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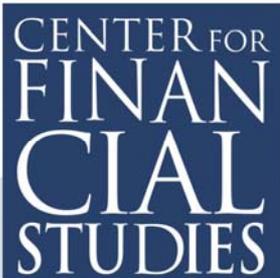
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## CFS Working Paper Series

No. 530

Andrea Zaghini

### Fragmentation and Heterogeneity in the Euro – Area Corporate Bond Market: Back to normal?

# FRAGMENTATION AND HETEROGENEITY IN THE EURO-AREA CORPORATE BOND MARKET: BACK TO NORMAL? <sup>1</sup>

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## Abstract

We assess the degree of market fragmentation in the euro-area corporate bond market by disentangling the determinants of the risk premium paid on bonds at origination. By looking at over 2,400 bonds 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 shrank in 2013 and receded to pre-crisis levels only in 2014. However, the low level of estimated market fragmentation is coupled with a still high heterogeneity in actual bond yields, challenging the consistency of the new equilibrium.

*Key words:* Corporate bond market; Sovereign debt crisis, financial fragmentation.

*JEL Classification:* G32; G38.

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## 1. Introduction

The economic literature traditionally highlights the advantages of financially integrated markets, as integration leads to more opportunities for risk sharing and diversification, better allocation of capital among investment opportunities and potential for higher economic growth (Lane and Milesi-Ferretti 2008, Jappelli and Pagano 2008, Fecht et al. 2012). During the most acute phase of the euro-area sovereign debt crisis it also became evident that integrated financial markets are of utmost relevance for the effective conduct of monetary policy (ECB 2013).

After a prolonged period of increasing financial market integration in the euro area, the process records an abrupt halt during the global financial crisis. The sudden drop of cross-border banking activities and the ring-fencing of domestic financial markets lead to a freeze in the euro-area interbank market and a strong dependence on the European Central Bank (ECB) liquidity. Particularly hit is also the bond market, both in the sovereign and corporate segments, in which dispersion in bond yields increases significantly and the spreads with respect to core countries record unprecedented spikes. This large heterogeneity is soon labelled financial market fragmentation. However, the fact that bond yields and risk premia are different across countries is not enough for a market to be called fragmented. Actually, the definition of fragmentation is usually referred to as the absence of perfect market integration. The latter, relying on the law of one price, envisages a situation in which yield spreads on bonds from different countries do not depend on the country of residence of the issuer, but only on the factors that have a bearing on the riskiness of the bond (Baele et al. 2004). Thus, the reason why the mere heterogeneity in bond yields cannot be directly used as a measure of market fragmentation is that actual spreads are primarily influenced by bond features, such as duration and liquidity, and the different creditworthiness of the issuer. This in turn implies that the first step when assessing financial markets' integration is to control for all potential determinants of bond risk premia; then, if after this filtering out there is evidence of significant country-specific effects, we can speak of a market fragmented along national borders.

The aim of this paper is to shed light on the (possible) fragmentation in the euro-area corporate bond market by assessing whether the quoted heterogeneity in spreads across countries can be attributed to a change in the fundamental determinants of the credit risk or in an increase in the country-specific effects. Thus, we first estimate a model

of risk premia to disentangle the different sources of risk priced in bond yields and to isolate the country-specific effects; then, we use the estimated country-specific effects to compute a measure of the degree of market fragmentation.

We focus on the spread paid at origination by non-financial corporations on around 2,400 bonds issued over the period from 2006 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 a significant turmoil in the sovereign debt market. In addition, we are able to compare the two phases of the crisis with the tranquil period before its explosion and the period of easing tensions started immediately after the *whatever-it-takes* speech of the ECB President Draghi in July 2012.

To preview our results, we find that in the years before the global financial crisis the evidence of market fragmentation is weak (only Belgium and Portugal in 2006 and Portugal alone in 2007 show significantly higher funding costs than Germany), suggesting that financial integration was achieved in the euro-area corporate bond market. In the two years after the outburst of the crisis (2008-2009), the overall market integration does not deteriorate significantly even though the spread to Germany increases for some countries while it declines for others. Instead, during the sovereign debt crisis, actual spreads with respect to Germany become positive everywhere and the estimated country-specific effects peak to unmatched heights making indeed the market fragmentation a source of concern.

While the intervention of the ECB in trying to ease the tensions and reduce the pricing of tail risks (such as the break-up of the euro) leads, from the second half of 2012, to an improvement of the market access for both sovereigns and corporations, a broad heterogeneity in the actual spreads at origination persists. In addition, in two economies (Italy and Portugal), the estimated country-specific component of the spread in 2014 is still significantly different from zero. However, the overall euro-area measure of fragmentation (the sum of all country-specific coefficients) suggests a return to a level of integration similar to that achieved before the crisis.

Nevertheless, the empirical evidence provided in the paper raises some doubts on the consistency of the new equilibrium which seems to prevail at the end of the sample period in the corporate bond market. Indeed, the still large heterogeneity in actual yield spreads across countries is coupled with an overall measure of market integration which points to a very mild degree of fragmentation, if not to the successful return to market integration. The most likely interpretation of this puzzling evidence is that market agents might be currently mispricing some sources of risk. The recent literature points, in particular, to a

wrong assessment of the sovereign risk which directly and indirectly influences the corporate cost of funding (De Grauwe and Li 2014, Gibson et al. 2015, Bedendo and Colla 2015).

The paper is organized as follows. In Section 2 we briefly review the empirical literature on market fragmentation; in Section 3 we describe the dataset; in Section 4 we introduce the econometric methodology and analyse the factors determining bonds' risk premium at origination; in Section 5 we estimate the country-specific effects and compute a measure of fragmentation for the corporate bond market; in Section 6 we provide robustness checks; in Section 7 we draw the conclusions.

## **2. Literature review**

Since the early 1990s, in the euro area, legal and institutional reforms, along with the development of new financial instruments and trading platforms, have facilitated financial market integration leading to a strong increase in both capital and trade flows across countries (Hartmann et al. 2003, Baele et al. 2004). The creation of the monetary union in 1999 was a milestone on the road to more integrated financial markets, eliminating the exchange rate risk within the euro area. As a result, from its establishment up to 2007, the euro area witnessed a rapidly growing financial integration, evident in terms of both volume and prices (de Sola Perea and Van Nieuwenhuyze 2014).

