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FRAGMENTATION AND HETEROGENEITY IN THE EURO-AREA CORPORATE BOND MARKET

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Abstract

We assess the degree of market fragmentation in the euro-are corporate bond market by disentangling the determinants of the risk premium paid on bonds at origination. In this way we are able to isolate the country-specific effects which are a suitable indicator of the market fragmentation. We find that after peaking during the sovereign debt crisis, fragmentation shrunk in 2013 and receded to pre-crisis level only in 2014. However, the low level of assess market fragmentation is coupled with a still high heterogeneity in actual bond yields.

Key words: Sovereign debt crisis, financial fragmentation, too-big-to-fail.
JEL Classification: G32; G38.

Contents

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1. Introduction

During the global financial crisis the process of financial integration of the euro-area bond market recorded an abrupt halt. Since the second half of 2010, after a massive involvement of governments in sustaining the domestic financial systems hardly hit by the first wave of the crisis, some peripheral euro-area countries faced significant strains in the access to capital markets. The market started to price-in the possibility of a break-up of the monetary union due to the exit of some peripheral countries. In 2011, contagion effects, often unjustified by economic fundamentals (Blommestein et al. 2012, Giordano et al. 2013, Favero 2013), involved much bigger countries as Italy and Spain leading to a surge in the spread on sovereign bond yields across countries. The sovereign debt market turbulence soon spilled over to the corporate bond market.

In the paper we provide an assessment of the fragmentation of the euro-area corporate bond market by disentangling the different sources of risk which are priced in bond yields. Starting from the assumption that in an integrated market the country of issuance of a bond should not influence the yield at origination, we use the estimated country effects to measure the degree of market fragmentation. In particular, we focus on the spread paid at origination by non-financial corporations over the period from 2005 to 2014. The time span allows us to cover the unfolding of the global financial crisis and the subsequent great recession period, which in the euro area is also characterized by the significant turmoil in the sovereign debt market of several countries. In addition, we are able to compare the two phases of the crisis with the tranquil period immediately before its explosion and the period of easing tensions started from the *whatever-it-takes* speech of the ECB President Draghi in July 2012.

We find that, once all sources of risk are properly taken into account, already in the years before the burst of the crisis there is evidence of market fragmentation. While the credit spreads at origination are relatively close, the estimated spread vis-à-vis Germany are in many cases negative and ample suggesting a likely underestimation of the sovereign risk. After the evolution of the financial crisis into a proper sovereign debt crisis, both the actual spreads and the estimated country-specific effects spike to unprecedented heights making the market fragmentation a policy issue. The intervention of the ECB in trying to ease the tensions and reduce the pricing of tail risks leads to the introduction of the OMT, and the

subsequent improvement of market access for both sovereigns and corporations of the most distressed countries. On average, the estimated degree of market fragmentation decreases significantly in 2013 and goes back to pre-crisis level only in 2014. However, in several economies, not only the idiosyncratic country component of the ASW spread is still significantly different from zero, but also the part attributable to a poor sovereign creditworthiness has not receded to pre-crisis levels. This circumstance is most likely aggravated by the fact that the market assessment of sovereign creditworthiness might still be misjudged, especially in the lower rated countries (De Grauwe and Ji 2012, De Santis 2012, Camba-Méndez and Serwa 2014). Indeed, the sovereign rating of the country most involved in the sovereign debt crisis (Ireland, Italy, Portugal and Spain) in 2014 is much lower than during the tranquil period (between 5 and 8 notches). This evidence raises some concerns on the consistency of the new equilibrium which seems to prevail in the corporate bond market. From the one hand, there is still a large heterogeneity of actual yield spreads across countries, from the other hand, the overall measures of market integration points to a relatively moderate degree fragmentation.

The paper is organized as follows. In Section 2 we describe the dataset; in Section 3 we introduce the econometric methodology; in Section 4 we first analyse the factors determining bonds' risk premium at origination and estimate the domestic idiosyncratic effects, we then compute some measures of fragmentation; in Section 5 we draw the conclusions.

2. Data and sample characterization

The premium (or spread) over a risk-free security associated to bonds encompasses the credit risk specific to the borrower, as well as other kinds of risk related to the features of the issue, such as the duration and the liquidity of the bond, and to other aspects common to the whole market, such as global liquidity and risk-aversion. In the paper, the measure of the distance from the risk-free asset is the asset swap (ASW) spread, which is the difference between the actual bond yield and the fixed-leg rate of the corresponding asset swap contract. In particular, having to deal with corporate market instruments, we prefer to rely on the reference corporate market rate (the swap rate), instead of using *ad hoc* interpolated yield curves of sovereign securities. In fact, such yield curves are built relying on models that can introduce biases in the identification of the relevant parameter (the market-based risk-free

rate). In addition, in the period under analysis, the euro-area sovereign debt market was strongly affected by "flight to quality/liquidity" phenomena and the pricing-in of a possible break-up of the euro (the so called redenomination risk), which pushed to historical lows the yields of government bonds in fiscally sounder states, Germany in particular (Di Cesare et al. 2012, Klose and Weigert 2014, Dewachter et al. 2014).

