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Temporary Alienation or Lasting Separation? Covered and Government Bond Spread Movements during and after the Crisis of 2007-2009

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Abstract

This study examines the interrelationship of asset swap spreads on government and mortgage covered bonds in Germany, France, Italy, and Spain between 2007 and mid-2014. Using a local least squares estimator with time varying parameters, we find that in all of the four countries under investigation, the pattern of spread movements for these two bond classes underwent significant changes over time. In Germany, where the confidence of market participants in the solidity of public finances appears to be largely unshaken, spreads were driven apart due to “flight to safety” effects in times of turmoil, and drew closer again when the situation steadied. Yet in France, Italy, and Spain, the (partial) erosion of confidence in the sustainability of government debts led to a protracted weakening of the linkage between the spread movements of government and mortgage covered bonds.

Keywords: covered bond spreads, flight to safety, time varying parameter model

1. Introduction

Covered bonds are interest-bearing, dual recourse bonds which are backed by a pool of underlying loans. The cover pools can either consists of commercial or residential mortgage loans, loans to public sector entities, or shipping and aircraft loans that serve as collateral for investors. Covered bondholders benefit from a dual protection in the form of a preferential claim over the cover assets in addition to a claim against the creditworthiness of the issuer itself.

Due to these additional safety layers, covered bonds have, over most of their history, been regarded as close substitutes for government bonds from the respective issuer’s country of residence. In a “well-behaved” market, yields on covered bonds and yields on domestic government bonds of the comparable maturity can hence reasonably be expected to move roughly in parallel as time passes, with a small yield advantage for covered bonds that reflects the residual risk of a joint default by the issuer and the cover pool.

Yet the global financial crisis of 2007-2009, which originated in the U.S. subprime crunch, culminated with the collapse of Lehman Brothers in September 2008, and subsequently transformed into a sovereign debt crisis for some of the countries affected, has left deep marks on global financial markets, abruptly challenging patterns in asset pricing relationships that had been previously taken for granted, as Eichert and Rudolf (2013, p. 71) put it. There are three main reasons to suspect that this diagnosis also holds true for the price relationship between government bonds and covered bonds in the Euro currency area:

- Firstly, in countries with a strong reputation for stable government finances, the yield gap between covered and government-issued bonds can be expected to widen substantially in periods of severe market distress because anxious investors flee riskier assets in favour of (alleged) safe haven investments.
- Secondly, in countries where a protracted turmoil within the financial sector raises the spectre of a possible government default, the formerly imagined safety advantage of government bonds presumably wears out the more obvious the severity of the crisis becomes. In principle, it could even be possible for lenders to remain solvent while their domestic government defaults, particularly if the former are considered “systemically relevant” and thus eligible for capital and/or liquidity support by some supranational entity. On the other hand, it is hard to imagine a sovereign debt crisis not being accompanied by a wave of defaults

in the market for domestic cover assets. Such a situation might instead induce governments to change the legal framework in favour of defaulted borrowers, barring lenders from taking possession of the cover assets and thus passing on any resulting losses to either covered bond issuers or investors. In any case, it is plausible to assume that the resulting uncertainty can be reasonably expected to induce a prolonged decoupling of the yields on otherwise comparable covered and government-issued bonds.

- Thirdly, selective central bank bond purchases aimed at stabilising targeted market segments and resolving banks' refinancing problems in times of crisis almost inevitably impact (or, as critics would have it, "distort") the price relationships prevailing on the market. For the issue addressed here, three distinct asset purchase programmes by the European Central Bank (ECB) deserve particular attention. These are:
  - The first Covered Bond Purchase Programme (CBPP1), lasting from July 2009 through June 2010 and involving a nominal value of € 60bn (source: ECB, 2011).
  - The Securities Market Programme (SMP, May 2010 to February, 2012), leading to the purchase of around € 214bn of government bonds from Greece, Portugal, Spain, Italy, and Ireland (sources: Eser et al., 2012, and ECB, 2013), and,
  - The second Covered Bond Purchase Programme (CBPP2, November 2011 through October 2012), once again amounting to a nominal value of € 60bn (source: ECB, 2012a).

The fact that the ECB has announced a third Covered Bond purchase programme in October 2014 (see ECB, 2014) with a view to stimulating credit supply and averting deflation underscores that (at least) the last-mentioned point will remain very present in the near future.

Against this background, the purpose of this paper is to trace the impact which the recent crisis and the policy measures aimed at its resolution have made on the market's perception of the default risk of covered vis-à-vis government bonds in four European economies (Germany, France, Italy, and Spain). The investigation concentrates on the mortgage-covered segment of the covered bond market because this currently is by far the largest one in terms of outstanding value (see, e.g., European Banking Authority, 2014). More specifically, this paper seeks to answer the following questions:

- Did the long-standing tendency of covered and government bond prices to move in an equidirectional manner over time unravel in the course of the crisis? And if so, was the observed decoupling of these two market segments a short-lived or long-lasting phenomenon?
- Are there any marked differences in the development of pricing patterns for both asset subclasses between the individual countries under investigation?
- How did the unconventional monetary policy measures taken by the European Central Bank in response to the crisis affect risk premia on both sub-markets in the countries involved?

The remainder of this paper is organized as follows: The following section 2 provides a brief review of the relevant literature. The data in use are described and some related descriptive statistics are then presented in Section 3. Section 4 contains a brief description of the statistical model and estimation methods used. The empirical results are presented and commented upon in Section 5. The paper ends with a short summary and some conclusions (section 6).

2. Literature Review

The levels of credit spreads in the bond market, and their movements over time, have been analysed in a considerable number of earlier studies, most of which have focused on the U.S. Examples include Chen (2010), Longstaff, Mithal, and Neis (2005), Elton et al. (2001), Ng and Phelps (2011), as well as Churm and Panigirtzoglou (2005), among others. Most of these studies, however, relate to unsecured bonds issued by corporates or (less frequently) by financial institutions.

Given the size of the covered bond market and its importance for financial market stability, it might come as a surprise that existing empirical investigations of the behaviour of credit spreads in this market are comparatively small in number. Most of the related research focuses on the German *Pfandbrief* market and often centres around the yield gap between *Pfandbriefe* and German government bonds; see, e.g., Bühler and Hies (1998), and Jobst (2006). A predictive model relating the 10 year *Pfandbrief* spread to a number of macroeconomic factors has been developed by Rees (2001), whereas Koziol and Sauerbier (2007), Siewert and Vonhof (2011) as well as Kempf et al. (2012) examine the linkage between *Pfandbrief* spreads and market liquidity measures. Moreover, the effects that both credit risk and market liquidity have on the related markets have been examined by Breger and Stovel (2004) as well as Sünderhauf (2006).

So far, few empirical investigations of the behaviour covered bond spreads on a cross-national basis have been carried out. The contributions by Packer et al. (2007), and Volk and Hillenbrand (2006) give evidence of the significant impact that the issuer's country of residence has on covered bond yields, which can, at least in part, be ascribed to the lack of a common regulation of national covered bond markets in Europe. Another very revealing study in this context is the one by Prokopczuk and Vonhoff (2012) who, on the basis of a large panel dataset, find that cross country differences in asset swap spreads on covered bonds are a lot more pronounced in times of economic turmoil than under stress-free economic conditions.

The current paper builds on this body of research, while shifting attention more towards the various footprints the subprime mortgage crisis of 2007-2009, the subsequent sovereign debt crisis in the peripheral countries of the Euro currency area, and the ECB's crisis management operations have left on the markets for both covered and government bonds.

3. Underlying Data and Descriptive Statistics

The purpose of this empirical investigation is to identify and examine structural changes in the market-implied credit risk of mortgage covered vs. sovereign bonds. To this end, average market credit spreads pertaining to these two asset subclasses are used as a measurement criterion. More specifically, the country-specific iBoxx Mortgage Covered Bond and Sovereign Bond indexes (both being provided by Markit Ltd., a global, financial information company) are used for measuring the performance of the selected covered bond markets. Markit indices are widely used as benchmarks by investors and asset managers. They benefit from multiple-contributor pricing from selected leading financial institutions, which also provide support to the index family in research and trading.