Starting from the subprime crisis in 2007, and especially after the collapse of Lehman Brothers in 2008, the euro area has experienced an increasing turmoil in financial markets with a freeze in interbank markets, a heavy reliance on ECB liquidity facilities and a growing heterogeneity in sovereign debt yields. Also bank lending rates started to differ systematically across countries and portfolios of financial intermediaries and households showed a significant bias towards domestic securities, suggesting a possible fragmentation of several market segments along national borders (Battistini et al. 2014).<sup>2</sup>

The financial conditions deteriorate even further from mid-2010: after a massive involvement of governments in sustaining the domestic financial systems hit hardly by the first wave of the crisis, some small euro-area countries face significant strains in the access to capital markets. The market starts to price-in the possibility of a break-up of the

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<sup>2</sup> See Giannetti and Laeven (2012) for an analysis of the rebalancing of loan portfolio in favour of domestic borrowers during the crisis based on data from the global syndicated loan market.

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, De Santis 2014), involve much larger countries as Italy and Spain leading to a surge in the spread on sovereign bond across countries. The sovereign debt market turbulence soon spills over to the corporate bond market. Not only do corporate risk premia reach unprecedented levels, but also the heterogeneity across countries increases significantly, leading to a worrying widening in the yield spreads between bonds issued by firms headquartered in the countries most involved in the crisis and bonds issued by firms headquartered in countries showing sounder public finances. In addition, the misalignment of rates across countries starts raising concerns about the effective transmission of monetary policy impulses, becoming a relevant policy issue (ECB 2013).

Since the interbank market was the first market segment hit by the crisis, several empirical studies focus on the analysis of that market. Angelini et al. (2011) suggest that borrower characteristics were not a significant determinant of the banks' cost of funds during the pre-crisis period and that the most important determinant of the widening of spreads in the inter-bank markets after the Lehman Brother default is the rise in aggregate risk aversion. Instead, Garcia de Andoain et al. (2015), by directly estimating the country fixed effects, show that several banks were facing higher funding cost just because of their nationality, and identify several episodes of significant market fragmentation. Finally, Mayordomo et al. (2015) provide a measure of market fragmentation over the period 2005-2012 by looking at the spread between each country-specific (average) interbank rate and an *ad hoc* benchmark. By filtering out the credit risk of domestic banks and the changes in the ECB official rate from the spread, they report significant country differences, with peripheral economies experiencing much higher spreads.

Another rich strand of the literature on fragmentation focuses instead on the second wave of the crisis and the government bond market. Even though the methods employed are often different, as well as the reference measure of sovereign creditworthiness (mainly CDS spreads or sovereign yield spreads to German Bunds), the gathered evidence suggests that the fragmentation in the sovereign bond market was due to an increased reaction to country-specific factors (Georgoutsos and Migiakis 2013, Dewachter et al. 2014, Battistini et al. 2014) or even to contagion effects (Giordano et al. 2013, De Santis 2014). In addition, several contributions emphasize that market reactions exhibited overshooting characteristics and were in many instances not linked to the countries' fiscal and

macroeconomic fundamentals (Di Cesare et al. 2012, De Grauwe and Ji 2012, Aizenman et al. 2013, Gibson et al. 2015).

An important consequence of the turmoil in the euro-area sovereign debt market is the transmission of the crisis to the corporate debt market. The deterioration of sovereign creditworthiness has in the first instance affected the credit risk of domestic banks since there are several linkages between the two sectors going in both directions (CGFS 2012, Angelini et al. 2014). Still, also the non-financial sector was involved in the “transfer risk” phenomenon, experiencing a deterioration of the funding ability of firms. Bedendo and Colla (2015) analyse the CDS data of 118 non-financial corporations and show that the pass-through between sovereign and corporate markets is statistically significant: an increase in the sovereign risk of 10% translates into a 0.5% - 0.8% increase in corporate risk. Of a comparable size is the effect reported by Pianeselli and Zaghini (2014): a downgrade by one notch of the sovereign rating leads to an increase in the corporate spread of 10 basis points.

Notwithstanding the relevance of the bond market as a source of funding for non-financial corporations and the link with the real sector of the economy, in addition to the present paper there are few other contributions. Actually, to our knowledge, Horny et al. (2015) is the only other paper trying to assess the corporate bond market fragmentation in some euro-area countries. By looking over the period 2005-2014 at the secondary market pricing of selected bonds issued by non-financial corporations headquartered in Germany, France, Italy and Spain, they show that the spread to German bonds is hardly ever significantly different from zero for France, it peaks for Italy at the end of 2011 and it peaks for Spain at the end of 2012. Yet, their model is rather basic being entirely based on dummy regressions for just three variables: i) the countries’ fixed effect, ii) the bond rating, iii) the slope of the term structure.

### **3. Data and sample characterization**

The spread of a bond yield with respect to a risk-free rate (premium when positive, discount when negative) reflects 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 this 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. While both markets suffered from high volatility during the two waves of the crisis, the sovereign bond market was further affected by the “flight to safety” phenomenon and the pricing-in of a possible break-up of the euro (the so called redenomination risk), which artificially pushed to historical lows the yields of government bonds in fiscally sounder states, Germany in particular, making those rates less suited as a benchmark (Klose and Weigert 2014, Dewachter et al. 2015).

Our analysis focuses on the actual cost of funding faced by issuing corporations, namely the yield offered on bonds in the primary market. In particular, we follow the methodology used in the early contributions by Morgan and Stiroh (2001) and Sironi (2003), which has been recently applied to the bond issuance of financial corporations by Santos (2014) and Zaghini (2014).

There are several reasons supporting our choice of focusing on the unique 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 a 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. Finally, it allows a larger selection of bonds and issuing institutions.