In the paper, we depart from large part of the literature on bond spreads by analysing the actual cost of funding faced by issuing corporations, namely the yield offered on bonds on the primary market. There are several reasons supporting our choice of focusing on the single issuance premium. The first is that the secondary market pricing of any debt security reflects the market assessment in that moment but it does not change the cost of the initial funding and it is only an imperfect measure of an hypothetical funding decision for that date (often being based on brokers' indicative prices or dealers' quotes). In addition, the use of secondary market spreads is averted because of the scarce liquidity of some securities in the secondary market. While this approach might reduce the full exploitation of the time dimension of the dataset, it leads to a larger selection of bonds and issuing institutions. In doing so we follow the methodology used in the early contributions by Morgan and Stiroh (2001) and Sironi (2003), which has been recently applied to the debt issuance of financial corporations by Zaghini (2014) and Santos (2014) and non-financial corporations by Pianeselli and Zaghini (2014).

Our dataset contains bonds issued over the period 2005-2014 by euro-area listed and unlisted non-financial corporations with maturity at origination of at least 1 year for which the ASW spread at issuance is available from *Thomson Reuters Datastream*. In particular, the final sample includes 2,562 bonds issued by 283 firms from 10 countries.[1] Table 1 proposes a snapshot of country's issuance activity. We grouped Austria, Belgium and Finland and Ireland and Portugal into two sets of countries given the similarity in the main bond characteristics and sovereign creditworthiness and in order to have more degree of freedom in the econometric analysis.

[1] The countries are Austria, Belgium, Finland, France, Germany, Ireland, Italy, the Netherlands, Portugal, Spain. We did not consider around 50 issues from Cyprus, Greece and Luxembourg for which the whole set of variables is available, since the mentioned countries did not tap the bond market regularly over the period under investigation. However, including them in the regressions does not change the results of the paper.

Table 1 Bond characteristics by country

Country	Issuers	Bonds	Maturity at issue	Tranche Value	ASW
Austria-Belgium-Finland	32	160	3,200	465	173
France	84	781	2,689	484	144
Germany	70	948	2,208	451	112
Italy	32	205	3,535	714	252
Netherlands	24	176	3,342	655	175
Spain	26	201	2,986	582	224
Portugal-Ireland	15	91	2,666	488	326
Total	283	2,562	2,678	508	158

Sources: *Dealogic and Thomson Reuters Datastream*
Averages; Maturity at issue in days, Tranche value in millions of euros, ASW spread in basis points..

Given the significant heterogeneity of bond basic characteristics (maturity at issue and tranche value) it is not surprising that the risk premium paid by the issuers headquartered in the different euro-area countries shows a broad range: from 112 bp in Germany to 326 bp in Portugal and Ireland. However, also the development over time of the risk premium is extremely different across countries (Table 2). While it is evident the common effect of the global financial crisis in the period 2008-2009, which brings about a significant increase in the premium paid in each country, it is also clear that during the period of the sovereign debt crisis the financial turmoil is felt in a very different way in the euro area. Not only does the premium paid by firms in the 4 countries most hit by the crisis (Ireland, Italy, Spain and Portugal) increase significantly, also the spread to German corporations widens to alarming values. Finally, other two circumstances stand out. First, even in the more tranquil period (2013-2014) which followed the introduction of the OMT tool by the ECB, the premium paid at issuance by euro-area corporations is well above the one paid before the global financial crisis (2005-2006). In addition, also the spread to German corporations is far from being back to pre-crisis levels.

This preliminary evidence of still large heterogeneity in market prices may lead to concerns about the degree of integration of the euro-area corporate bond market. In particular about the consistency of the new framework of higher risk premia and different spreads with respect to Germany with the correct assessment of all sources of risk. Unluckily, a direct comparison of corporate bond risk premia across countries does not serve as a good indicator of fragmentation/integration, as yield differences are likely to reflect also

other factors such as the different time-to maturity and liquidity of bonds, and the different issuer credit ratings. Only when all the relevant characteristics of the bond and the issuer are properly taken into account it is possible to isolate (if any) the country-specific effects which may jeopardize the full market integration. Indeed, according to the law of one price, if the market were perfectly integrated, the risk premium should reflect only the characteristics of the bond and the issuing firm. Instead, evidence that the country of residence of the issuer is an additional source of price discrimination points to a fragmented market.

Table 2 ASW spread dynamics

Country	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Austria-Belgium-Finland	47	96	90	115	344	152	159	196	175	99
	(-12)	(72)	(55)	(-37)	(124)	(2)	(50)	(82)	(69)	(13)
France	28	15	29	93	233	160	152	215	153	157
	(-31)	(-9)	(-6)	(-59)	(14)	(10)	(42)	(102)	(46)	(70)
Germany	59	24	35	152	219	150	110	113	106	86
	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Italy	70	90	56	228	265	161	302	324	331	287
	(11)	(66)	(21)	(76)	(46)	(11)	(192)	(211)	(225)	(201)
Netherlands	22	152	113	222	177	270	319	118	151	179
	(-37)	(128)	(78)	(71)	(-43)	(120)	(209)	(5)	(45)	(93)
Spain	29	69	48	155	210	249	323	303	271	213
	(-30)	(45)	(13)	(3)	(-9)	(99)	(213)	(190)	(165)	(127)
Portugal-Ireland	47	197	87	351	335	448	342	499	309	275
	(-12)	(173)	(52)	(199)	(116)	(298)	(232)	(386)	(202)	(188)
Total	43	53	46	137	237	187	167	191	168	148

Sources: *Dealogic and Thomson Reuters Datastream*
Averages. ASW spread in basis points. Spread to Germany in parentheses.

Thus, in order to measure the degree of market fragmentation, the first step is to investigate the broad determinants of the risk premium paid at origination by euro-area firms, then check whether there is an idiosyncratic country effect at work, and finally, based on the estimated country effects, compute some measures of fragmentation. The rest of the paper deals with addressing this goal.