To isolate the credit risk premium from the remaining economic drivers behind the observable index levels, the daily *asset swap spread* of each index segment (covered and sovereign) is gathered for each of the four countries under investigation. In line with Choudry (2008), it can be characterized as follows: An asset swap is a package that combines an interest rate swap with a cash bond, thus transforming the interest rate basis of the bond. Typically, a fixed rate bond will be combined with an interest rate swap in which the bondholder pays fixed and receives floating coupon, the latter of which is a short-term interbank rates such as Euribor/Libor and increased by a spread, which is referred to as the asset swap spread. Its level at any given time reflects the credit risk of the underlying bond relative to the inter-bank credit risk.

For the purpose this investigation, asset swap spreads pertaining to the different iBoxx indexes in use are calculated, in line with Markit (2010, p. 16), by weighting the asset swap spread of each bond included in the index with its corresponding market capitalization and duration:

$$ASW_{Index,t} = \frac{\sum_{i=1}^{N} ASW_{Bond\ i,t} \cdot MV_{i,t} \cdot D_{i,t}}{\sum_{i=1}^{N} MV_{i,t} \cdot D_{i,t}} \tag{1}$$

For the sake of completeness, it must be mentioned that asset swap spreads based on bond market indexes like iBoxx do not constitute a perfect representation of the market's perception of the underlying default risks. This is due to the following reasons: The composition of the indexes may change over time, the constituents of two different members of the index family may differ in terms of duration, and government bonds usually tend to be more actively traded than covered bonds (see Dick-Nielsen et al., 2012). Although all these factors add some "noise" to the data, the above measure is used for this investigation because there simply are no comparable bond market indexes that do not suffer from these ailments.

The database used consists of asset swap spread data for both government bonds and mortgage covered bonds from Germany, France, Italy, and Spain. The sampling period ranges January 1, 2007 to May 28, 2014. In the case of Germany, France, and Spain, this corresponds to 1,914 total observations, each referring to a particular trading day. For Italy, covered bond spread data are only available from January 1, 2009, onwards, which means that in this case, only the period starting at that date could be investigated.

Here and in the following, the level of the mortgage covered bond spread at any trading day *t* are denoted by C., and its change between two subsequent trading days *t* and *t-1* by ΔC_t. Likewise, S_t and ΔS_t, respectively, stand for the level and the day-to-day change in the sovereign bond spread. Country-specific descriptive statistics for these quantities during the sampling period are given below:

Table 1. Descriptive statistics for Germany (all figures shown in basis points)

	S_t	ΔS_t	C_t	ΔC_t	ΔC_t-ΔS_t
Sampling period	Jan 2007-May 2014	Jan 2007-May 2014	Jan 2007-May 2014	Jan 2007-May 2014	Jan 2007-May 2014
Mean	-30.1361	0.0053	13.0236	0.0060	0.0007
Standard Deviation	12.4520	2.2045	22.8227	1.5805	2.2947
Minimum	-69.9200	-21.4400	-29.8400	-16.4500	-26.3100
1% quantile	-59.8452	-5.8910	-15.5486	-3.2122	-5.0274
5% quantile	-51.2120	-3.1600	-14.5230	-1.6170	-2.8800
10% quantile	-45.8960	-2.1200	-13.6620	-1.1570	-1.9600
25% quantile	-40.0200	-0.9900	-3.1600	-0.5400	-0.8500
Median	-28.4700	-0.0400	12.3500	-0.0250	-0.0200
75% quantile	-21.0650	0.9600	20.2350	0.5300	0.7900
90% quantile	-14.4740	2.2070	45.7100	1.1900	1.8400
95% quantile	-12.0750	3.2070	59.7910	1.7570	2.9800
99% quantile	0.1808	5.3400	84.3822	3.3948	6.2435
Maximum	7.2300	23.3800	89.2000	17.7700	25.0800

Table 2. Descriptive statistics for France (all figures shown in basis points)

	S_t	ΔS_t	C_t	ΔC_t	ΔC_t-ΔS_t
Sampling period	Jan 2007-May 2014	Jan 2007-May 2014	Jan 2007-May 2014	Jan 2007-May 2014	Jan 2007-May 2014
Mean	11.1880	0.0261	46.5485	0.0147	-0.0114
Standard Deviation	33.8065	4.6297	42.4188	6.2146	4.9229
Minimum	-51.5200	-108.5000	-21.1300	-138.3600	-57.6500
1% quantile	-39.4962	-9.6411	-11.6800	-4.0654	-8.9948
5% quantile	-35.5130	-4.4040	-10.2230	-1.9870	-4.6635
10% quantile	-32.6660	-2.7900	-9.0500	-1.3400	-2.7440
25% quantile	-21.5150	-1.1700	19.2400	-0.6500	-1.0700
Median	5.5800	-0.0500	41.2500	-0.0500	0.0150
75% quantile	32.3700	1.1400	65.0450	0.6000	1.0500
90% quantile	57.7340	2.9600	113.8540	1.3870	2.5170
95% quantile	75.3560	4.8905	127.6660	2.1435	4.0700
99% quantile	93.3026	8.9749	154.7516	5.1731	11.3419
Maximum	128.5400	105.6000	162.8500	143.0700	58.1200

Table 3. Descriptive statistics for Italy (all figures shown in basis points)

	S_t	ΔS_t	C_t	ΔC_t	ΔC_t-ΔS_t
Sampling period	Jan 2007-May 2014	Jan 2007-May 2014	Jan 2009-May 2014	Jan 2009-May 2014	Jan 2009-May 2014
Mean	135.5454	0.0779	153.8290	0.0138	-0.0266
Standard Deviation	117.5566	6.8043	90.3119	3.0730	6.6081
Minimum	-16.2000	-55.2600	35.7100	-46.9800	-38.8400
1% quantile	-14.0316	-21.6083	40.7100	-6.5705	-17.4915
5% quantile	-10.3420	-9.3440	47.7400	-3.2720	-10.4610
10% quantile	-6.6440	-5.6900	52.9000	-2.2400	-6.8610
25% quantile	43.7800	-2.1600	90.3500	-0.9700	-3.1200
Median	119.7900	-0.1000	128.8200	-0.1400	0.1200
75% quantile	227.0350	2.3675	212.4800	0.8425	2.7625
90% quantile	304.9380	6.3440	300.9500	2.2320	6.2690
95% quantile	359.9090	10.0425	326.8600	3.7260	9.7010
99% quantile	394.1364	20.2966	387.6800	7.4937	20.8805
Maximum	445.4200	56.9800	392.2000	46.9100	44.4200

Table 4. Descriptive statistics for Spain (all figures shown in basis points)

	S_t	ΔS_t	C_t	ΔC_t	ΔC_t-ΔS_t
Sampling period	Jan 2007-May 2014	Jan 2007-May 2014	Jan 2007-May 2014	Jan 2007-May 2014	Jan 2007-May 2014
Mean	132.7517	0.0805	187.5043	0.0634	-0.0171
Standard Deviation	135.0054	9.0835	135.9189	8.5923	7.3306
Minimum	-38.9800	-179.9200	-4.4400	-227.4500	-114.7900
1% quantile	-35.5186	-22.4036	-3.3686	-6.5787	-16.9787
5% quantile	-31.6660	-9.9650	-2.1100	-3.2505	-9.8870
10% quantile	-26.5680	-6.5140	10.1040	-2.1200	-6.3310
25% quantile	6.7050	-2.0275	81.5700	-0.9575	-2.2600
Median	136.7300	-0.0400	173.7400	0.0050	0.0600
75% quantile	240.3900	2.4550	278.0600	0.9075	1.9900
90% quantile	323.1540	6.8180	387.3420	2.3170	5.8500
95% quantile	373.4290	11.0670	438.5060	3.6735	9.3300
99% quantile	439.3422	21.9353	506.5206	7.6157	19.8074
Maximum	509.2500	180.4300	527.0600	227.2000	118.8700

4. Empirical Methodology

4.1 The Regression Equation

In order to capture a possible, temporary or permanent divergence of the risk premia associated with governments bonds and mortgage-covered bonds from the same country, a linear regression model with time varying coefficients is used. In the following, ΔC_t denotes the change in the asset swap spreads on covered bonds between two subsequent trading days *t* and *t-1*, and ΔS_t stands for the change in the sovereign bond spread in the related country during the same period. Then, the regression equation by which the co-movement, or the permanent or temporary drifting apart of these two quantities is being modeled, reads:

$$\Delta C_t - \Delta S_t = \alpha(t) + \beta(t) \cdot \Delta S_t + \varepsilon_t \tag{2}$$

where the error terms ε_t are mutually independent with $E(\varepsilon_t) = E(\varepsilon_t \mid \Delta S_t) = 0$. This specification, which may appear somewhat peculiar at first sight, is chosen because at least some of the possible parameter constellations it permits lend themselves to a straightforward interpretation:

- In periods where neither *α(t)* nor *β(t)* differs significantly from zero, covered bond spreads and sovereign spreads tend to move in an essentially parallel manner, disturbed only by the realizations of the error term ε_t This is the state one would expect to prevail if the risk content of both bond classes and the risk appetite (or risk aversion) of investors remained unchanged over time.
- Values of *β(t)* that are significantly below zero but greater than (-1) would imply that, at the particular point *t* in time, an increase in the sovereign spread tends to be accompanied by an equidirectional, but less pronounced change in mortgage-covered bond spreads. Economically, such an observation implies that as the market-implied default risk of the sovereign increases, the perceived "safe haven" property of government bonds gradually tends to wear out.
- Values of *β(t)* that do not significantly differ from (-1) indicate that at the time of measurement, mortgage-covered bond spreads have completely decoupled (because in this case, equation (2) would just boil down to $\Delta C_t = \alpha(t) + \varepsilon_t$).
- Values of *β(t)* that lie significantly below (-1) suggest countervailing movements of sovereign and mortgage-covered bond spreads
- A value of *α(t)* that significantly exceeds zero implies that the market-implied default risk of mortgage-covered bonds, relative to sovereign bonds with the same country of origin, has increased by a larger amount than the concurrent move in the sovereign bond spread would have led one to expect.
- Likewise, a value of *α(t)* that is significantly below zero indicates that the market-implied default risk of sovereign bonds, as compared to mortgage-covered bonds from the same country of origin, has decreased further than suggested by the simultaneous change in the covered bond spread.

By examining the developments of the regression coefficients in (2) over time, it is possible to discern different "régimes" as to the relationship between mortgage-covered and sovereign bond spreads, and, perhaps, to trace them back to evolving or already completed changes in the underlying economic fundamentals. The following subsection deals with the estimation method applied for this purpose.

4.2 Estimation Method: Locally Weighted Least Squares

For the functions *α(t)* and *β(t)*, which describe the development of the regression coefficients over time, no particular form has been specified. Rather, it will only be assumed in this paper that these functions are smooth, so that, for every particularly value t_0 of *t*, they can be approximated by a constant in a reasonably chosen neighbourhood of t_0, In the following, the parameter *h,* referred to as the bandwidth, stands for the size of this neighbourhood, and the so-called kernel function *K()* denotes a non-negative weight function. (Here and in the remainder of this subsection, the description closely follows Fan et al. (2003). The local regression technique described, *inter alia*, by Fan and Gijbels (1996), consists of finding estimates $\alpha(t_0)$ and $\beta(t_0)$ for each of the possible values t_0 of *t* by minimizing the locally weighted least-squares criterion function

$$\sum_{t=1}^{T}\left(\Delta C_t - \Delta S_t - \widetilde{\alpha}(t_0) + \widetilde{\beta}(t_0)\cdot \Delta S_t\right)^2 K_h(t-t_0) \tag{3}$$

where $K_h(\cdot) = K(\cdot/h)/h$, with respect to parameters $\widetilde{\alpha}(t_0)$ and $\beta(t_0)$. In the particular context, we choose *K()* to have one-sided support ranging from minus infinity to zero, to reflect the fact that between two observation times only past data can be used for predictive purposes. More specifically, we set *K()* to

$$K(t-t_0) = \begin{cases} \phi((t_0-t)/h) & \text{if } t_0 \geq t \\ 0 & \text{otherwise} \end{cases} \tag{4}$$

Here, $\phi(\cdot)$ denotes the density function of the Standard Normal distribution. This choice is only one of several possible forms for the kernel function (see Cleveland & Devlin, 1988, for an overview), but experience suggests that the particular form of the kernel function chosen usually does not significantly affect the estimation process.

Then, the locally weighted least squares estimators of $\alpha(t_0)$ and $\beta(t_0)$, denoted by $\hat{\alpha}(t_0)$ and $\hat{\beta}(t_0)$, are the minimizers of the weighted least-squares criterion (3).

4.3 Bandwidth Selection

The bandwidth *h* equation (3) determines how quickly the weights of the past observations decrease as the distance from the reference date t_0 grows. In cases where *h* is “too small”, the resulting parameter estimates tend to “fit the noise”, i.e. to be too sensitive to the specific realizations of the random influences present in the data, to possess excessive variance, and to be poorly generalizable. On the other hand, choosing *h* to be “too large” will cause important features in the unknown, true functions $\alpha(t)$ and $\beta(t)$ to go unnoticed. In the context of this investigation, the proposed solution to this dilemma is to follow Härdle (1990, section 5.1.1.) in choosing the “optimal” value h^* of *h* in such a way that it minimizes the “leave-one-out criterion”

$$h^* = \arg\min_h \sum_{t_0}\sum_{\substack{t=1\\t<t_0}}^{T}\left(\Delta C_t - \Delta S_t - \widetilde{\alpha}(t_0) + \widetilde{\beta}(t_0)\cdot \Delta S_t\right)^2 K_h(t-t_0) \tag{5}$$

The intuition behind this decision criterion is that a reasonable choice of *h* should be the one that best predicts the dependent variable (ΔC_{t0}-ΔS_{t0}) by using only observations from the past ($t < t_0$).

4.4 Standard Errors and Estimated Confidence Intervals

Assuming that the sample size is large enough for the coefficient estimates to be approximately normally distributed, the estimated standard errors $\alpha(t)$ and $\beta(t)$ can be used to calculate asymptotic confidence intervals for these coefficient estimates, and to assess whether or not they are sufficiently distant from certain reference values (e.g. zero or minus one in the cases discussed above) to support (or reject) the hypotheses associated with such an observation. Since the regression (3) is merely a special case of the weighed least squares estimation technique (see, e.g. Gouriéroux and Monfort, section 8.3.), the related asymptotic properties apply. The formulas for standard errors can thus be adopted from p. 115 of Fan and Gijbels (1996). Throughout the following discussion of the estimation results, a parameter estimate is considered significantly different from a reference value *v* if *v* lies outside the surrounding two-sided 95% confidence interval.

5. Results

5.1 Germany

The time paths of the parameter estimates for Germany, along with the related 95% confidence intervals (CI), are displayed in Figures 1 and 2 and supplemented by the descriptive statistics of Table 5. The estimated intercept term $\hat{\alpha}(t)$ hovers close to zero during most of the sampling period, being significantly different from zero for only 20.87% of the observations. In contrast, $\hat{\beta}(t)$ floats mostly between 0 and (-1), being significantly below zero on 96.12% and significantly greater than (-1) on of 86.37% the observed trading days. Only for a 19 out of 1,914 trading days in our sample, we find values of $\hat{\beta}(t)$ that are significantly below (-1).

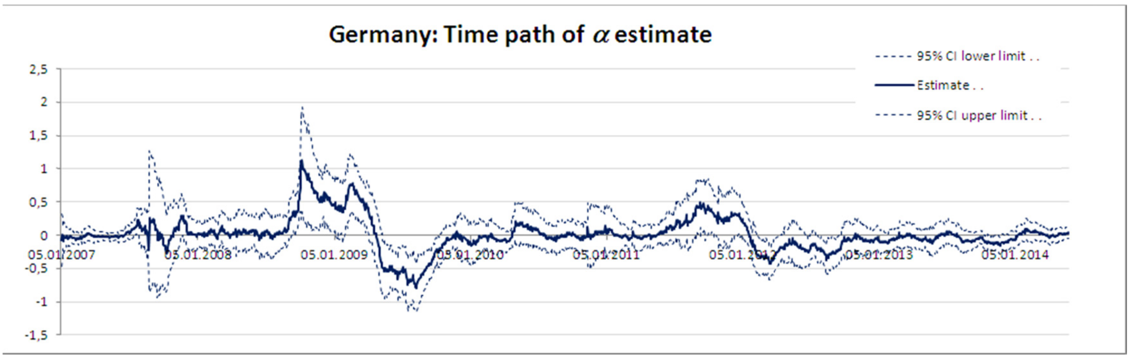

Figure 1. Estimate of intercept parameter (α) over time (Germany)