Relying on the primary market might instead reduce the full exploitation of the time dimension of the dataset (especially over longer horizons) and thus it might reduce the number of observations employed in the regressions. However, given that the availability of time series for secondary market prices is restricted to a relatively limited number of euro-area securities, our sample is of a comparable size or even larger than those used in many empirical investigations based on secondary market data. Indeed, when dealing with secondary prices it is not uncommon to have a number of observations around, or even below 1,000 (De Grauwe and Li 2012, Giordano et al. 2013, Mayordomo et al 2015, Gibson et al. 2015). In addition, given that the time-span of our investigation is relatively

limited (9 years), the time dimension can be conveniently taken into account by time dummies.<sup>3</sup>

The dataset exploited in the paper contains bonds issued over the period 2006-2014 by euro-area listed and non-listed non-financial corporations with life to maturity of at least one year. In particular, the final sample includes 2,434 bonds issued by 256 firms from 8 countries.<sup>4</sup> Table 1 proposes a snapshot of the issuance activity by country.

<b>Table 1 Bond characteristics by country<sup>1</sup></b>						
<b>Country</b>	<b>Issuers</b>	<b>1-timers</b>	<b>Bonds</b>	<b>Maturity at issue</b>	<b>Tranche Value</b>	<b>ASW</b>
<i>Belgium</i>	11	3	88	3,567	577	182
<i>Finland</i>	11	2	65	2,631	297	219
<i>France</i>	79	23	753	2,674	486	148
<i>Germany</i>	69	26	928	2,136	443	114
<i>Italy</i>	32	11	198	3,429	720	260
<i>Netherlands</i>	22	4	171	3,350	659	178
<i>Portugal</i>	6	1	33	2,296	586	280
<i>Spain</i>	26	10	198	2,967	584	227
<b>Total</b>	256	80	2,434	2,628	508	158

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

The number of firms which have been issuing bonds over the sample period goes from 79 in France to 6 in Portugal. Many firms (80) are 1-timers, i.e. they issued only one

<sup>3</sup> Even though the problem is shared with the literature dealing with secondary market yields, a further caveat concerns the sampling selection of bonds. Since we look at the bond which have been issued and do not investigate the decision of whether (or when) to issue a bond, there might be the possibility of a selection bias.

<sup>4</sup> The countries are Belgium (BE), Finland (FI), France (FR), Germany (GE), Italy (IT), the Netherlands (NE), Portugal (PT) and Spain (SP). We did not consider around 150 bonds from Austria, Greece, Ireland 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 main regressions does not change the results of the paper.

bond, ranging from 17% in Portugal to 38% in Germany.<sup>5</sup> At the same time the largest number of bonds in the sample was issued by German firms (928 bonds). The maturity at issue suggests that Belgian, Italian and Dutch firms are used to placing the bonds with the longest redemption horizon (the average being over nine years), whereas German firms prefer to issue bond with shorter maturities (the average being below six years). As for the volume of the initial placement, there are only three countries issuing with an average tranche value below 500 million euros (Finland, France and Germany).

**Table 2 ASW spread and spread to German bonds<sup>1</sup>**

<b>Country</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>
<i>Belgium</i>	21 (-3)	185 (150)	218 (66)	354 (134)	194 (44)	235 (125)	165 (52)	117 (11)	99 (13)
<i>Finland</i>	33 (9)	56 (21)	164 (12)	327 (108)	228 (78)	175 (66)	277 (163)	239 (133)	111 (24)
<i>France</i>	15 (-9)	29 (-6)	93 (-59)	233 (14)	160 (10)	152 (42)	215 (102)	153 (46)	157 (70)
<i>Germany</i>	24 (0)	35 (0)	152 (0)	219 (0)	150 (0)	110 (0)	113 (0)	106 (0)	86 (0)
<i>Italy</i>	90 (66)	56 (21)	228 (76)	265 (46)	161 (11)	302 (192)	324 (211)	331 (225)	287 (201)
<i>Netherlands</i>	76 (52)	113 (78)	222 (71)	201 (-18)	270 (120)	319 (209)	118 (5)	151 (45)	179 (93)
<i>Portugal</i>	62 (38)	87 (52)	290 (138)	246 (27)	300 (150)	296 (187)	532 (419)	328 (222)	225 (139)
<i>Spain</i>	69 (45)	48 (13)	155 (3)	210 (-9)	249 (99)	323 (213)	303 (190)	271 (165)	213 (127)
<i>Average</i>	28	47	44	43	73	148	163	121	95
<i>Range</i>	75	156	197	153	140	171	414	214	188
<i>Stdev</i>	27	49	59	54	50	65	125	82	61

Sources: Dealogic and Thomson Reuters Datastream.

(1) Top panel: Averages; ASW spread in basis points; Spread to Germany in parentheses. Bottom panel: Average, range and standard deviation of the distribution of the spreads to Germany.

Given the reported significant heterogeneity even in the bond basic characteristics (maturity and volume), it is not surprising that the risk premium paid by issuers

<sup>5</sup>The distribution by issuer is positively skewed: in addition to the 80 firms with one bond only, there are 119 firms which have issued 2 to 10 bonds, 53 firms with a number of bonds between 11 and 100, and only 4 firms able to issue more than 100 bonds.

headquartered in different euro-area countries shows a broad range: from 114bp in Germany to 280bp in Portugal. 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 premia paid in each country, it is also clear that over the sovereign debt crisis (2010-2013) the financial turmoil is perceived in a very different way across the euro area. Not only does the ASW spread paid by firms headquartered in the countries most hit by the crisis (Italy, Spain and Portugal) increase significantly, but also the distance from the cost of funding of German corporations widens to alarming values.

In addition, two other circumstances stand out. First, even in the relatively more tranquil period which followed the introduction of the outright monetary transactions (OMT) by the ECB (2013-2014), the premium paid at issuance by euro-area corporations is well above the one paid before the global financial crisis (2006). Second, the spread to German corporations is everywhere positive and usually far from being back to pre-crisis levels. Concerning the latter point, the bottom panel of Table 2 shows some basic indicators of the distribution of the spreads with respect to Germany (reported in parentheses in the top panel). It is evident that, even though having curbed, the heterogeneity across countries in 2014 is still very high, with the three indicators suggesting a context more similar to the crisis years (2008-2013), than before the burst of the global financial crisis.