3. The empirical approach

To empirically assess the determinants of risk premium we propose, in a first step, the following model of bond spreads for the ASW spread paid on the primary market by euro-area corporations:

$$spread_i = \alpha_0 + \sum_k \alpha_k V_{i,k}^{issue} + \sum_l \alpha_l V_{i,l}^{issuer} + \sum_z \alpha_z V_{i,z}^{market} + \sum_j \beta_j D_{i,j}^{country} + \varepsilon_i; \qquad (1)$$

where $spread_i$ is the ASW spread at origination on bond i, V_k^{issue} are the variables tracking the bond features, V_l^{issuer} are the variables characterizing the issuer, V_z^{market} are variables which

take into account the market conditions at the time of the issuance, and $D_j^{country}$ are single country dummies. All exogenous variables are taken at time *t* (the exact issuance day) with the exception of total assets which are lagged by one year (i.e., they refer to the latest annual balance available at time *t*).

As for the bond features, we control for the time to maturity of the issue, the amount issued (single tranche), the currency denomination and the bond rating (investment grade vs high yield). With regard to the volume of the issue, we expect that, ceteris paribus, issuing corporations will face higher costs to generate a sufficiently large demand for their placements. At the same time, while corporations that are more creditworthy usually find it easier to issue longer-term bonds, this kind of placement tends to be coupled by a higher yield, regardless of the merit of the issuing institution, due to the longer redemption horizon. It follows that the relation between the bond maturity and the spread is ex-ante ambiguous. Finally, we expect that investment grade bonds pay a smaller premium than high yield ones.

In order to take into account the issuer characteristics, in addition to the specific sector,[2] we rely on two other variables: firm rating and total assets. The first is a measure of the perceived risk of the issuing institution as assessed on professional basis by rating agencies. In particular, the variable rating is the average of the available ratings provided by Moody's, Fitch and Strandard&Poors linearized between 1 (CC/Ca) and 20 (AAA/Aaaa), so that a better rating is coupled with a higher value of the variable. It conveniently gathers all the information about the default risk of the issuer we need for our regressions, since it is an assessment valid at the time of the issuance. In other words, since we do not follow the ASW spread evolution over time, we do not need any other variable tracking the change in the riskiness of the issuer. It is expected to influence the ASW with a negative sign: the better the rating the lower the premium. Also the size of the issuing company (log of total assets) should negatively affect the bond premium since large firms are better positioned to reduce risk having more diversified activities and, given their prominence for the domestic economy, eventually benefit from the too-big-to-fail (TBTF) implicit government support (Acharya et al. 2014). In particular, the idea is that governments will not allow large

[2] Firms are classified into 8 sectors: industrials, consumer goods, consumer services, utilities, telecommunications, technology, basic materials, oil & gas. For each sector a dummy variable which takes 1 if the firm belongs to that sector and 0 otherwise is provided.

corporations to go bankrupt if their failure would significantly harm the stability of the financial system and the economic activity. It is thus assumed that, because of the TBTF support, investors expect the government to back the debt of these institutions should they face financial stress. This expectation is referred to as an implicit guarantee since there is not an official commitment by the relevant authorities.[3] Finally, market conditions are taken into account by the VSTOXX Index, which is commonly employed as a market proxy for risk aversion and uncertainty in the euro area.

Table 3 Summary statistics

	Obs	Mean	Median	Std. Dev.	Max	Min
ASW Spread	2562	157.6	102.8	167.7	1141.0	-197.4
Bond Rating	2562	12.9	13.0	3.1	20.0	3.0
Duration	2562	2678	2059	2822	36535	366
Currency Denomination	2562	0.7	1.0	0.5	1.0	0.0
Total asset (log)	2562	10.5	10.6	1.4	13.7	2.5
Bond Value	2562	508	470	404	2900	0.5
Firm Rating	2562	12.7	13.0	3.1	20.0	1.0
Sovereign Rating	2562	18.9	20.0	2.3	20.0	9.0
Volatility Index	2562	23.7	21.5	9.2	77.2	11.6

The table presents summary statistics. ASW spread is the difference between the bond yield and the fixed-leg rate of a swap contract with the same maturity (basis points). Total asset is the bank balance sheet value of all assets (millions of euros). Duration is the bond maturity at issuance (days). Bond Value is the tranche value of the bond issuance (millions of euros); Bond Rating, Firm Rating and Sovereign Rating are the average of the ratings provided by Moody's, Fitch and Strandard&Poors linearized between 1 (CC) and 20 (AAA); Currency denomination is a dummy which takes the value 1 for euro-denominated bonds and 0 otherwise; Volatility Index is the weekly average of the VSTOXX Index.

The working hypothesis under regression (1) is that the coefficients on $D_j^{country}$ should not be significantly different from zero. Indeed, if a market is perfectly integrated, the risk premium should not depend on the country of residence of the issuer, provided that all the other characteristics are correctly taken into account (Baele et al. 2004). If country differences are instead present we have a fragmented market and we can assess the degree of fragmentation using the estimated country coefficients.

[3]See Mishkin (2006) for a general survey on the relevance of the TBTF effect, whereas Anginer and Warburton (2014) and Pianeselli and Zaghini (2014) provide recent empirical analyses specific to non-financial corporations.

