and France), while only between 0.23 (Greece and Ireland) and 0.66 (Italy and Spain) within the periphery. Estimated correlation between the core and the periphery vary more substantially between the very low, albeit still significant, 0.18 (Netherlands and Greece) and 0.64 (Belgium and Spain). Put differently, we identify two distinct groups of countries: the one group consisting of the highly synchronized countries in the Euro zone core (with an average within-core correlation of 0.70) and a second group with the relatively less synchronized countries in the Euro zone periphery (with an average within-periphery correlation of 0.40). This result is in line with Dias (2012) and Gilmore et al. (2010). The between periphery and the core average conditional correlations lie in-between the previous two groups with a value of 0.45.

Notice that the DCC model is well specified, as the multivariate versions of the Portmanteau statistic of Hosking (1980) and Li and McLeod (1981) do not reject the null hypothesis of no serial correlation in the standardized and squared-standardized residuals, respectively, for up to 10 lags.

Figure 2 presents the estimated pairwise dynamic conditional correlations from the DCC model within and between countries in the Euro zone periphery and the core. Apart from the large observed heterogeneity in fluctuations, dynamic correlations seem to follow an inverted U-shaped curve. Specifically, correlations reveal an increasing trend since the beginning of our sample; especially since the beginning of the global financial crisis in 2008 (fall of Lehman Brothers), until the beginning of 2010. Thereafter, correlations, on average, gradually declined till the summer of 2012, indicating decoupling effects in the Euro zone bond markets during the ongoing debt crisis.

Given these initial observations of BYS correlation dynamics during the global financial crisis and the Euro zone debt-ridden crisis from Figure 2, we now examine whether (and how) actual credit rating downgrades of Euro zone countries by the major three credit rating agencies exert an influence on dynamic correlations on government bond yield spreads. To accomplish that, we apply a Fisher transformation on the estimated dynamic correlations, $\rho_{ij,t}$, between countries i and j according to $DC_{ij,t} = log((1+\rho_{ij,t})/(1-\rho_{ij,t}))$, so as to ensure our dependent variable is not confined to the interval $[-1,1]$,[3] and estimate panel regressions of the form

$$DC_{ij,t} = \alpha_{ij} + \beta Trend + \gamma CR_{ijm,t} + \epsilon_{ij,t}, \tag{6}$$

where α_{ij} are cross-section fixed-effects, $Trend$ is a linear time trend, CR_t is a dummy variable that is equal to 1 if a credit rating agency downgrades a country's credit rating in our sample, and 0 otherwise. In total, since March 3 2007 and until June 18 2012, there were 74 credit rating downgrades for the countries in our sample from the three agencies. The Netherlands is the only country in our sample that has not been downgraded during the period of our investigation. Among the three rating agencies, Moody's was the most active agency with 35 downgrades, while Fitch and Standard and Poor's had only 20 and 19, respectively.

[3] The results are not sensitive to this transformation though.

Table 3 presents the results of the various forms of model (6). Under Columns (1)-(4) we examine the overall-effects on dynamic conditional correlations of credit rating downgrades. Put differently, we do not differentiate between (or within) the core and the periphery at this point, but rather we ask about the effects on the pairwise correlations in the Euro zone as a whole. According to column (1) of Table 3, credit rating downgrades of Euro zone countries by all three credit rating agencies are, on average, associated with significant reductions in government yield spreads co-movements within the Euro zone. Nevertheless, credit rating downgrades by individual credit rating agencies suggest rather heterogeneous effects on dynamic correlations. Under column (2) we include three dummy variables, i.e. one for each of the three agencies, each of which is equal to 1 if a agency k (where $k = Standard\ \&\ Poor's$, $Moody's$, $Fitch$) downgrades the rating of a country, and 0 otherwise. According to column (2) of Table 3, credit rating downgrades by individual rating agencies have heterogenous effects on BYS co-movements. Specifically, credit rating downgrades by Standard & Poor's and Fitch are associated with a significant decline in BYS co-movements, while downgrades by Moody's lead to a significant, albeit quantitatively small, increase in BYS co-movements within the Euro zone. This results might be attributed to the variation in credit quality assessment by the major rating agencies (see, for instance Hill et al., 2010).