The preliminary evidence of still large heterogeneity in 2014 in both market yields and spreads to Germany might raise concerns about the process of integration of the euro-area corporate bond market and the consistency of the new framework. In particular, we might ask whether the higher risk premia and larger spreads with respect to Germany are consistent with a proper assessment of all sources of risk. Unluckily, a direct comparison of corporate bond risk premia across countries, while informative *per sé*, does not serve as a good indicator of the market fragmentation/integration, as yield differences reflect also factors such as the different time-to-maturity and liquidity of bonds, and the different probability of default of the issuer. 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, in turn, signal an imperfect 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.

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 a country-specific effect at work, and finally, based on the estimated country effects, compute a measure of fragmentation. The rest of the paper deals with addressing this goal.

#### 4. The empirical framework

We start our analysis of the determinants of the risk premia in the primary bond market from the model proposed by Morgan and Stiroh (2001) and Sironi (2003):

$$ASW_i = c + \sum_{m=1}^M \beta_m V_{i,m}^{issue} + \sum_{l=1}^L \beta_l V_{i,l}^{issuer} + \sum_{j=1}^J \beta_j D_{i,j}^{country} + \sum_{z=1}^Z \beta_z V_{i,z}^{market} + \varepsilon_i; \quad (1)$$

where  $ASW_i$  is the ASW spread at origination on bond  $i$ ,  $V_m^{issue}$  are the  $M$  variables tracking the bond features,  $V_l^{issuer}$  are the  $L$  variables characterizing the issuer,  $D_j^{country}$  are the  $J$  dummy variables for the country-specific effects, and  $V_z^{market}$  are the  $Z$  variables which take into account the market conditions at the time of the issuance.<sup>6</sup>

The initial choice of the regressors is based on the most recent findings of the empirical literature about the determinants of the borrowing cost of international corporations (Santos 2014, Pianeselli and Zaghini 2014, Ahmed et al. 2015, Horny et al. 2015). In particular, in addition to the sector, the issuer characteristics are taken into account by two variables: firm rating and total assets.<sup>7</sup> The first is a measure of the perceived risk of the issuing institution as assessed on a professional basis by rating agencies. In particular, the variable rating is the average of the available ratings provided by Moody's, Fitch and S&P linearized between 1 (CC/Ca) and 20 (AAA/Aaa), so that a better rating is coupled with a higher value of the variable. It conveniently gathers all the

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<sup>6</sup> The use of dummy variables to isolate country-specific effects is common in empirical works dealing with financial market data, especially for the euro area (Sironi 2003, Garcia de Andoain et al. 2014, Gibson et al. 2015).

<sup>7</sup> 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.

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 spread 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: given their diversified activities large firms are better positioned to reduce risk. In addition, their prominence for the domestic economy might entail them to benefit from the too-big-to-fail (TBTF) implicit government support. The idea is that governments will not allow large firms to go bankrupt if their failure would significantly harm the overall economic activity or even the domestic financial stability. 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 usually there are not official commitments (Mishkin 2006).

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 category. With regard to the volume of the issue, there are two effects going in the opposite direction. On the one hand, we expect that, *ceteris paribus*, issuing corporations will face higher costs to generate a sufficiently large demand for their placements; on the other hand a larger issuance volume may imply improved marketability for secondary market trades and thus lead to a lower risk premium at origination. It follows that the relation between the bond volume and the spread is *ex-ante* ambiguous. At the same time, firms may find more difficult to issue longer-term bonds, due to the roll-over risk associated to the longer redemption horizon, hinting to a positive relation with the ASW spread. As for the assessment of the *ex-ante* default risk of the bond, we refer to the broad categorization into “Investment grade” bonds (rating above or equal to BBB-) and “High yield” bonds (rating below BBB-). Other things being equal, we expect that investment grade bonds pay a smaller premium than high yield bonds.<sup>8</sup>

Finally, market conditions are taken into account by the VSTOXX Index, which is commonly employed as a proxy for risk aversion and uncertainty in the euro-area financial markets. It is a measure of equity market volatility, computed relying on both call- and put-

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<sup>8</sup> In the robustness checks in Section 6 we also employ the bond rating constructed both as a variable linearized between 1 (CC/Ca) and 20 (AAA/Aaa) and as a set of dummies.

implied volatilities from the DJ Euro STOXX 50 index. We expect that higher uncertainty is detrimental for investments and thus leads to an increased ASW spread.

As for the data sources, we merge information from several databases in order to have a sample of 2,434 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 comes from *Bloomberg*. All exogenous variables are taken at time  $t$  (the exact issuance day) with the exception of total assets which is lagged by one year (i.e., they refer to the latest annual balance available at time  $t$ ). Table 3 reports the summary statistics of the main variables employed in the estimations excluding time dummies and country dummies.

	<b>Obs</b>	<b>Mean</b>	<b>Median</b>	<b>Std. Dev.</b>	<b>Max</b>	<b>Min</b>
<i>ASW spread</i>	2434	158	108	164	1141	-197
<i>Bond rating</i>	2434	12.9	13.0	3.0	20.0	3.0
<i>Bond grade</i>	2434	0.82	1.00	0.38	1.00	0.0
<i>Duration</i>	2434	2628	2012	2628	36535	366
<i>Issuance in euros</i>	2434	0.66	1.00	0.47	1.00	0.0
<i>Bond value</i>	2434	508	467	407	2898	0.5
<i>Firm size</i>	2434	10.5	10.7	1.4	13.7	2.5
<i>Firm rating</i>	2434	12.7	13.0	2.9	20.0	1.0
<i>Sovereign rating</i>	2434	19.0	20.0	2.3	20.0	9.0
<i>Market volatility</i>	2434	24.2	21.8	9.2	73.1	13.2

(1) 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). Firm size is the log of the 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 averages of the ratings provided by Moody's, Fitch and S&P linearized between 1 (CC/Ca) and 20 (AAA/Aaa); Bond grade is a dummy which takes the value 1 for bonds rated BBB- or above and 0 otherwise; Issuance in euros is a dummy which takes the value 1 for euro-denominated bonds and 0 otherwise; Market volatility is the weekly average of the VSTOXX Index.