However, given that the degree of fragmentation is most likely not constant over time, especially in crisis times, in a second step of the analysis we try to take into account the time dynamics of country-specific conditions. We thus include in $D_j^{country}$ also the interaction of country dummies with time dummies (one per each year). Indeed, by comparing the coefficients on $D_j^{country}$ for each country with a reference one it is possible to study the single-country dynamics with respect to that country. By doing so, it is possible to identify the evolution of purely country-specific factors, i.e. the relative advantage/disadvantage for an issuer of being located in its home country instead of the reference country. We rely on Germany as the euro-area benchmark for our empirical analysis. The choice is convenient for two main reasons: (1) over the sample period, Germany has enjoyed a stable rating of triple A, thus any change in the contribution of the sovereign rating to the country-effects can be ascribed solely to the country which is being confronted with Germany; (2) the bonds issued by German corporations represent a large share of the sample so that they can serve as a statistically significant benchmark.

As for the data sources, we merge information from several databases in order to have a sample of 2,562 bonds issued by euro-area corporations for which we have the complete set of exogenous variables. In particular, the ASW spread is taken from *Thompson Reuter Datastream*, total assets are sourced from *Capital IQ*, issuance features come from *DCM Analytics* by *Dealogic*. The VSTOXX Index and the sovereign rating come from *Bloomberg*. Table 3 reports the summary statistics of the main variables employed in the estimations excluding time dummies and country dummies.

4. From the risk premium to fragmentation

The first column of Table 4 shows the results of a basic regression (A) in which, in addition to the variables taking into account the bond and issuer characteristics and the financial market conditions, there are only the country fixed effects (the set of dummies $D_j^{country}$).

The characteristics of the issue have the expected sign: the longer the duration and the larger the volume the higher the cost at launch. However, the coefficient of the tranche value is not significantly different from zero nor it is the one on the currency denomination of the

bond. At the same time, the coefficient on the dummy tracking the investment grade bonds has the expected (significant) negative sign.

Table 4: Panel regressions: the risk premium determinants[1]

	(A)	(B)	(C)	(D)	(E)
Duration	**0.006** ***	**0.006** ***	**0.006** ***	**0.006** ***	**0.006** ***
	0.000	*0.001*	*0.001*	*0.001*	*0.001*
Value	**0.011**	**0.012**	**0.011**	**0.011**	**0.010**
	0.011	*0.010*	*0.008*	*0.008*	*0.008*
Issuance in euros	**-12.47**	**-9.64**	**-11.94**	**-14.27**	**-12.28**
	9.196	*9.299*	*9.066*	*8.987*	*9.388*
Investment Grade	**-135.5** ***	**-115.8** ***	**-116.0** ***	**-115.7** ***	**-116.8** ***
	14.480	*18.320*	*18.708*	*19.070*	*18.829*
Issuer rating	**-25.52** ***	**-28.32** ***	**-24.89** ***	**-24.27** ***	**-24.70** ***
	5.379	*4.636*	*4.583*	*4.455*	*4.625*
Issuer Size	**-7.412** **	**-6.348** *	**-8.116** **	**-8.166** **	**-8.511** ***
	3.400	*3.015*	*2.785*	*2.679*	*2.564*
Market Volatility	**5.609** ***	**5.634** ***	**4.496** ***	**4.474** ***	**4.515** ***
	0.405	*0.403*	*0.392*	*0.387*	*0.380*
Sovereign rating				**-7.11** *	**-18.95**
				3.104	*12.796*
Italy	**72.55** ***	**65.00** ***	**64.23** ***	**30.18** **	**45.42** ***
	2.675	*3.802*	*3.027*	*14.128*	*12.392*
France	**13.73** ***	**4.67**	**7.94** *	**5.20**	**-0.05**
	0.899	*5.156*	*4.265*	*4.105*	*5.675*
Spain	**66.26** ***	**60.73** ***	**60.11** ***	**30.02** **	**44.93** ***
	2.597	*5.607*	*4.395*	*12.628*	*9.248*
Netherlands	**29.54** ***	**16.46** ***	**16.59** ***	**15.63** ***	**13.15** **
	3.899	*5.997*	*5.141*	*4.602*	*5.014*
ABF	**16.88** **	**14.48** **	**10.87** **	**2.74**	**-1.22**
	5.482	*5.171*	*5.248*	*5.019*	*8.601*
I&P	**83.34** ***	**78.89** **	**78.82** ***	**35.10** **	**60.89** ***
	7.442	*12.544*	*11.607*	*14.738*	*15.611*
FE Sector	**NO**	**YES**	**YES**	**YES**	**YES**
FE Year	**NO**	**NO**	**YES**	**YES**	**YES**
R-squared	**0.697**	**0.705**	**0.732**	**0.736**	**0.733**

(1) Dependent variable: ASW spread; included observations: 2,562; robust standard errors clustered by country in italic; symbols ***, ** and * denote statistical significance at 1% 5% and 10%, respectively. In regression (D) the sovereign rating variable is the rating assigned to the country of residence of the issuer by Moody's linearized between 1 (Ca) and 20 (Aaa); in regression (E) the sovereign rating variable is a dummy variable which takes 1 for AAA countries and 0 otherwise.

As concerns the features of the issuing firms, the size coefficients (log of total assets) is negative and significant. Our estimates thus confirm the possibility of a bias in favour of issuers of larger dimension. As suggested by a broad literature, larger corporations are able to get a discount on their issues not only because they tap more often the bond market and are able to diversify risks, but also because their absolute and relative dimension make them of (domestic) systemic relevance and beneficiary of the implicit government too-big-to-fail insurance. At the same time, the estimated coefficient of the issuer rating has the expected (significant) negative sign: a better rating leads to a smaller risk-premium. An increase of

one notch in the firm rating leads to a 26 bp discount on the risk premium paid at origination. Finally, the country dummies show statistically significant country-specific effects. Given that Germany is the omitted country, the coefficients suggest that firms from other euro-area countries pay an additional premium with respect to German corporations ranging from 14 bp in France to 83 bp in Ireland and Portugal.