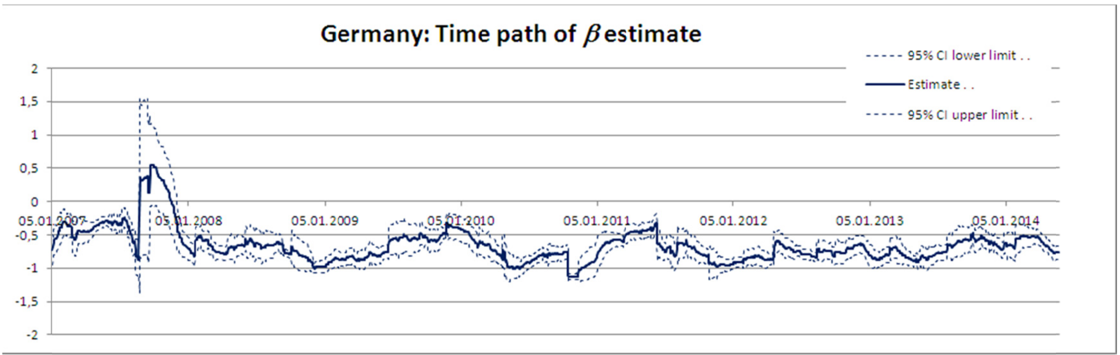

Figure 2. Estimate of slope parameter (β) over time (Germany)

The above findings indicate that over most of the sampling period, movements in asset swap spreads on government and mortgage-covered bonds tended to be equidirectional, but far from parallel. The presumption that a higher market-implied default risk of the sovereign, all else being equal, tends to lead to a gradual alignment of sovereign and mortgage-covered debt spreads, is therefore broadly supported by the results.

Table 5. Descriptive statistics of parameter estimates: Germany

	$\hat{\alpha}(t)$	$\hat{\beta}(t)$
Mean	0.0092729	-0.6586089
Standard Deviation	0.2498818	0.2543442
Minimum	-0.7957117	-1.1271055
1% quantile	-0.6696225	-1.1205117
5% quantile	-0.4323467	-0.9602193
10% quantile	-0.2374854	-0.9080585
25% quantile	-0.0813331	-0.8178177
Median	-0.0128698	-0.6930416
75% quantile	0.0668936	-0.5660334
90% quantile	0.3004117	-0.3966619
95% quantile	0.4911007	-0.3078592
99% quantile	0.8021758	0.3762238
Maximum	1.1353142	0.5532191

Moreover, the time path of the coefficient estimate of the intercept term $\hat{\alpha}(t)$ indicates two marked, yet temporary shifts in the market-implied relative default risk of mortgage-covered bonds as compared to government bonds, both of which were, however, reversed as time passed. The first of these shifts, indicated by the sharp upward move in $\hat{\alpha}(t)$ around mid-September 2008, coincides with escalation of the world financial crisis close to that that time. It is a clear indication of investors' growing distrust in the banking sector, and their subsequent flight to the perceived safety of German government bonds, which prevailed at that time. Towards the end of the second quarter of 2009, the combined effects of the state-initiated bank rescue packages and the nonstandard liquidity support measures taken by central banks began to take hold. On the part of the ECB, these measures included its first Covered Bond Purchase Programme (CBPP1) amounting to a nominal value EUR 60 billion (see ECB, 2010). As a consequence, the gap between mortgage-backed and government bond spreads began to narrow again, as is indicated by the significantly negative values of $\hat{\alpha}(t)$ during that period.

A second, yet less pronounced development of this kind took place between early August 2011 and September 2012: In a first phase, lasting until early January 2012, mounting fears about the sustainability of government debt in some Eurozone member countries temporarily drove the spread levels of German government and mortgage-covered bonds apart. This trend, too, was reversed, due to an agreement by the world's leading central banks to provide global financial markets with additional liquidity which included a second EUR 60-billion covered bond purchase programme by the ECB initiated in November 2011 (see ECB, 2012a).

Altogether, there appears to be no conclusive evidence of a permanent decoupling of mortgage-covered and government bond spreads in Germany. The temporary divergence in two critical phases of our sampling periods primarily appears to be a symptom of a momentary flight to safety by investors and a subsequent return to normality once confidence was restored. The following sections will centre around the question of whether a comparable pattern can also be found in France, Spain, and Italy.

5.2 France

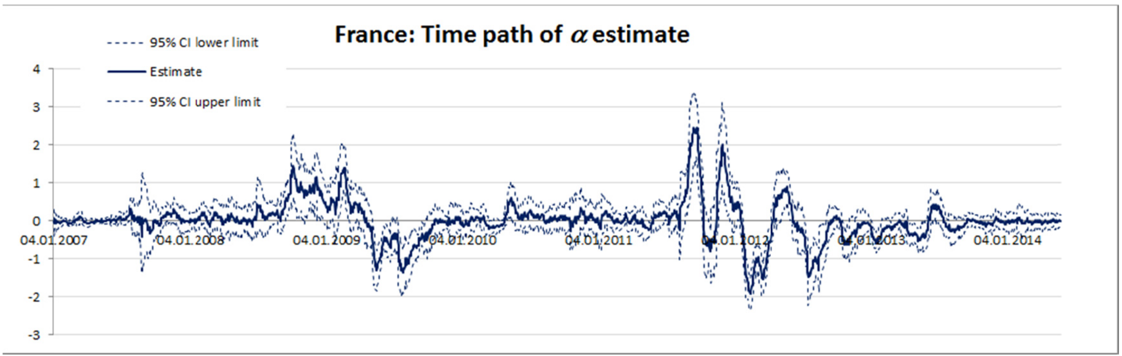

Figure 3. Estimate of intercept parameter (α) over time (France)

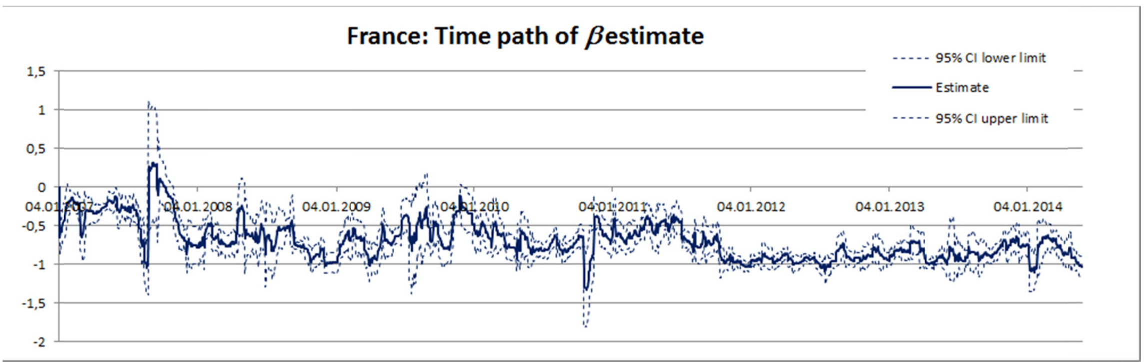

Figure 4. Estimate of slope parameter (β) over time (France)

In the case of France, the intercept estimate $\hat{\alpha}(t)$ moves a lot more erratically than in Germany, as is evidenced by the related descriptive statistics in Table 6. The percentage of related estimates that differs significantly from zero amounts to 24.55%, hence exceeding the corresponding value for Germany, yet without being conspicuously high in comparison. Like in Germany, $\hat{\beta}(t)$ is significantly below zero most of the time (frequency: 95.85%), but the percentage of observations where this parameter is significantly above (-1) is recognizably lower (69.3%) than in the case of its eastern neighbour. The development of the parameter estimates over the sampling period is displayed in Figures 3 and 4.

Table 6. Descriptive statistics of parameter estimates: France

	$\hat{\alpha}(t)$	$\hat{\beta}(t)$
Mean	0.0074013	-0.6932074
Standard Deviation	0.5153628	0.2485374
Minimum	-1.9216747	-1.3310547
1% quantile	-1.4534015	-1.0615026
5% quantile	-0.9765465	-0.9902325
10% quantile	-0.5258510	-0.9594615
25% quantile	-0.1338951	-0.8818368
Median	-0.0026240	-0.7270904
75% quantile	0.1436676	-0.5669593
90% quantile	0.5143279	-0.3188787
95% quantile	0.8443612	-0.2372818
99% quantile	1.7827951	0.0912086
Maximum	2.4545304	0.3219327

In a first phase of the sampling period, lasting from January 2007 through August 2011, the movement patterns of the coefficient estimates in France broadly resemble the ones observed in Germany: $\hat{\beta}(t)$ remains in the interval [-1; 0] over most of this sub-period, while $\hat{\alpha}(t)$ stays close to zero until, in autumn 2008, the events surrounding the "Lehman shock" drive it to new highs, reflecting, once again, the „flight to safety" effect sketched above. Subsequently, the combined impact of the fiscal and monetary policy measures, last but not least CBPP1, reverse this impulse, first driving $\hat{\alpha}(t)$ sharply into the negative and eventually leading to a temporary restoration of the relative calm prevailing before September 2008.