A first set of regressions, constructed by adding regressors by group (bond characteristics, issuer characteristics, country dummies, and market sentiment), shows a broad consistency of our ex-ante expectations with the empirical results (Table 4). Furthermore, by looking at the changes in the (adjusted) R-squared it is possible to gauge the relative explanatory power of each group.

**Table 4 Panel regressions: Risk premium determinants<sup>1</sup>**

	(1)	(2)	(3)	(4)
<b>Duration</b>	0.008 *** <i>0.001</i>	0.006 *** <i>0.001</i>	0.005 *** <i>0.001</i>	0.006 *** <i>0.001</i>
<b>Bond value</b>	0.028 ** <i>0.010</i>	0.028 *** <i>0.009</i>	0.027 *** <i>0.009</i>	0.011 * <i>0.007</i>
<b>Bond grade</b>	-284.3 *** <i>12.04</i>	-107.6 *** <i>23.14</i>	-112.0 *** <i>19.95</i>	-129.6 *** <i>20.67</i>
<b>Issuance in euros</b>	16.80 <i>11.33</i>	-11.22 ** <i>5.621</i>	-11.37 * <i>6.109</i>	-15.90 *** <i>5.386</i>
<b>Firm rating</b>		-27.70 *** <i>3.267</i>	-26.38 *** <i>2.778</i>	-24.84 *** <i>2.658</i>
<b>Firm size</b>		-8.808 ** <i>3.849</i>	-6.071 * <i>3.351</i>	-8.925 *** <i>3.191</i>
<b>D_BE</b>			668.1 *** <i>40.25</i>	533.1 *** <i>41.87</i>
<b>D_FI</b>			660.7 *** <i>37.78</i>	517.7 *** <i>37.91</i>
<b>D_FR</b>			630.9 *** <i>37.58</i>	501.1 *** <i>38.46</i>
<b>D_GE</b>			612.8 *** <i>41.12</i>	484.6 *** <i>42.77</i>
<b>D_IT</b>			641.2 *** <i>37.88</i>	512.9 *** <i>37.15</i>
<b>D_NE</b>			684.1 *** <i>41.39</i>	560.6 *** <i>42.60</i>
<b>D_PT</b>			668.2 *** <i>41.32</i>	551.0 *** <i>42.07</i>
<b>D_SP</b>			723.2 *** <i>41.59</i>	590.2 *** <i>41.54</i>
<b>Market volatility</b>				4.344 *** <i>0.366</i>
<b>D_07</b>				0.884 <i>10.14</i>
<b>D_08</b>				56.03 *** <i>9.580</i>
<b>D_09</b>				99.21 *** <i>10.24</i>
<b>D_10</b>				41.80 *** <i>10.44</i>
<b>D_11</b>				37.78 *** <i>12.97</i>
<b>D_12</b>				78.10 *** <i>13.89</i>
<b>D_13</b>				74.03 *** <i>11.03</i>
<b>D_14</b>				50.49 *** <i>8.599</i>
<b>Adj R-squared</b>	0.460	0.573	0.789	0.851

(1) Dependent variable: ASW spread; included observations: 2,434; robust standard errors clustered by issuer. Symbols \*\*\*, \*\* and \* denote statistical significance at 1%, 5% and 10%, respectively. Variables as described in Table 3.

Starting from the last column we see that the characteristics of the issue have the expected sign: the longer the duration and the larger the volume, the higher the cost at launch. At the same time, the coefficient on the dummy tracking the investment grade bonds has the expected (significant) negative sign; also the euro currency denomination has a significant negative sign (positive but not significant only in the first regression). This group of variables alone is able to explain 46% of the overall variance of the ASW spread (first column).

With regards to the features of the firms, 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 25bp discount on the risk premium at origination. At the same time, the coefficient of size (log of total assets) is negative and significant: the estimate thus confirms the possibility of a bias in favour of issuers of larger dimension. This result is in line with the most recent findings of the empirical literature. Both Pianeselli and Zaghini (2014) from a global sample and Santos (2014) for the US market find that large non-financial corporations enjoy a discount on the primary market issuance. In addition, Ahmed et al. (2015) find that large US firms from several industries face a discount on their secondary market spread of a size comparable to the TBTF subsidy exhibited by large banks. The group of regressors concerning the firm characteristics adds another 11% to the explanatory power of the regression.

When adding the country dummies and the variables tracking the market sentiment at the time of issuance (annual dummies and the VSTOXX index) the R-squared increases significantly, reaching 85% in the last regression. It is worth noting that the volatility index shows a positive and significant coefficient, confirming that a framework characterized by high uncertainty in the equity market is detrimental for bond placements (Campbell and Taksler 2003).

A first hint of a possibly fragmented market emerges from the broad differences within the group of country dummies and the large increase in the explanatory power of this set of variables.<sup>9</sup> Given that a similar variability is also recorded for the coefficients of the time dummies, it is worth investigating their interaction. In this way we are able to track the evolution of country-specific effects over time and provide an indicator of the degree

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<sup>9</sup> According to the standard testing procedure, the differences between the coefficient of each country dummy and the coefficient of Germany are all significantly different from zero in regression (3), while they are not significant for France and the Netherlands in regression (4).

of fragmentation for every year of the analysis. This is done in the next section of the paper.

## 5. From risk premia to fragmentation

In order to check whether county-specific effects can be suitably identified over the time span 2006-2014, we expand the model in Equation (1) in two ways. We first introduce in the set  $D_j^{country}$  the interaction of country dummies with time dummies; we then use Germany as our benchmark. By excluding Germany from the set of country-specific effects, the estimated coefficients and the standard errors will show, for each variable, the difference with respect to Germany and the relative accuracy.<sup>10</sup> We rely on Germany as the reference country for two main reasons: (1) Germany is the largest euro-area economy and it is the only country which has enjoyed a stable rating of triple A over the whole period under analysis; (2) since the bonds issued by German corporations are a large share of the sample they can serve as a statistically significant benchmark.