This first empirical evidence is broadly confirmed when taking into account the different sector specialization of firms (second column, regression B) and adding fixed effect by year (third column, regression C).

In addition to the characteristics of the issuer, the features of the bonds, and the market conditions at the time of the issuance, in regressions D and E we also take into account the soundness of the sovereign. A high sovereign rating reflects a positive market assessment of the soundness of public finances, which in turn might suggest room of manoeuvre to intervene in the economy with expansionary measures when needed (via direct support to the economy as a whole or targeted sector/industry interventions). Moreover, rating agencies are giving raising importance to the growth outlook of scrutinised economies, thus a high sovereign rating hints at a favourable economic framework for the domestic activity and propitious conditions for both financial and non-financial corporations. In particular, in regression D the sovereign rating variable is the official Moody's rating on the day of bond issuance linearized between 1 (Ca) and 20 (Aaa), whereas in regression E it is a dummy variable taking the value 1 for Aaa countries and 0 otherwise. We thus expect a negative sign: a better rating should be associated to a lower risk premium. In both specifications the coefficient has the expected sign but the statistical significance is at most weak. Nevertheless, the overall evidence of country fragmentation is confirmed for several euro-area economies.

Given the weak evidence for the support of the introduction of a sovereign rating variable among the exogenous variables, and assuming that the influence of the sovereign rating on the ASW spread of corporate bonds is at most sporadic both over time and across countries (De Grauwe and Ji 2012, Di Cesare et al. 2012, Camba-Méndez and Serwa 2014), we prefer to rely on a model specification in which the sovereign creditworthiness is not explicitly taken into account but it is included among the country effects. It is clear, however, that the soundness of the sovereign has also an indirect influence on the risk premium on corporate bonds since rating agencies consider the outlook of the country of

residence of the issuer (including the sovereign soundness) among the determinants which lead to the assignment of the rating of issuers and bonds. It also contributes to the overall financial market sentiment.

Starting from the evidence of fragmentation reported in Table 4 we move a step further and aim at determining whether there is a common pattern in the country effects across countries and assess the degree of market fragmentation over time. Thus in a second step of the analysis we interact the set of country dummies with the time dummies, using Germany as the euro-area benchmark to gauge the different behaviour across countries.[4]

The top panel of Table 5 shows the estimated coefficient on bond, issuer and market characteristics, while the bottom panel reports the coefficients of the interaction between country and time dummies of the same regression, which can be interpreted as the relative advantage/disadvantage with respect to German firms. In particular, a positive coefficient suggests that the difference in the risk premium paid by a firm headquartered in a given country with respect to a firm from Germany is higher than what implied by the fundamentals (bond, issuer and market characteristics). For instance, in 2005 the spread in the cost of funding between Dutch and German firms is by 63.9 bp attributable merely to different country of residence (country-specific effect).

Results show that in the tranquil period before the eruption of the crisis, characterized by buoyant financial market conditions, there are several countries in which the premia on corporate bonds are, ceteris paribus, smaller than German peers. In particular, in 2006 French, Italian and Spanish issuers are experiencing large negative spreads vis-à-vis the German corporate sector, suggesting that German corporations were on average perceived as more risky than corporations headquartered in other euro-area countries. This is most likely due to the fact that while bond issuance was already widespread across German corporations before the crisis, in other euro-area countries only major firms were issuing. At the same time, another possible interpretation is that in the run-up to the global financial crisis, sovereign credit risk in the euro area tended to be under-priced (De Grauwe and Ji 2014, Aizenman et al. 2014).

[4] This means that we exclude Germany from the set of dummy variables. This in turn means that the coefficients on other countries estimate the difference with Germany. From an econometric point of view this is equivalent to include Germany in the set of dummies and then compare the coefficients of each country with those of Germany and then test the significance of the difference.

Table 5: Panel regression: country effects over time[1]

	Coefficient	Std. Err.	P-value		Coefficient	Std. Err.	P-value
Duration	0.007	82.74	0.000	**Investment Grade**	-113.9	9.572	0.000
Value	0.006	0.001	0.172	**Issuer rating**	-21.90	2.564	0.000
Issuance in euros	-17.61	3.839	0.000	**Issuer Size**	-9.958	2.051	0.000
Bond rating	-5.641	2.461	0.022	**Market Volatility**	4.714	0.280	0.000

	AT-BE-FI	France	Italy	Netherlands	Spain	PT-IR
2005	-16.1 **	18.2 ***	-12.5 ***	63.9 ***	46.3 ***	31.1 ***
2006	-32.7	-12.7 **	-45.9 ***	23.5 ***	-17.5 ***	18.3 ***
2007	-107.0 ***	-14.5 ***	10.8 **	70.8 ***	-33.3 ***	75.7 ***
2008	-138.5 ***	-63.4 ***	-5.8	-18.6 ***	-18.7 ***	85.2 ***
2009	69.7 ***	-18.2 ***	-5.0	-32.6 ***	-21.2 ***	32.5
2010	-16.0	5.5	33.5 ***	35.5 ***	90.2 ***	104.9 ***
2011	19.5	23.7 ***	127.4 ***	49.9 ***	156.2 ***	213.0 ***
2012	24.6 ***	53.4 ***	165.7 ***	20.8 ***	180.9 ***	168.7 ***
2013	33.0 **	18.9 **	131.7 ***	2.4	110.0 ***	67.3 ***
2014	-5.1	-2.6	44.6 ***	-13.7 ***	-25.9 ***	-13.1

(1) Dependent variable: ASW spread; included observations: 2,562; robust standard errors are clustered by country; it include FE by sector and FE by year; R-squared=0.877; symbols ***, ** and * denote statistical significance at 1%, 5% and 10%, respectively.