Given these initial results, we now explore whether credit rating downgrades of countries in the periphery or the core have a different outcome on dynamic correlations in the Euro zone. To achieve that, we introduce two dummy variables, CR_{GIIPS} and CR_{ABFN}, which are equal to 1 if any of the three agencies downgraded any of the countries within the periphery and within the core respectively, and 0 otherwise. According to column (3) of Table 3, credit rating downgrades of countries within the periphery and within the core lead to significant declines in dynamic correlations in the Euro zone. These results remain very similar for credit rating downgrades of specific countries by the 3 rating agencies. These results are presented under column (4) of Table 3. Specifically, we find that credit rating downgrades in Greece, Spain, Austria and Belgium lead to a decline in BYS correlations, while in Ireland they lead to an increase in BYS in the Euro zone. For the remaining countries the estimated parameters are not statistically significant. Summing up, there is evidence of decoupling effects in sovereign bond yield spreads in the Euro zone as a whole indicating increased bond diversification benefits in the Euro zone.

However, results on the overall dynamic correlations might mask several empirical regularities specific to each countries group's pairwise correlations. In order to examine whether the impact of credit rating downgrades is different on dynamic correlation within the core, within the periphery, and between the periphery and the core, we repeat the analysis for each of these three groups and present the results under columns (5)-(8), (9)-(12) and (13)-(16), respectively.

These results reveal a more clear-cut pattern. Specifically, credit rating downgrades lead to a reduction of government bond yield spread co-movements within the core (results under columns (5)-(6)) and between the periphery and the core (results under columns (13)-(16)). However, the effects of credit rating downgrades on dynamic correlations within the periphery reveal a rather heterogenous pattern. In particular, credit rating downgrades (on average) lead to an increase in correlations within the periphery. This result holds when we either pool credit rating agencies, CR, under column (9) or even when we include specific dummy variables for each of the three rating agencies under column (10). In the latter case, downgrades by the Fitch rating agency do not have a significant effect on BYS correlations within the periphery. Conversely, credit rating downgrades of countries within the periphery and within the core lead to differentiated effects on the dynamic correlation of BYS within the periphery. In particular, downgrades of countries within the periphery, CR_{GIIPS}, leads to a significant increase in dynamic correlations within the periphery, while downgrades of countries within the core, CR_{ABFN}, lead to a significant decline in dynamic correlations within the periphery (results under column (11)). These results are further supported when we introduce country-specific credit downgrade dummy variables. Specifically, credit rating downgrades of Ireland, Portugal and Spain lead to an increase in BYS co-movements within the periphery, while credit rating downgrades of Austria and Belgium lead to a decline in BYS correlation within the periphery. Estimated parameters for credit rating downgrades of the remaining countries are correctly signed, albeit insignificant.

Summing up, our results reveal an increasing separation of the two groups of Euro zone countries (the highly synchronized core and the relatively less synchronized periphery) with the deepening of the Euro zone debt crisis. Nevertheless, credit rating downgrades by major rating agencies seem to have contributed to closing this gap between these two groups of countries by reducing co-movements of BYS in the former group and increasing BYS co-movements in the latter.

As a robustness analysis, we repeated the estimation with the correlation between contemporaneous sovereign government bond yield spreads and lagged credit rating downgrades announcements, so as to let the announcement materialize in the markets. In addition, leads of the credit rating downgrades variables have been employed as a proxy for watch signals, or announcements of upcoming downgrades by rating agencies,[4] and to account for any possible reverse causality between BYS correlation and credit rating downgrades. Our results remain qualitatively identical.

4. Conclusion

The Euro zone debt crisis that followed the global financial crisis led to extraordinary

[4]Previous studies suggest that outlook and watch signals by rating agencies are at least as important as rating changes in their market impact (see, for instance, Afonso et al., 2012; Hill and Faff, 2010; Sy, 2004; Kaminsky and Schmukler, 2002)

measures by governments and central banks to prevent a potential collapse of the Euro zone. Given the debt crisis was accompanied by a slowdown in economic activity, the impact of fiscal consolidation has been limited, and many Euro zone countries (especially in the periphery) face rising threat to their long-term sustainability. Fears of further fiscal worsening in the periphery, given the degree of interdependencies between the Euro zone periphery and the core, have led international markets start to request higher sovereign risk premia – not only in the Euro zone periphery, but also in the core since the beginning of the debt crisis. Credit rating agencies interventions during the same period might have also contributed to the extend of sovereign bond yield spreads co-movements in the Euro zone.