The working hypothesis under the enlarged model is that the coefficients on each variable in the set  $D_j^{country}$  should not be significantly different from zero. As already mentioned, when a market is perfectly integrated, risk premia do not depend on the country of residence of the issuer, provided that all the relevant sources of risk are 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 coefficients. In particular, the sum of all dummy coefficients (i.e., the sum of the estimated country-specific spreads to Germany in each year) can work as a suitable indicator of the overall degree of fragmentation in the euro-area corporate bond market.

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 from the same regression. The latter coefficients can be interpreted as the relative yearly advantage/disadvantage in tapping the bond market with respect to German firms due to the different country of residence of the issuer. In particular, a positive (negative) coefficient suggests that the difference in the risk premium

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<sup>10</sup> From an econometric point of view this is equivalent to include Germany in the set of dummies - as done in regression (3) and (4) in Table 4 - then compare the coefficients of each country with those of Germany and finally test the significance of the differences.

paid by firms headquartered in a given country with respect to a firm from Germany is higher (lower) than what implied by the fundamentals (bond, issuer and market characteristics). For instance, in 2006 the spread in the cost of funding between Portuguese and German firms is by 21bp attributable merely to the different country of residence of the issuer: a pure country-specific effect. The last column of the bottom panel is instead our proposed measure of overall market fragmentation: the sum of all the estimated country-specific spreads to Germany. Only when the value is not significantly different from zero we can claim that the market is perfectly integrated.

<b>Table 5 Panel regression: Country-specific effects over time<sup>1</sup></b>									
	Coefficient			Std. Err.			P-value		
<b>Duration</b>	0.007	0.001	0.000	<b>Issuer rating</b>	-28.43	2.436	0.000		
<b>Value</b>	0.008	0.005	0.100	<b>Issuer Size</b>	-9.918	3.435	0.004		
<b>Issuance in euros</b>	-18.95	6.474	0.004	<b>Market Volatility</b>	4.679	0.356	0.000		
<b>Bond Inv Grade</b>	-106.1	18.71	0.000						
	<b>Belgium</b>	<b>Finland</b>	<b>France</b>	<b>Italy</b>	<b>Netherlands</b>	<b>Spain</b>	<b>Portugal</b>	<b>Euro area</b>	
<b>2006</b>	24.6 *	-1.0	-10.2	-15.1	26.6	-14.3	21.2 *	31.8	
<b>2007</b>	-6.1	-36.6	-12.8	15.4	54.0	-31.7	62.7 ***	45.0	
<b>2008</b>	8.4	-0.8	-60.8 ***	-3.4	-19.3	-13.4	46.9 **	-42.4	
<b>2009</b>	57.9 ***	75.3 *	-16.0	-3.1	-33.5	-18.8	-8.9	52.8	
<b>2010</b>	14.6	71.3 **	10.1	35.7	38.4 *	96.8 ***	73.9 ***	340.9 ***	
<b>2011</b>	77.0 ***	84.2 **	24.4	127.2 ***	53.4 **	159.4 ***	229.9 ***	755.6 ***	
<b>2012</b>	61.7 **	30.2	54.8 ***	165.0 ***	20.0	182.8 ***	257.8 ***	772.3 ***	
<b>2013</b>	53.7 ***	19.1	21.7	130.8 ***	2.4	112.0 ***	107.4 ***	447.1 ***	
<b>2014</b>	16.7	-33.0	-1.6	44.4 *	-11.7	-25.1	71.0 ***	60.7	

(1) Dependent variable: ASW spread; included observations: 2,434; robust standard errors are clustered by issuer; regression includes FE by sector; Adj R-squared=0.868; symbols \*\*\*, \*\* and \* denote statistical significance at 1%, 5% and 10%, respectively. For the variables' description see footnote on Table 3.

Results show that in the tranquil period before the eruption of the crisis, characterized by buoyant financial market conditions, there are only two countries (Belgium and Portugal) for which the premia on corporate bonds are, ceteris paribus, slightly higher than in Germany. As a consequence, the aggregate fragmentation measure suggests a financially integrated market. The framework improves even further in 2007, year in which only Portuguese firms pay an ASW spread at origination significantly larger than German peers. In 2008 and 2009, several countries are able to cope better than Germany with the financial crisis showing negative estimated differences in bond premia,

however only in France is the difference significant (-61bp). The overall degree of fragmentation remains non significantly different from zero.

In the following period (2010-2012), the eruption of the sovereign debt crisis and the consequent abrupt reassessment of sovereign risk significantly weights on several countries' funding conditions. Rating agencies immediately provide a series of subsequent downgrades to the sovereign rating of Portugal and Spain and soon start to revise also Italian and Belgian creditworthiness. To a more muted extent, the process involves also 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 safety" 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 yield spreads to Germany (Di Cesare et al. 2012, Klose and Weigert 2014, Dewachter et al. 2015).

Thus it does not come as a surprise the fact that the sovereign debt crisis brings about the largest changes in the relative funding conditions of euro-area corporations. The country-specific premium with respect to German peers skyrockets to 258bp in Portugal, 183bp in Spain and 165bp in Italy. While the premium peaks in the most hit countries, the relative weakening in funding conditions is evident also in the other countries. For any of them, the estimated differences are significant at least in one year between 2011 and 2012. The overall value of market fragmentation, already significant in 2010, doubles in 2011 and peaks in 2012.

Only after the introduction by the ECB of the non-conventional monetary policy tool of OMT does the market sentiment change in the euro area.<sup>11</sup> 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.

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<sup>11</sup> The technical features of OMT were officially announced by the ECB after the September 2012 Governing Council meeting. However, the idea behind OMT, namely the possibility of ECB actions to address unjustified sovereign risk premia related to fears of the break-up of the euro, was first announced by President Draghi in a speech in London (July 26, 2012), and further elaborated following the August 2012 Governing Council meeting.