The rather close resemblance between the examined spread movement patterns came to an abrupt end as the fears about the possibility of sovereign defaults in one or more of the "peripheral" member states of the Eurozone (Greece, Ireland, Italy, Portugal, and Spain, or GIIPS) grew in July, 2011. The sharp upward jump in $\hat{\alpha}(t)$ at the beginning of this sub-period presumably reflect the large extent to which French banks used to be exposed to the default risk of the GIIPS governments and financial institutions - particularly from Greece - at that time (see, e.g., Curley, 2012; Daneshkhu, 2012). The second, massive wave of government bond purchases conducted by the ECB (roughly between August, 2011 and January, 2012; see Trebesch & Zettelmeyer, 2013, p. 40) in the course of its SMP programme appears to have brought a rather short-lived and incomplete relief from these tensions, as the sharp and very erratic movements in the $\hat{\alpha}(t)$ in that period of time suggest. Apparently, it is not until the effects of CBPP2 begin to materialise near the end of 2011 that $\hat{\alpha}(t)$ first declines and then becomes negative for a period of about ten weeks following January 27, 2012. Yet because of French banks' considerable exposure to neighbouring Spain, $\hat{\alpha}(t)$ briefly shot back up into the positive terrain in June 2012, when that country faced difficulty in accessing bond markets (Traynor & Watt, 2012).

The behaviour of $\hat{\beta}(t)$ during the months following August, 2011, is (at least) just as telling. During most of the time span between November 2011 and the end of the sampling period, $\hat{\beta}(t)$ hovers closely to (-1), indicating a protracted weakening, or even a near-complete break-up of the previously observed linkage between the spread levels for mortgage-covered and government bonds. A plausible explanation for this phenomenon is that in France, the huge transfer of private sector risk to the public sector that occurred in the course of the state-sponsored rescue packages has led to an erosion of the perceived safety advantage of government debt over covered bonds. As a consequence, the solvency of both the government and the financial sector have nowadays become significantly dependent on the continuing readiness (and ability) of the European Central Bank "to do whatever it takes to preserve the euro", as ECB President Mario Draghi put it at the Global Investment Conference in London on July 26, 2012 (see ECB, 2012b), shortly before announcing the Outright Monetary Transactions (OMT) programme allowing for (theoretically) unlimited purchases of Eurozone sovereign bonds in the secondary market if needed.

5.3 Italy

The results obtained for Italy can only be compared to those of the other countries with a great deal of reservation. The reason is that the available time series of the mortgage-covered bond spreads for Italy only begins in January 2009 and hence fails to cover the events preceding and immediately following the collapse of Lehman Brothers in October 2008.

Within this more restricted time frame the intercept estimate $\hat{\alpha}(t)$ moves a lot more erratically than in Germany, as is evidenced by the related descriptive statistics in Table 7. The percentage of related estimates that differs significantly from zero (38.22%) is higher than the corresponding values for France and Germany. During most of the sampling period (i.e. for 97.08% of all observations) $\hat{\beta}(t)$ is significantly smaller than zero. At the same time, the share of observations for which $\hat{\beta}(t)$ significantly exceeds (-1) is recognizably lower (58.05%) than in the cases of Germany and France. Figures 5 and 6 show time paths of the parameter estimates.

From the beginning of the sampling period until (roughly) the end of the fourth quarter of 2011, the $\hat{\beta}(t)$ estimates mostly vary between (-1) and (-0.5), with some sharp, yet short-lived upward and downward movements. The link between the changes in government and mortgage covered bond spreads is rather weak from the very start of the sampling period. From early 2012 onwards, as $\hat{\beta}(t)$ almost stabilises at a level only slightly above (-1), the formerly weak inter-relation between the spread moves for both bond types almost ceases to exist.

Table 7. Descriptive statistics of parameter estimates: Italy

	$\hat{\alpha}(t)$	$\hat{\beta}(t)$
Mean	0.0177101	-0.8493033
Standard Deviation	1.0582382	0,1478758
Minimum	-3.8181818	-1.2421997
1% quantile	-3.0672686	-1.1044204
5% quantile	-1.6367291	-1.0171059
10% quantile	-1.1326746	-0.9687931
25% quantile	-0.5472121	-0.9270576
Median	-0.0749905	-0.8751015
75% quantile	0.4233314	-0.8150835
90% quantile	1.1563210	-0.7226043
95% quantile	1.7724497	-0.5612439
99% quantile	3.5112617	-0,1868447
Maximum	4.5521960	-0,0477611

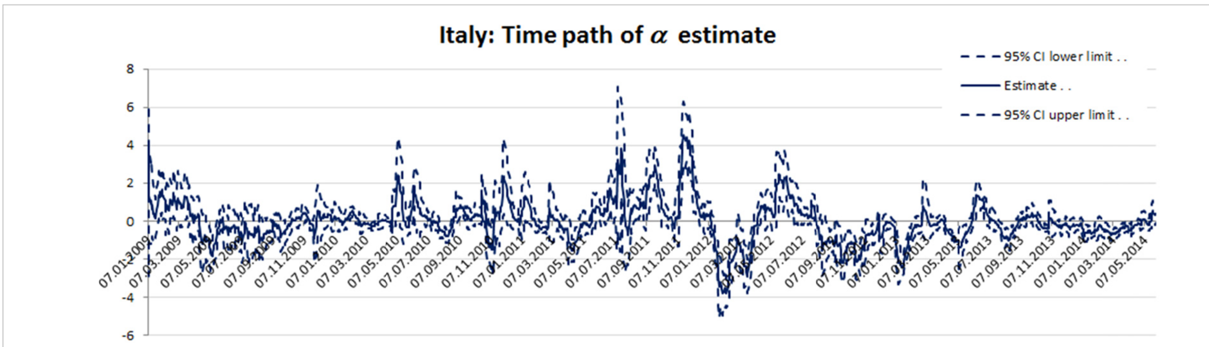

Figure 5. Estimate of intercept parameter (α) over time (Italy)

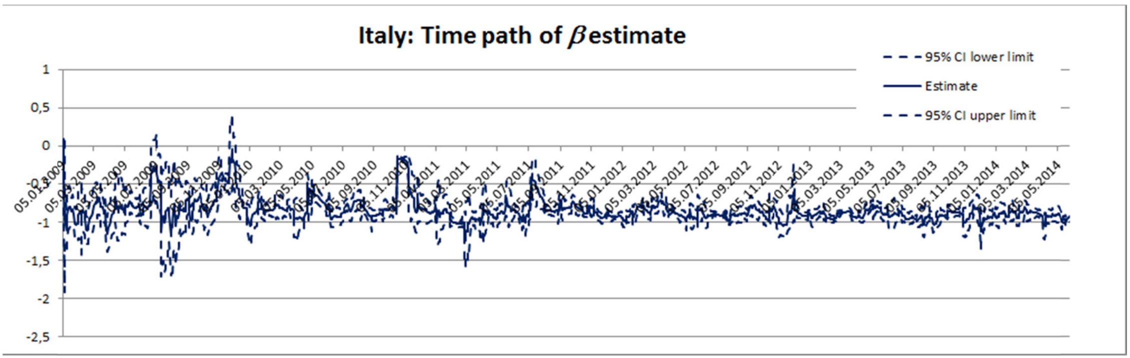

Figure 6. Estimate of slope parameter (*β*) over time (Italy)

The time path of the $\hat{\alpha}(t)$ estimates in the first two months of 2009 suggests that some of the after-effects of the Lehman collapse and the subsequent market turmoil were also felt in the Italian banking sector; yet the late beginning of the sampling period does not allow any substantive conclusions about the relative strength of any "flight-to-safety" effect that may have occurred. The subsequent slide of $\hat{\alpha}(t)$ into negative territory in May, which can be ascribed to the crisis management by governments and by central banks, is a lot more short-lived than in the cases of France and Germany. The CBPP1 programme, however, seems to have had only a very limited impact on Italian covered bond spreads, as the mostly insignificant estimates of $\hat{\alpha}(t)$ at that time indicate. This phenomenon may be due to the fact that, according to Beirne et al. (2011), the Italian covered bond market saw a significant increase in the number of issuers and outstanding amounts during the life of CBPP1, which may well have compensated most of the demand effects of the ECB's purchases. The two sharp peaks of $\hat{\alpha}(t)$ observed in May and June, 2010, are associated with the announcement and subsequent commencement of the ECB's Security Market Programme (SMP) at that time. Although the ECB's bond purchases during this first phase of the SMP focused on Greek, Irish, and Portugese debt (see Hume, 2010), the mere anticipation thus aroused that the ECB would be able and willing to step in to ease the interest burden of financially troubled sovereign borrowers seems to have brought at least a short-lived improvement in the market's perception of the relative default risk of Italian government debt.