During the years of the global financial crisis (2007-2009), corporations from the group of sound countries and France increase their advantage with respect to German firms and those from Netherlands switch from a disadvantage to a significant advantage. At the same time Italy and Portugal and Ireland see a deterioration in their cost of funding with respect to German peers, whereas Spanish firms maintain their relative advantage.

In the following period (2010-2012), the abrupt reassessment of sovereign risk significantly weights on several countries' funding conditions. Rating agencies provide a series of subsequent downgrades to the sovereign rating of Ireland, Portugal and Spain and start to revise also Italian and Belgian creditworthiness. To a more muted extent, the process involves also Austria and France; only Finland and the Netherlands are spared from it. In addition, over the most acute phase of the sovereign debt crisis, two phenomena characterise the euro-area (corporate and sovereign) bond market: the "flight to quality" effect, which tends to reduce the premium on German bonds, and the fear of a euro break-up (the so called redenomination risk), which starts to be priced in peripheral euro-area securities, further increasing the yield spread to Germany (Di Cesare et al. 2012, Klose and Weigert 2014, Dewachter et al. 2014).

Thus it does not come as a surprise the fact that the sovereign debt crisis brings about the largest changes in the funding conditions of euro-area corporations. The overall risk premium difference with respect to German peers attributable to country-specific effects skyrockets to 213 bp in Portugal and Ireland, 181 bp in Spain and 166 bp in Italy. While the spread peaks in the most hit countries, also in France, the Netherlands and the group of sound economies the weakening is significant: the positive spread in the funding cost ranging between 25 and 53 bp.

Only after the introduction by the ECB of the non-conventional monetary policy tool of OMTs does the market sentiment change in the euro area. The technical features of OMTs were officially announced after the September 2012 Governing Council meeting. Essentially, the tool was meant to avoid that a distorted market assessment, plagued by the inconsistent appraisal of tail-risks, could lead to a security pricing which did not reflect the fundamentals of a country and could impair the market placement of sovereign and corporate debt. The risk premia start a slow but steady decline, especially in the most troubled economies, and the overall reduction in the spread with respect to the German corporate cost of funding is sizable. However, while in 2013 the improvement with respect to the previous period is substantial, it is not enough to fully offset the deterioration recorded in the two waves of the crisis. With the only exception of the Netherlands, all other euro-area countries show a positive significant country-effect, still very large for Italy and Spain (132 and 110 bp, respectively), hinting to the persistence of the overall relative advantage of German firms in tapping the bond market, due exclusively to the country of residence of the issuer, and thus suggesting a still fragmented corporate bond market.

In 2014, instead the issue of fragmentation seems to be less of a concern in the euro area. For the group of sound economies, France and even Portugal and Ireland the estimated country effects are no more statistically significant. Nevertheless, the difference attributable to the country of residence of the issuer is still positive and sizable in Italy (45 bp) and negative in the Netherlands and Spain (14 and 26 bp, respectively). While with respect to 2006, the year immediately before the global financial crisis, the estimated country effect was of a comparable size for Spain, it has switched sign for the Netherlands and Italy.

As already mentioned, according to the law of one price, yield spreads should not depend on the country of issuer, once all the different sources of risk are properly taken into account. Yet, our empirical evidence suggests that risk premia on euro-area corporate bonds

still depends on the country where the bond was issued. Thus we can use the estimated country coefficients to assess the degree of market fragmentation and its development over time.

Table 6 Indicators of fragmentation by periods

	(1)	(2)	(3)	(4)	(5)	(6)
2005	21.8	29.1	188.1	24.2	18.4	28.4
2006	-11.2	25.1	150.6	20.8	11.2	23.4
2007	0.4	62.8	312.2	29.3	35.1	40.1
2008	-26.6	67.0	330.1	45.2	46.6	52.4
2009	4.2	35.8	179.2	25.3	20.2	31.7
2010	42.3	43.0	285.7	30.2	37.0	44.7
2011	98.3	72.4	589.6	68.1	72.4	90.2
2012	102.3	70.3	614.0	91.5	70.3	111.7
2013	60.6	47.3	363.4	56.3	47.3	74.9
2014	-2.6	22.4	105.1	12.9	14.2	19.2

Authors' computation based on the estimated country-effects reported in Table 5. (1) simple average; (2) standard deviation; (3) sum of absolute values; (4) weighted average of absolute values; (5) standard deviation of absolute values; (6) squared average absolute deviation.

Table 6 shows some possible indicators of fragmentation based on the regression results: the simple mean of the country-effects (1), the standard deviation (2), the sum of the absolute values (3), the average of the absolute values weighted by the total amount issued by country (4), the standard deviation of the absolute value (5) and the square root of the average of the squared deviations from zero (6), which is a measure similar to the standard deviation, but based on deviations from zero instead that deviations from the mean of the distribution.

In the period before the global financial crisis the proposed measures suggest a relatively mild degree of fragmentation in 2005 (comparable to the one recorded in 2009) and an even lower degree in 2006. While the first wave of the crisis can be thought of as a temporary stall to the process of market integration, with a clear increase the fragmentation but not a dramatic change of the market framework, the sovereign debt market crisis is striking U-turn. All measures spike in 2011 and 2012 to unprecedented levels, suggesting a degree of fragmentation two times higher than during the global financial crisis and three

time higher than the tranquil period 2005-2006. Even though declining, still in 2013, the degree of fragmentation is higher than in the global financial crisis years. Data concerning 2014 show instead a sort of return to normality, with several measures hinting to a degree of fragmentation even smaller than in the pre-crisis years.