However, while in 2013 the funding conditions of firms headquartered in Finland, France and the Netherlands can be said to be in line with those of German peers, for the highly indebted countries the improvement it is not enough to fully offset the deterioration recorded during the sovereign debt crisis. The market fragmentation is still ample.

In 2014, instead, the issue of fragmentation seems to be less of a concern in the euro area. Just for Italy and Portugal the spread to Germany is still positive and significant. All the other countries show differences (both positive and negative) which are not significantly different from zero. As a consequence also the estimated degree of fragmentation drops to a value which is not statistically significant suggesting the return to an integrated corporate bond market. It thus seems that after the abrupt halt in the process of market integration caused by the sovereign debt crisis, the progress in the restructuring of the EU governance, the improved macroeconomic outlook, the launch of the Single Supervisory Mechanism, in addition to the non-conventional monetary policy measures, were able to bring back the market integration to the pre-crisis levels.

Nevertheless, the evidence from estimated country-specific effects and from the proposed measure 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? Are there inconsistencies among sources of risk or even across euro-area countries? One issue of concern, for instance, is the sovereign creditworthiness: ratings assigned to euro-area sovereigns in 2014 are still well below those prevailing before the global financial crisis, especially for the countries most involved in the sovereign debt crisis (between five and eight notches), with only Germany boasting an immaculate AAA rating from each of the three main rating agencies (Fitch, Moody’s, S&P). This in turn suggests an increased cost of public debt and a reduced ability of 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.<sup>12</sup> Moreover, there is evidence that the market assessment of the sovereign creditworthiness might be misjudged, especially in the lower rated countries (De Grauwe and Ji 2014, Camba-Méndez and Serwa 2014, Gibson et al. 2015). Firms may thus face deteriorated funding conditions because of a distorted assessment of

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<sup>12</sup>The sovereign rating is often used as a cap for the domestic corporations (CGFS 2011) even though non-sovereign entities can exceed the rating of the sovereign, but it is usually rare (Moody’s 2009, Fitch Ratings 2014).

the sovereign creditworthiness which spills over to their “fundamental” determinants of the cost of funding (Bedendo and Colla 2015). Another possible source of mispricing might be the different macroeconomic framework. Even though the euro area before the crisis was close to be an optimal currency area, with business cycles relatively synchronized, converging price levels and negligible differentials in interest rates across countries, the sovereign debt crisis almost broke the area into two subsets: a core one improving after the global financial crisis and the great recession and a peripheral one struggling into another recession.

In the next section, while providing broad robustness checks, we also further investigate the role of sovereign creditworthiness and macroeconomic conditions in influencing our estimates of market fragmentation.

## **6. Robustness**

In this section we examine how the main results concerning the degree of market fragmentation are affected by the choice of the regressors in Equation (1). In particular, we check whether results are robust to changes in the issuer rating, the bond rating and the variable assessing the market mood. In addition, in order to enrich the model and mitigate any possible omitted variable effect on our results, we also investigate the role of two further sets of country-specific variables: the sovereign creditworthiness and the macroeconomic position of each country.

Starting from the firm rating, it must be noted that the probability of default of the issuer might be non-linear in the rating. Thus, instead of using a linearized variable for the firm rating, we rely on a set of dummy variables, in which each dummy shows 1 if the rating has the corresponding level and zero otherwise. The estimated degree of market integration/fragmentation is reported in the first column of Table 6. A second check stems from the similarity in the bond and firm ratings. Bond ratings are assigned by rating agencies to the single issue at the time of issuance and as such, they reflect both the issuer default risk and the facility seniority and security structure. Since they are assigned at the moment of the bond placement, the agencies’ evaluation might reflect an even more updated assessment of the firm than the firm’s rating itself. As a matter of fact, the firm rating and the bond rating are highly correlated (0.957), but far from being coincident (there are 885 items for which the firm rating is different from the bond rating). We thus

use the bond rating (both linearized between 1 and 20 and as a set of dummy variables) as a proxy of the firm rating (column 2 and column 3, respectively).<sup>13</sup>

In a further set of checks we change the variable identifying the ex-ante default risk of the bond by using the bond rating instead of the investment grade dummy. We first rely on the linearized version of the bond rating (maintaining also the firm rating as a linearized variable), in a second regression we employ the bond rating as linearized variable but we use the firm rating as a set of dummies; in a third regression we proceed the other way around and in a fourth regression both bond rating and firm rating are employed as set of dummies (Table 6, columns 4-7). Finally, to check for a possible noise in the estimation procedure due to the high correlation between bond and firm default risk, we completely drop the regressor concerning the market assessment of bond riskiness (column 8).

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
<b>2006</b>	-6.04	-5.81	21.2	51.8	-12.8	63.6	6.42	72.4	72.5	49.2
<b>2007</b>	112.7	27.4	60.7	3.51	99.5	110.7	95.7	36.7	53.0	46.7
<b>2008</b>	71.2	-45.1	-46.1	-54.8	57.0	54.8	27.2	-22.5	-13.7	31.2
<b>2009</b>	95.6	52.3	99.7	4.3	94.3	81.9	76.8	8.4	66.7	86.2
<b>2010</b>	405.7 ***	266.1 **	339.5 ***	305.0 ***	395.1 ***	397.1 ***	366.9 ***	334.5 **	354.7 ***	299.4 **
<b>2011</b>	741.3 ***	771.2 ***	829.7 ***	730.3 ***	743.2 ***	787.4 ***	779.1 ***	730.6 ***	757.4 ***	621.6 ***
<b>2012</b>	848.5 ***	772.9 ***	844.8 ***	811.2 ***	850.0 ***	828.3 ***	845.0 ***	812.0 ***	771.6 ***	709.0 ***
<b>2013</b>	443.3 ***	394.4 ***	398.2 ***	367.2 ***	432.4 ***	371.5 ***	415.7 ***	397.4 ***	447.3 ***	430.7 ***
<b>2014</b>	61.9	71.5	63.8	-43.9	55.5	-45.1	29.2	-28.5	80.6	74.3

(1) The table reports the degree of fragmentation in the euro-area corporate bond market measured as the sum of the estimated country-specific coefficients of ten different regressions. Columns (1) to (3) are robustness regressions for the firm rating; columns (4) to (8) are robustness regressions for the bond rating; column (9) and (10) are robustness regressions for the market sentiments. Dependent variable: ASW spread; included observations: 2,434; robust standard errors are clustered by issuer; regression includes FE by sector; symbols \*\*\*, \*\* and \* denote statistical significance at 1%, 5% and 10%, respectively.