During the twelve months following events, $\hat{\alpha}(t)$ moved in a rather unsteady manner as it became increasingly obvious that the recovery from the great recession of 2008/09 was short-lived, and that the quality of bank assets had worsened substantially (see, e.g., International Monetary Fund, 2013). The situation took another dramatic turn as Italy got drawn into the Eurozone sovereign debt crisis in July 2011. As Jones (2012) points out, the market participants' increased distrust in the European leaders' efforts to manage the sovereign debt crisis had been fuelled by the bitter struggles between them during the negotiations for the second Greek bailout package. Besides, the outcome of the second round of stress test by the European Banking Authority strengthened existing fears that the European financial system as a whole was still ailing (see, e.g., Onado, 2011). The first upward jolt in $\hat{\alpha}(t)$ during June and July, 2011, can probably be ascribed to this constellation.

The ECB's policy reaction to this escalation of the Eurozone sovereign debt crisis was to reactivate the SMP on August 7, 2011 (see ECB, 2011), thus initiating a second wave of sovereign bond purchases, which lasted until December 2011 and, according to Chaturvedi et al. (2011), mainly involved Spanish and Italian debt. This move led to sharp declines in the risk premium on sovereign relatively to mortgage covered bonds, and find its expression in the two vehement upward jumps in $\hat{\alpha}(t)$ in this time period. It was however, subsequently overcompensated by the effects of CBPP2, which drove $\hat{\alpha}(t)$ far into negative terrain for more than 8 weeks from mid-January, 2012.

Yet the relief brought about by these measures, too, proved to be temporary. On 12 April, Italian borrowing costs increased in a sign of fresh concerns among investors about the country's ability to reduce its high levels of debt. In mid-April 2012, the Italian government shocked markets by reducing its growth forecast for the year from minus 0.4% down to minus 1.2%, and declaring that it would not be able to balance its budget by 2013, thus re-awakening fears that the country's sovereign debt burden might turn out to be unsustainable (source: BBC News, 2012). Concerns about the negative impact this would have on the asset quality of Italian lenders, and about their ease of access to market funding, caused rating agency Moody's to downgrade the long-term debt and deposit and ratings of 26 Italian banks in May, 2012, by one to four notches (source: Moody's Investors Service, 2012). In the time path of the coefficient estimates presented here, these events are reflected in a sharp increase in $\hat{\alpha}(t)$, which was subsequently reversed in the aftermath of the announcement of the OMT programme by ECB president Mario Draghi during the last week of July.

5.4 Spain

For Spain, the estimated intercept parameter $\hat{\alpha}(t)$ hovers closely to zero until early 2009, then starts to move in a protracted series of sharp and apparently erratic upward and downward jumps, and finally returns to relative calm during the last twelve months of the sampling period (see Figure 7). 44.89% of all $\hat{\alpha}(t)$ estimates differ significantly from zero, which by far outstrips the percentages obtained for Germany and France. $\hat{\beta}(t)$ is significantly less than zero for almost all (98.11%) of the sampling period and significantly higher than (-1) in 76.06% of all cases, putting the country in between France and Germany. During the first three-and-a-half years of the sampling period, it mostly moves between (-1) and 0 in large jumps, before drawing closer to (-1) in the second half of 2011 and moving slightly above that level, yet with smaller fluctuations, for most of the remaining sampling period.

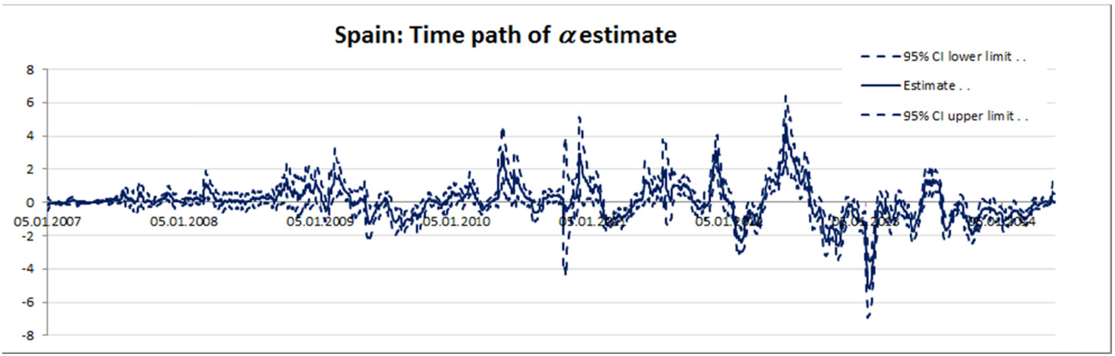

Figure 7: Estimate of intercept parameter (α) over time (Spain)

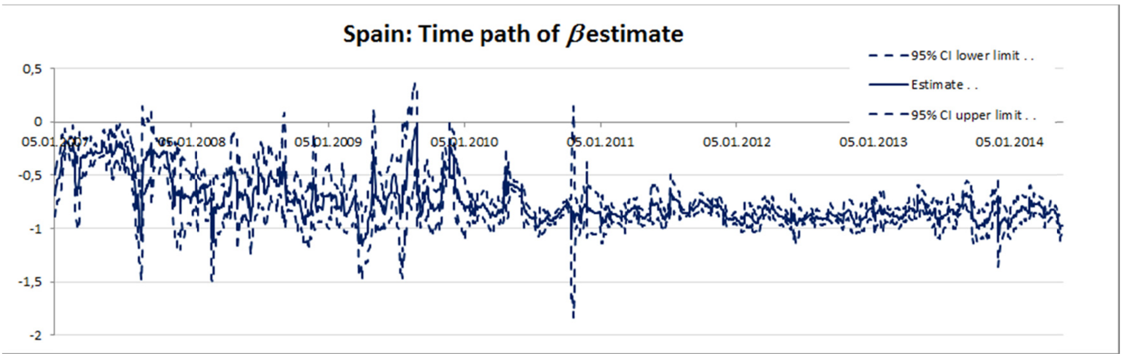

Figure 8. Estimate of slope parameter (β) over time (Spain)

Table 8. Descriptive statistics of parameter estimates: Spain

	$\hat{\alpha}(t)$	$\hat{\beta}(t)$
Mean	0.0239417	-0.7483189
Standard Deviation	1.0156086	0.2019283
Minimum	-5.1935930	-1.1646361
1% quantile	-2.5988198	-1.0607729
5% quantile	-1.5529219	-0.9548450
10% quantile	-1.0933956	-0.9248340
25% quantile	-0.4912764	-0.8819153
Median	0.0467334	-0.8138243
75% quantile	0.4778707	-0.6853961
90% quantile	1.1360244	-0.3607758
95% quantile	1.5689363	-0.2835506
99% quantile	2.9509387	-0.2008364
Maximum	4.7420263	-0.0554658

Spain differs from the three other economies examined here in that the financial crisis that the country underwent in the years after 2007 can, at least to a considerable extent, be attributed to the bursting of a domestic property bubble in the first half of 2008. However, in much 2008 and early 2009, it appeared that Spanish banks would emerge from the financial crisis relatively unscathed because of their strong capital and provisioning buffers (see International Monetary Fund, 2009, p. 45). The fact that the flight-to-quality effect diagnosed for Germany and France during the period from (roughly) mid-September 2008 to January 2009 is hardly detectable in the case of Spain can, at least in part, be attributed to this phenomenon.