However, the evidence from estimated country-specific effects and measures of fragmentation is somewhat at odds with the actual price heterogeneity still visible in the corporate bond market (Table 2). Is the "new equilibrium" suggested by the econometric investigation based on a correct market assessment? Or are there some inconsistencies among sources of risk or even across euro-area countries? One issue of concern, for instance, is that ratings assigned to euro-area sovereigns in 2014 are still well below those prevailing in 2005-2006, especially for the countries most involved in the sovereign debt crisis (between 5 and 8 notches), with only Germany boasting an immaculate AAA rating from each of the three main rating agencies. This in turn suggests an increased cost of public debt and a reduce support for the economy which most likely has a negative impact on the rating and the general risk assessment of the corporations headquartered in those countries. However, there is evidence that the market assessment of the sovereign creditworthiness might be misjudged, especially in the lower rated countries (De Grauwe and Ji 2012, Di Cesare et al. 2012, Camba-Méndez and Serwa 2014). Firms may thus face an increased cost of funding because of a distorted assessment of the sovereign creditworthiness which spills over to their "fundamentals".

Summing up, the empirical evidence gathered suggests that after the abrupt phase of risk re-appraisal, both at the corporate and sovereign level, triggered by the two waves of the financial crisis, the euro-area bond market is slowly moving towards a new equilibrium, whose characteristics, however, have still to be fully assessed.

5. Conclusion

One of the most persistent consequences of the global crisis started in the summer 2007 is the financial market fragmentation in the euro area. Even if it originates in the US subprime mortgage market, the crisis soon moves to Europe and lingers there longer than elsewhere. Starting from mid-2010, the second wave of the crisis, now known as euro-area sovereign debt crisis, leads to a freeze in the interbank markets, a strong dependence on the European

Central Bank (ECB) liquidity and to repeated spikes in sovereign debt yields of several euro-area countries. Evidence of the reversal of the euro-area financial integration process can be found in the systematical difference in bank rates across countries and in the "home bias" in the portfolios of financial intermediaries and households. This in turn hampers the pass-through of the policy rates leading to a breakdown in the monetary policy transmission mechanism. Only after extensive monetary policy interventions, often of non-conventional nature, and the announcement by the ECB of the new tool named Outright Monetary Transactions (OMT) does the market sentiment change, moving to an easing of the tensions and a reduction of the market fragmentation. Nevertheless, the process is lengthy and the recovery towards a new normal fragile.

As for the bond market, the crisis significantly affects the corporate (financial and non-financial) funding costs, due to a general overhauling of risk profiles that involves financial instruments, issuing institutions and also the sovereign creditworthiness. Yet, the consequences have been extremely heterogeneous across countries and over time. The paper investigates the causes of the different yields paid by euro-area corporations over the subsequent phases of the global financial crisis. In particular, by disentangling the different sources of price determination we focus on the country-specific effects, which are a suitable indicator of the degree of financial fragmentation.

Building upon the model proposed by Morgan and Stiroh (2001) and Sironi (2003), we estimate the difference in the risk premium paid by corporations headquartered in euro-area countries with respect to corporations from a reference country (Germany), taking into account all the main bond and issuer characteristics. By doing so, we identify the role of purely country-specific factors, i.e. the relative advantage/disadvantage for an issuer of being located in its home country instead of Germany. Using the estimated country-specific coefficients we provide several measures of market fragmentation.

We find that the market integration process was only temporary halted by the first wave of the global financial crisis, with a recovery in 2009. Fragmentation becomes an issue only during the sovereign debt crisis (2010-2012) during which the country-specific spreads to Germany and all fragmentation measures spike to unprecedented levels. Thanks to the ECB interventions and the announcement of OMTs the degree of fragmentation significantly shrinks in 2013 and reaches again pre-crisis levels in 2014.

All in all, our evidence hints at a disorderly process of risk assessment over the extended period of the global financial crisis, the great recession and the sovereign debt crisis, which is pushing the euro-area corporate bond market towards a new framework, in which a possibly mild degree of fragmentation and a sizable heterogeneity in the actual yields coexist.

References

Acharya V.V., Anginer D. and Warburton A.J. (2014), "The End of Market Discipline? Investor Expectations of Implicit State Guarantees" mimeo, New York University, Stern School of Business.

Aizenman J., Hutchison M. and Jinjarak Y. (2013) "What is the Risk of European Sovereign Debt Defaults? Fiscal Space, CDS Spreads and Market Pricing of Risk", *Journal of International Money and Finance.* Vol.34, No.2, pp.37-59

Anginer D. and Warburton A.J. (2014), "The Chrysler Effect: The Impact of Government Intervention on Borrowing Costs." *Journal of Banking and Finance*, Vol.40, No.1, pp.62-79.

Angelini P., Grande G. and Panetta F. (2014), "The negative feedback loop between banks and sovereigns", Bank of Italy Occasional Paper No.213.

Arping S. (2010), "The pricing of bank debt guarantees", *Economic Letters*, Vol.108, No.2, pp.119-121.

Baele L, Ferrando A. Hördal P., Krylova E. and Monnet C. (2004), "Measuring Financial Integration in the Euro Area", ECB Occasional Paper No.14.

Bertay A.C, Demirgüç-Kunt A. and Huizinga H. (2013), "Do we need big banks? Evidence on performance, strategy and market discipline", *Journal of Financial Intermediation*, Vol.22, No.4, pp.532-558.