This paper has examined the extent of dynamic correlations of sovereign bond yield spreads in the Euro zone periphery and the core during the latest global financial and Euro zone debt crisis, along with the role of credit rating agency downgrades on those co-movements. Estimation results from a multivariate DCC-GARCH model on daily BYS data for nine Euro zone countries over the period 2007-2012 suggested an inverted U-shaped curve of BYS co-movements during the period of the financial and debt crisis. In addition, two distinct groups of countries were identified: the one group consisting of the highly synchronized countries in the Euro zone core (with an average within-core correlation of 0.70) and the second group with the relatively less synchronized countries in the Euro zone periphery (with an average within-periphery correlation of 0.40).

Credit rating downgrades by major rating agencies indicated rather idiosyncratic patterns of government bond yield spreads co-movements within and between the Euro zone periphery and the core. Overall, increasing benefits of bond portfolio diversification were identified under the period of our investigation in the Euro zone arising from actual credit rating downgrades by major rating agencies; apart from the case of rating downgrades in the periphery wherein diversification benefits declined.

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Figure 1: Sovereign bond yield spreads and credit rating agencies downgrades

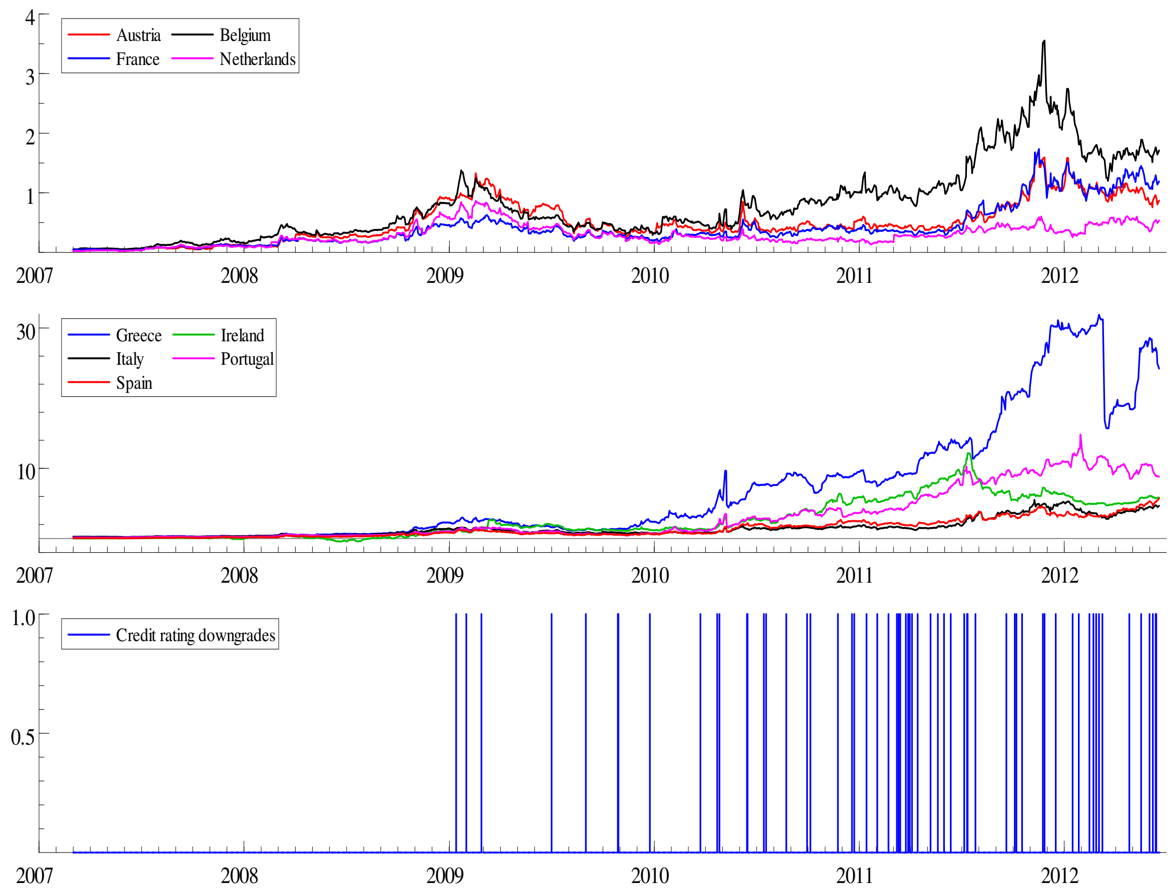
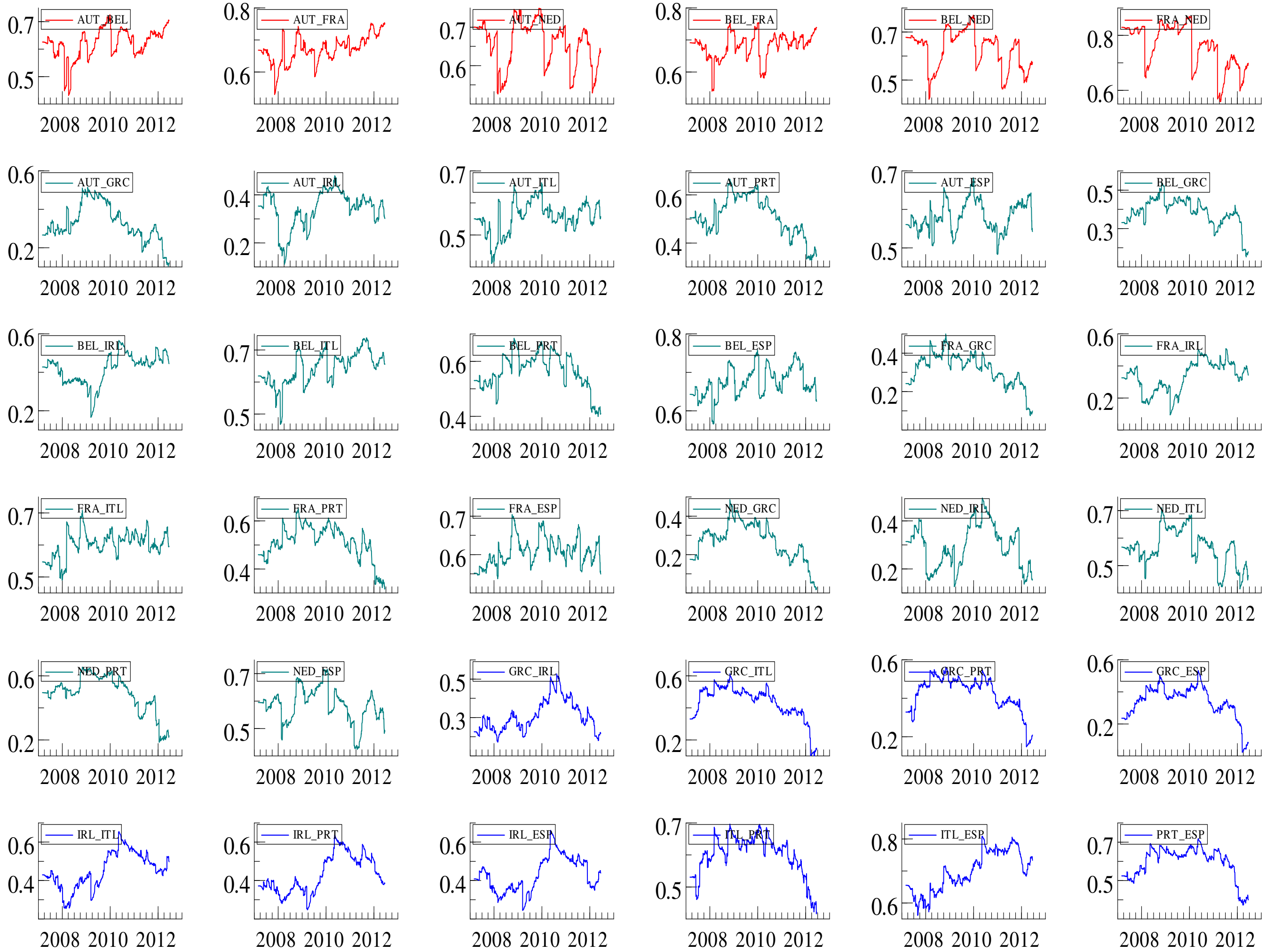