The first cracks in the apparently solid foundation of the Spanish banking sector occurred later during the first quarter of 2009, when the medium-sized the savings bank Caja Castilla La Mancha (CCM), which had been heavily exposed to the property sector, suffered a capital shortfall and was subsequently taken over by the government (see Reuters, 2012). In the time series of our parameter estimates, this development is reflected by a first, sharp upward move in $\hat{\alpha}(t)$ during that period of time. However, the announcement and subsequent execution of CBPP1 in mid-2009 appear to have impacted the Spanish mortgage-covered bond market strongly, as the temporary yet pronounced move of $\hat{\alpha}(t)$ into negative territory in the second half of the year suggests. The fact that, in June 2009, the Spanish government established the banking bailout and reconstruction programme "Fondo de Reestructuración Ordenada Bancaria" (FROB; see Hugh, 2010), probably also played a role in this development.

The period of relative calm that followed came to an abrupt end when in May, 2010, FROB was forced to take control of Cajasur, another savings bank with troubled property loans (see Reuters, 2012). The vehement upward movements in $\hat{\alpha}(t)$ around that time are indicative of the recurrence of distrust in the stability of the Spanish banking and real estate sectors among investors. The next peak in the time path $\hat{\alpha}(t)$ is observable for November and December 2010.

Likewise, the three remaining peaks in the time path of $\hat{\alpha}(t)$ during the sampling period can be linked to specific events within the Spanish banking sector:

- In the second quarter of 2011, Caja de Ahorros del Mediterráneo (CAM; Mediterranean Savings Bank) slid into financial difficulties and was taken over by the FROB in July.
- Between mid-October and early December 2011, a large number of Spanish banks were downgraded by rating agencies S&P and Fitch (see McDermott, 2011), raising fresh concerns about the inability of further savings banks to deal with their bad real estate loans or raise additional capital from the market. This prompted the government to partially nationalize some of the weakest *cajas* in early 2012. This appears to have brought some relief to the mortgage-covered bond market, as the move of $\hat{\alpha}(t)$ into negative territory by the end of January, 2011, indicates.
- In May, 2012, the credit ratings of several Spanish banks were downgraded, some to "junk" status. Bankia, the country's largest mortgage lender (which had resulted from the merger in December of 2010 of Caja Madrid, Bancaja and five other smaller savings banks), was nationalised on 9 May, and on 25 May it announced that it would require a bailout of €23.5 billion to cover losses from failed mortgages (sources: Minder, 2012; Santos, 2014).

In June, 2012, Spain abandoned the attempt to re-develop its distressed bank unilaterally and joined Greece, Ireland, and Portugal in requesting a rescue package of up to €100bn from the European Financial Stability Facility (ESM; source: Tremlett, 2012). In December, 2012, the Spanish government raised a specific request for aid amounting to € 39.5 bn, which the ESM granted the FROB shortly thereafter. Another tranche totaling € 1.5 bn was released and subsequently paid out in January 2013 (source: Rose, 2013). In the above estimates, the relief this step (and the effects of CBPP2) brought to the Spanish banking sector is reflected in the fact that in August, 2012, $\hat{\alpha}(t)$ moves into negative territory and stays there over most of the remaining sampling period.

The tendency of mortgage covered and government bond spreads to move equidirectionally, as measured by the parameter $\hat{\beta}(t)$, appears to be weaker in Spain than in France and (particularly) in Germany, as the lower median value of this parameter estimate and its somewhat erratic fluctuations, particularly before July 2010, indicate. During most of the time that follows, $\hat{\beta}(t)$ essentially moves up and down between (-0.7) and (-1), indicating an almost complete dissolution of any observed linkage between the spread levels for both bond types. Like in the case of France after November 2011, a plausible explanation for this having occurred is the evanescence of the perceived solvency advantage of the government over covered bond issuers due to the assumption of private sector default risk by the state. In Spain, too, the financial health of domestic banks and the public sector have become mutually dependent on each other, and jointly dependent on the continued willingness, and ability, of the ECB to quench any anxiety on the part of investors by large-scale secondary market bond purchases when required.

6. Summary and Conclusions

This paper examined the interrelationship of government and mortgage covered bond spreads during a sampling period which stretches from the incubation time of the most recent financial crisis in early 2007 through to the year 2014, using a linear regression model with time varying parameters based on a locally weighted least squares estimation procedure.

In all four countries under investigation, the accustomed tendency of government and mortgage covered bond spreads to move equidirectionally has at least been interrupted during the sampling period. In Germany, where the confidence of market participants in the solidity of public finances appears to be largely unshaken, credit spreads on government bonds and mortgage covered bonds were temporarily driven apart due to "flight to safety" effects when the financial crisis of 2007-2009 and the subsequent Eurozone sovereign debt crisis peaked, and drew closer again as the impacts of the crisis-management efforts by governments and central banks became effective. In all other countries examined–France, Italy, and Spain–the (partial) erosion of confidence in the sustainability of government debts has led to a protracted weakening of the linkage between the spread movements of government and mortgage covered bonds which, in the cases of Italy and Spain, has come close to a complete uncoupling. The policy reactions of the ECB, most notably the Covered Bond Purchase Programmes, have also had a temporary yet momentous impact on the relationship between these two variables. Although the stabilization measures taken by the ECB have succeeded in bringing down the borrowing costs of the highly indebted member states, the relationship between the spread movements of government and mortgage-covered bonds in these countries has so far not returned to its pre-crisis normal. A possible interpretation of this finding is that in these countries, the financial health of domestic banks and the public sector have become mutually dependent on each other, and jointly dependent on the continued willingness, and ability, of the ECB to act as a lender of last resort if required.

References

BBC News. (2012). *Italy slashes its 2012 growth forecast, 18 April 2012*. Retrieved from http://www.bbc.com/news/business-17759429

Beirne, J., Dalitz, L., Ejsing, J., Grothe, M., Manganelli, S., Monar, F., Sahel, B. et al. (2011). *The impact of the eurosystem's covered bond purchase Programme on the primary and secondary markets.* European Central Bank, Occasional paper no. 122. Retrieved from http://www.ecb.europa.eu/pub/pdf/scpops/ecbocp122.pdf

Breger, L., & Stovel, D. (2004). Agency ratings in the Pfandbrief market. *Journal of Portfolio Management, 30*(4), 239-243. http://dx.doi.org/10.3905/jpm.2004.239

Bühler, A., & Hies, M. (1998). Yields and spreads on the German market. *The Pfandbrief, 3*, 51-58.

Chaturvedi, N., Brown, M., & Horobin, W. (2011). ECB Buys Italian, Spanish Bonds. *The Wall Street Journal.* Retrieved from http://www.wsj.com/articles/SB10001424053111904140604576495642494019216

Chen, H. (2010). Macroeconomic Conditions and the Puzzles of Credit Spreads and Capital Structure. *Journal of Finance, 65*(6), 2171-2212. http://dx.doi.org/10.1111/j.1540-6261.2010.01613.x

Choudry, M. (2008). Bond Spreads and Relative Value. In F. J. Fabozzi (Ed.), *Handbook of Finance, Financial Markets and Instruments* (Vol. 1, pp. 463-468). Hoboken, NJ: Wiley. http://dx.doi.org/10.1002/9780470404324.hof001049

Churm, R., & Panigirtzoglou, N. (2005). *Decomposing credit spreads*. Working Paper no. 253, Bank of England. http://dx.doi.org/10.2139/ssrn.724043

Cleveland, W. S., & Devlin, S. J. (1988). Locally weighted regression: An approach to regression analysis by local fitting. *Journal of the American Statistical Association, 83*, 596-610. http://dx.doi.org/10.1080/01621459.1988.10478639

Curley, L. (2012). *Foreign Banks' Exposure to Spanish Banks*. Research Report, Haver Analytics. Retrieved from http://www.haver.com/comment/comment.html?c=120604b.html

Daneshkhu, S. (2012). French banks face Greek woes. *Financial Times*, *27*(May). Retrieved from http://www.ft.com/intl/cms/s/0/c50b5552-a68a-11e1-968b-00144feabdc0.html#axzz3LKR89QOA

Dick-Nielsen, J., Gyntelberg, J., & Sangill, T. (2012). *Liquidity in Government versus Covered Bond Markets*. Working paper, Bank for International Settlements Working Paper No 392. http://dx.doi.org/10.2139/ssrn.2191571

Eichert, F., & Rudolf, F. (2013). Covered bonds vs. sovereign debt. In *European Covered Bond Council: European Covered Bond Factbook* (pp. 60-71). European Mortgage Federation, Brussels. Retrieved from https://www.pfandbrief.de/cms/_internet.nsf/0/E64C94EBEF842292C1257DEF003857B1/$FILE/ECBC%20FAct%20Book%202013.pdf?OpenElement

Elton, E. J., Gruber, M. J., Agrawal, D., & Mann, C. (2001). Explaining the Rate Spread on Corporate Bonds. *The Journal of Finance, 56*(1), 247-278. http://dx.doi.org/10.1111/0022-1082.00324

Eser, F., Carmona, A. M., Iacobelli, S., & Rubens, M. (2012). *The use of the Eurosystem's monetary policy instruments and operational framework since 2009.* ECB Occasional Paper 135, European Central Bank. Retrieved from http://www.ecb.europa.eu/pub/pdf/scpops/ecbocp135.pdf

European Banking Authority. (2014). *EBA Report on EU Covered Bond Frameworks and Capital Treatment*. London.