Blommestein, H.J., Eijffinger S.C.W. and Qian Z. (2012): "Animal Spirits in the Euro Area Sovereign CDS Market", CEPR Discussion Papers No.9092.

Camba-Méndez G. and Serwa D. (2014), "Market perception of sovereign credit risk in the euro area during the financial crisis", ECB Working Paper No.1710.

CGFS, Committee on the Global Financial System (2011), "The impact of sovereign credit risk on bank funding conditions", CGFS Papers, No.43.

Correa R., Lee K.H., Sapriza H. and Suarez G.A. (2014), "Sovereign Credit Risk, Banks' Government Support, and Bank Stock Returns around the World", *Journal of Money, Credit and Banking,*Vol.46, No.1, pp.93-121.

De Grauwe P. and Ji Y.(2013), "Self-fulfilling crises in the Eurozone: An empirical test", *Journal of International Money and Finance*, Vol.34, pp.15-36.

De Grauwe P. and Ji Y.(2014), "Disappearing government bond spread in the eurozone – Back to normal?", CEPS Working Document No.396.

De Santis R. (2014), "The euro area sovereign debt crisis: Identifying flight-to liquidity and the spillover mechanisms", *Journal of Empirical Finance*, Vol.26, No.1, pp.150-170.

Demirgüç-Kunt A. and Huizinga H. (2013), "Are banks too big to fail or too big to save? International evidence from equity prices and CDS spreads", *Journal of Banking and Finance*, Vol.37, pp.875–894.

Dewachter H., Iania L., Lyrio M., de Sola Perea M. (2014) “A macro-financial analysis of the euro area sovereign bond market”, *Journal of Banking and Finance*, http:// dx.doi.org/10.1016/j.jbankfin.2014.03.011.

Di Cesare A., Grande G., Manna M., Taboga M. (2012), “Recent estimates of sovereign risk premia for euro countries”, Bank of Italy, Occasional Paper No.128.

Draghi, M. (2012), “The monetary policy of the European Central Bank and its transmission in the euro area”, speech at Università Bocconi, Milan, 15 November 2012.

Favero C.A. (2013), “Modelling and forecasting government bond spreads in the euro area: A GVAR model”, *Journal of Econometrics*, Vol.177, pp.343-356.

Giordano R., Pericoli M. and Tommasino P. (2013), “Pure or wake-up-call contagion? Another look at the EMU sovereign debt crisis”, *International Finance*, Vol.16, No.2, pp.131-160.

Grande G., Levy A., Panetta F. and Zaghini A. (2011), “Public guarantees on bank bonds: effectiveness and distortions”, *OECD Journal: Financial Market Trends*, Vol. 2011, No.2.

Gropp R., Hakenes H. and Schnabel I. (2011), “Competition, Risk-shifting, and Public Bail-out Policies”, *Review of Financial Studies*, Vol.24, No.6, pp.2084-2120.

Klose J. and Weigert B.(2014), “Sovereign Yield Spreads During the Euro Crisis: Fundamental Factors Versus Redenomination Risk”, *International Finance*, Vol.17, No.1, pp. 25-50.

Krosnzer R.S. (2013),“A Review of Bank Funding Cost Differentials”, University of Chicago Booth School of Business, mimeo.

Lane P. R. (2012), “The European sovereign debt crisis”, *Journal of Economic Perspectives*, Vol.26, No.3,pp. 49-68.

Levy A. and Zaghini A. (2011), “The pricing of government-guaranteed bank bonds”, *Banksand Bank Systems*, Vol.6, No.3, pp.16-24.

Mishkin, F. (2006), “How big a problem is too big to fail?”, *Journal of Economic Literature*, Vol.44, No.4, pp.988-1004.

Mody A. and Sandri D. (2012), “The eurozone crisis: how banks and sovereigns came to be joined at the hip”, Economic Policy, Vol.27, pp.199-230

Morgan, D.P. and Stiroh K.J. (2001). “Market Discipline of Banks: the Asset Test”, *Journal*

Panetta F., Faeh T., Grande G., Ho C., King M., Levy A., Signoretti F., Taboga M. and Zaghini A. (2009), “An assessment of financial sector rescue programmes”, BIS Papers, No.48.

Pianeselli D. and Zaghini A. (2014), “The cost of firms’ debt financing and the global financial crisis”, *Finance Research Letters*, Vol.11, No.2, pp.74-83.

Santos J. (2014), “Evidence from the bond market on banks’ too-big-to-fail subsidy”, *Economic Policy Review*, Vol.20, No.2.

Sironi, A. (2003), “Testing for market discipline in the European banking industry: evidence from subordinated debt issues”, *Journal of Money, Credit and Banking*, Vol.35, No.3, pp.443-472.

Stolz S.M. and Wedow M. (2010), “Extraordinary Measures in Extraordinary Times, Public Measures in Support of the Financial Sector in the EU and the United States”, ECB Occasional Paper No.117.

Ueda, K. and Weder di Mauro B. (2013), “ Quantifying structural subsidy values for systemically important financial institutions”, *Journal of Banking and Finance*, Vol.37, pp.3830-3842.

Völz M. and Wedow M. (2011), “Market discipline and too-big-to-fail in the CDS market: Does banks' size reduce market discipline?”, *Journal of Empirical Finance*, Vol.18, pp.195-210.

Zaghini A. (2014), “Bank Bonds: Size, Systemic Relevance and the Sovereign”. *International Finance*, Vol.17, No.2, pp.161-183.