Figure 2: Dynamic conditional correlations



Note: Red, blue and green lines denote pairwise correlations of countries within the core, within the periphery, and between the periphery and the core, respectively.

Table 1: Descriptive statistics of 10-year government bond yield spreads

Panel A: Raw series									
	AUT	BEL	FRA	NED	GRC	IRL	ITL	PRT	ESP
Mean	0.5012	0.7967	0.4145	0.2882	6.8689	2.6463	1.4511	3.0689	1.3752
Std	0.3416	0.6400	0.3454	0.1728	8.5908	2.7256	1.2601	3.6019	1.2915
Min	0.0330	0.0480	0.0300	0.0200	0.2000	-0.4520	0.1880	0.1120	0.0340
Max	1.6920	3.5540	1.7350	0.8650	31.903	12.162	5.5070	14.814	5.7070
ADF	-0.0202	-1.5780	-0.0133	-0.0227	-0.3155	-0.0083	-0.0023	-0.0046	0.0088
Panel B: First differences									
	AUT	BEL	FRA	NED	GRC	IRL	ITL	PRT	ESP
Mean	0.0718	0.1428	0.0985	0.0441	2.0626	0.5015	0.3806	0.7495	0.4871
Std	3.8565	6.2993	3.7670	2.2584	55.605	15.051	9.5969	20.225	9.2338
Min	-25.900	-29.900	-24.200	-12.200	-1440.7	-136.80	-93.700	-238.60	-99.400
Max	35.200	63.400	22.500	17.500	443.20	133.80	66.600	202.70	65.800
ADF	-30.81**	-31.12**	-34.06**	-32.04**	-31.12**	-28.11**	-36.39**	-32.59**	-33.11**
	Unconditional Correlations								
AUT	1.0000								
BEL	0.7006	1.0000							
FRA	0.7357	0.7009	1.0000						
NED	0.5798	0.4676	0.5654	1.0000					
GRC	0.1667	0.2218	0.1484	0.1276	1.0000				
IRL	0.2942	0.4269	0.2872	0.1928	0.2733	1.0000			
ITL	0.5251	0.6932	0.5960	0.4111	0.1963	0.4691	1.0000		
PRT	0.2427	0.3591	0.2635	0.1820	0.2304	0.5311	0.4571	1.0000	
ESP	0.5373	0.6625	0.5462	0.4469	0.2169	0.4794	0.8041	0.4177	1.0000

Note: ADF denotes augmented Dickey Fuller tests with 5% (1%) critical values of -2.86 (-3.44). * and ** indicate significance at 5% and 1% level, respectively.

Table 2: Estimation results of AR(5)-DCC-GARCH model, Period: 3.03.2007–18.06.2012

ρ	AUT	BEL	FRA	NED	GRC	IRL	ITL	PRT
AUT								
BEL	0.6259**							
	(0.0348)							
FRA	0.6682**	0.6912**						
	(0.0330)	(0.0333)						
NED	0.7001**	0.6776**	0.8294**					
	(0.0387)	(0.0395)	(0.0348)					
GRC	0.2668**	0.3314**	0.2416**	0.1751**				
	(0.0431)	(0.0387)	(0.0414)	(0.0436)				
IRL	0.3535**	0.4280**	0.3259**	0.3140**	0.2260**			
	(0.0502)	(0.0464)	(0.0504)	(0.0530)	(0.0477)			
ITL	0.5505**	0.6187**	0.5471**	0.5671**	0.3310**	0.4294**		
	(0.0399)	(0.0345)	(0.0382)	(0.0418)	(0.0446)	(0.0433)		
PRT	0.5054**	0.5303**	0.4592**	0.4953**	0.3284**	0.3723**	0.5306**	
	(0.0400)	(0.0388)	(0.0407)	(0.0410)	(0.0451)	(0.0454)	(0.0373)	
ESP	0.5606**	0.6427**	0.5517**	0.5948**	0.2357**	0.4084**	0.6550**	0.5242**
	(0.0368)	(0.0351)	(0.0382)	(0.0432)	(0.0455)	(0.0449)	(0.0303)	(0.0351)
α				0.0072** (0.0016)				
β				0.9861** (0.0040)				
df				2.3256** (0.0264)				
Log-Lik				-23877.77				
$H(10)$				565.956 [0.76]				
$H^2(10)$				666.859 [0.99]				
$Li-McL(10)$				566.369 [0.75]				
$Li-McL^2(10)$				668.151 [0.99]				