European Central Bank. (2011). Statement by the President of the ECB. Press release. Retrieved from http://www.ecb.europa.eu/press/pr/date/2011/html/pr110807.en.html

European Central Bank. (2012a). Press Release: 31 October 2012-Ending of covered bond purchase programme 2 (CBPP2). Retrieved from http://www.ecb.europa.eu/press/pr/date/2012/html/pr121031_1.en.html

European Central Bank. (2012b). *Verbatim of the Speech by Mario Draghi, President of the European Central Bank*. The Global Investment Conference in London.

European Central Bank. (2013). *European Central Bank Annual Report 2012*. Retrieved from http://www.ecb.europa.eu/pub/pdf/annrep/ar2012en.pdf

European Central Bank. (2014). Decision of the European Central Bank of 15 October 2014 on the implementation of the third covered bond purchase programme (ECB/2014/40).

Fan, J., & Gijbels, I. (1996). *Local Polynomial Modelling and Its Applications*. London (Chapman and Hall). http://dx.doi.org/10.1007/978-1-4899-3150

Fan, J., Jiang, J., Zhang, C., & Zhou, Z. (2003). Time Dependent Diffusion Models for Term Structure Dynamics. *Statistica Sinica, 13*, 965-992.

Gouriéroux, C., & Monfort, A. (1999). *Statistique et Modèles Econometriques*. Paris: Economica.

Härdle, W. (1990). *Applied Nonparametric Regression*. Cambridge (University Press). http://dx.doi.org/10.1017/ccol0521382483

Hume, N. (2010). *The peripheral bond buyer of last resort.* FT Alphaville, 13 December 2010. Retrieved from http://ftalphaville.ft.com//2010/12/13/434886/the-peripheral-bond-buyer-of-last-resort

International Monetary Fund. (2009). *Spain: Selected Issues*. IMF Country Report No. 09/129, Washington D.C.

International Monetary Fund. (2013). *Italy: Technical Note on the Financial Situation of Italian Households and Non-Financial Corporations and Risks to the Banking System*. Country Report 13/348 (Washington, D.C.)

Jobst, A. A. (2006). European securitization: A GARCH model of secondary market spreads. *Journal of Structured Finance, 12*(1), 55-80. http://dx.doi.org/10.3905/jsf.2006.628545

Jones, E. (2012). Italy's Sovereign Debt Crisis. *Survival: Global Politics and Strategy, 54*(1), 83-110. http://dx.doi.org/10.1080/00396338.2012.657545

Kempf, A., Korn, O., & Uhrig-Homburg, M. (2012). The term structure of illiquidity premia. *Journal of Banking and Finance, 36*, 1381-1391. http://dx.doi.org/10.1016/j.jbankfin.2011.12.003

Koziol, C., & Sauerbier, P. (2007). Valuation of bond illiquidity: An option-theoretical approach. *Journal of Fixed Income, 16*(4), 81-107. http://dx.doi.org/10.2139/ssrn.424282

Longstaff, F. A., Mithal, S., & Neis, E. (2005). Corporate Yield Spreads: Default Risk or Liquidity? *Journal of Finance, 60*(5), 2213-2253. http://dx.doi.org/10.1111/j.1540-6261.2005.0079

Markit. (2010). *Markit iBoxx Spread Analytics - July 2010*. Frankfurt, Markit Indices Limited. Retrieved from http://www.markit.com/assets/en/docs/products/data/indices/bond-indices/iboxx-rules/documentation/Markit_iBoxx_Spread_Analytics.pdf

McDermott, J. (2011). S&P and Fitch Downgrade Spanish Banks. FT Alphaville, 11 October 2011. Retrieved from http://ftalphaville.ft.com/2011/10/11/699456/sp-and-fitch-downgrade-spanish-banks

Minder, R. (2012). Spanish Lender Seeks 19 Billion Euros; Ratings Cut on 5 Banks. *The New York Times.*

Retrieved from http://www.nytimes.com/2012/05/26/business/global/spanish-lender-seeks-state-aid-ratings-cut-on-5-banks.html?pagewanted=all

Moody's Investors Services. (2012). *Rating Action: Moody's downgrades Italian banks; outlook remains negative*. Research Report, Global Credit Research.

Ng, K. Y., & Phelps, B. D. (2011). Capturing Credit Spread Premium. *The Financial Analysts Journal, 67*(3), 63-75. http://dx.doi.org/10.2469/faj.v67.n3.4

Onado, M. (2011). European Stress Tests: Good or Bad News? Retrieved from http://www.voxeu.org/article/european-stress-tests-good-or-bad-news

Packer, F., Stever, R., & Upper, C. (2007). The covered bond market. *BIS Quarterly Review, 34*(3), 43-55.

Prokopczuk, M., & Vonhoff, V. (2012). Risk Premia in Covered Bond Markets. *Journal of Fixed Income, 22*(2), 19-29.

Rees, A. (2001). A fair value model for the Pfandbrief spread. *The Pfandbrief, 6*, 59-66.

Reuters. (2012). Timeline-Spain's banking crisis. Retrieved from http://www.reuters.com/article/2012/06/08/spain-banks-timeline-idUSL5E8H88YV20120608

Rose, D. (2013). Euro-Rettungspakete: Der Geldfluss in die Krisenstaaten. Retrieved from http://www.tagesschau.de/wirtschaft/rettungspakete108.html

Santos, T. (2014). *Antes del diluvio: The Spanish banking system in the first decade of the Euro*. Working paper, Columbia University. Retrieved from https://www.gsb.columbia.edu/mygsb/faculty/research/pubfiles/6162/Santos-March-2014.pdf

Siewert, J. B., & Vonhof, V. (2011). *Liquidity and Credit Risk Premia. in the Pfandbrief Market.* Working paper, University of Mannheim. Retrieved from http://gess.uni-mannheim.de/fileadmin/gess_db/Publications/0385.pdf

Sünderhauf, R. (2006). *Bewertung des Ausfallrisikos deutscher Hypotheken-Pfandbriefe*. Berlin (BWV Berliner Wissenschafts-Verlag).

Traynor, I., & Watt, N. (2012). Spain calls for new tax pact to save Euro: Madrid calls for Europe-wide plan but resists "humiliation" of national bailout. *The Guardian,* 6 June 2012. Retrieved from http://www.theguardian.com/business/2012/jun/06/spain-euro-finished-fiscal-union

Trebesch, C., & Zettelmeyer, J. (2013). *ECB interventions in distressed sovereign debt markets: The case of Greek bonds*. Manuscript, University of Frankfurt. http://dx.doi.org/10.2139/ssrn.2148301

Tremlett, G. (2011). Spain to part-nationalise weakest savings banks. *The Guardian*. Retrieved from http://www.theguardian.com/business/2011/jan/21/spain-part-nationalise-savings-banks-cajas

Tremlett, G. (2012). Spain to get bank bailout that may run up to €100bn. *The Observer.* Retrieved from http://www.theguardian.com/world/2012/jun/09/spain-bank-bailout-eurozone-crisis

Volk, B., & Hillenbrand, F. (2006). The European Jumbo covered bond market in the footsteps of the German Pfandbrief. *The Pfandbrief, 11*, 58-70.