Note: $H(10)$, $H^2(10)$ and $Li-McL(10)$, $Li-McL^2(10)$ are the multivariate Portmanteau statistics of Hosking (1980) and Li and McLeod (1981), respectively, up to 10 lags. Standard Errors in parenthesis and p-values in square brackets. ** and * denote statistical significance at the 1 percent and 5 percent level, respectively.

Table 3: Sovereign bond yield spreads co-movements and credit rating downgrades

	Overall effects				Within-Core effects				Within-Periphery effects				Between Core & Periphery effects			
Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
CR	-0.019**				-0.042**				0.023*				-0.033**			
	0.005				(0.013)				(0.010)				(0.006)			
$CR_{S\&P's}$		-0.030**				-0.102**				0.040*				-0.042**		
		(0.009)				(0.025)				(0.019)				(0.011)		
$CR_{MOODY's}$		0.015*				-0.006				0.050**				0.004		
		(0.007)				(0.019)				(0.013)				(0.008)		
CR_{FITCH}		-0.067**				-0.051*				-0.039				-0.085**		
		(0.009)				(0.024)				(0.021)				(0.011)		
CR_{GIIPS}			-0.018**				-0.048**				0.033**				-0.034**	
			(0.005)				(0.014)				(0.011)				(0.006)	
CR_{ABFN}			-0.058**				-0.003				-0.112**				-0.048**	
			(0.013)				(0.036)				(0.023)				(0.016)	
CR_{GRC}				-0.049**				-0.109**				0.004				-0.056**
				(0.009)				(0.024)				(0.018)				(0.011)
CR_{IRL}				0.043**				0.008				0.119**				0.016
				(0.009)				(0.022)				(0.018)				(0.010)
CR_{ITL}				0.014				0.018				0.009				0.016
				(0.015)				(0.035)				(0.034)				(0.019)
CR_{PRT}				0.004				-0.089*				0.090**				-0.010
				(0.010)				(0.035)				(0.016)				(0.011)
CR_{ESP}				-0.080**				0.009				0.101**				-0.093**
				(0.014)				(0.034)				(0.031)				(0.017)
CR_{AUT}				-0.107**				-0.122				-0.153*				-0.082
				(0.037)				(0.112)				(0.067)				(0.046)
CR_{BEL}				-0.053**				-0.026				-0.086**				-0.045*
				(0.017)				(0.048)				(0.033)				(0.022)
CR_{FRA}				0.017				0.053				-0.015				0.023
				(0.021)				(0.062)				(0.035)				(0.027)
$Trend \times 10^{-3}$	-0.007*	-0.006	-0.006	-0.004	-0.008**	-0.008**	-0.008**	-0.008*	-0.010**	-0.010**	-0.010**	-0.009**	-0.007*	-0.006	-0.006*	-0.005
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
N	41832	41832	41832	41832	41832	41832	41832	41832	41832	41832	41832	41832	41832	41832	41832	41832
R^2	0.772	0.773	0.772	0.773	0.772	0.772	0.772	0.773	0.772	0.772	0.772	0.773	0.772	0.773	0.772	0.773

Notes: In each specification, the dependent variable is the transformed correlation based on the Fisher transformation. All specifications include country-specific effects and time trends. Heteroskedasticity and serial correlation consistent standard errors are reported in parentheses. ***, ** and * denote statistical significance at the 1 percent, 5 percent, and 10 percent level, respectively.