A final check concerns the variable used to track market sentiments. Instead of the VSTOXX Index, we first refer to the VIX Index, which is the equivalent of the VSTOXX for the US equity market, and which is usually employed as the reference indicator of the global market sentiment (column 9). We then use the CISS Index, which is the financial

<sup>13</sup> The investment grade dummy is maintained for the bond assessment.

market stress indicator for the euro area proposed by Hollo et al. (2012) and regularly updated at the monthly frequency by the ECB statistical data warehouse (column 10).

Each regression confirms that in 2006 the euro-area corporate bond market was already integrated and that the global financial crisis did not bring about significant changes. It is also confirmed that the sovereign debt crisis led instead to a dramatic change with fragmentation becoming significant and sizeable from 2010 till 2013, with a peak in 2012. Finally, 2014 is the year of return to an integrated market. Also the value of the estimated degree of fragmentation is similar across regressions, in particular over the sovereign debt crisis period, confirming the robustness of the results obtained in the previous section.

As a further robustness assessment, we look for possible additional factors, which may influence our estimates of market fragmentation, to check whether relevant variables were omitted in modelling the ASW spread. In particular, in normal times, the rating of firms and bonds adequately reflects the creditworthiness of the issuer and the risk of default of the bond. Thus, all the conditions which influence the probability of default are properly taken into account at the moment of the bond issuance and reflected in the ASW spread paid at launch. However, in periods of market turmoil the assessment might not be straightforward and characteristics which are usually taken into account in bond and firm ratings may themselves provide an additional source of price discrimination in market trades. When the characteristics are univocally linked to the different countries they may end up affecting the estimated country-specific component. In order to check how this possible market distortion affects our estimates and our market fragmentation assessment, we explicitly take into account two distinct country-specific characteristics: the sovereign creditworthiness and the country's macroeconomic conditions. The choice is dictated by the observation that during the sovereign debt crisis the creditworthiness of a given set of euro-area countries was severely challenged, while it was not the case for the remaining countries (or at least not so strongly). Given the perverse link between the deterioration in the sovereign creditworthiness, the soundness of the domestic banking system and the funding of firms (CGFS 2011, Angelini et al. 2014), also the real sector of the economy was negatively affected determining a sort of decoupling. Fiscally sounder countries enjoyed a rebound in the economic activity while less sound countries experienced a return to recession.

To check how the phenomenon might affect our results, we introduce in the baseline regression of Table 5 a variable tracking first the market assessment of the sovereign

creditworthiness and then the macroeconomic position of each country. In both cases we refer to three possible alternative indicators. Concerning the sovereign creditworthiness we use the sovereign rating provided by Moody's (linearized by 1 and 20, from Ca to Aaa), the sovereign CDS spread and the spread of the sovereign 5-year benchmark bond from the equivalent German Bund. As regards the macroeconomic position we use the unemployment rate, the inflation rate (monthly change in the HICP) and the industrial production (all sourced from the ECB statistical data warehouse). With the exception of the regression involving the unemployment rate, whose coefficient was not statistically significant, Table 7 provides the estimate of the coefficients (top panel) and the degree of fragmentation (bottom panel).

	<b>Sovereign Rating</b>	<b>Sovereign Spread</b>	<b>Sovereign CDS</b>	<b>Ind. Production</b>	<b>Inflation</b>
<b>Added variable</b>	-5.892 *	16.15 **	0.245 ***	-2.561 ***	16.92 ***
<b>Duration</b>	0.007 ***	0.007 ***	0.007 ***	0.007 ***	0.007 ***
<b>Value</b>	0.008 *	0.009 *	0.009 *	0.008 *	0.008 *
<b>Issuance in euros</b>	-19.14 ***	-19.48 ***	-19.39 ***	-19.83 ***	-19.14 ***
<b>Bond Inv Grade</b>	-106.8 ***	-107.2 ***	-107.7 ***	-106.0 ***	-106.0 ***
<b>Issuer rating</b>	-28.43 ***	-28.28 ***	-28.23 ***	-28.54 ***	-28.47 ***
<b>Issuer Size</b>	-9.750 ***	-9.969 ***	-9.936 ***	-9.988 ***	-9.769 ***
<b>Market Volatility</b>	4.653 ***	4.444 ***	4.019 ***	4.101 ***	4.669 ***
<b>Adj R-squared</b>	0.8685	0.8689	0.8693	0.8691	0.8694
<b>Corporate bond market degree of fragmentation</b>					
<b>2006</b>	52.41	50.17	49.80	8.08	-7.98
<b>2007</b>	47.58	40.89	43.48	-22.88	88.94
<b>2008</b>	-42.21	-75.78	-59.68	-40.68	-113.2
<b>2009</b>	43.99	-5.15	-2.85	112.41	29.15
<b>2010</b>	341.9 ***	267.6 ***	231.0 ***	271.7 ***	287.5 ***
<b>2011</b>	746.7 ***	525.7 ***	466.3 ***	644.8 ***	704.7 ***
<b>2012</b>	757.1 ***	481.9 ***	430.8 ***	703.2 ***	703.8 ***
<b>2013</b>	445.8 ***	275.8 ***	242.5 ***	441.8 ***	475.9 ***
<b>2014</b>	81.36	-13.10	-28.20	38.81	27.16

(1) Dependent variable: ASW spread; included observations: 2,434; robust standard errors are clustered by issuer; regression includes FE by sector; symbols \*\*\*, \*\* and \* denote statistical significance at 1%, 5% and 10%, respectively. For the variables' description see footnote on Table 3.

The additional country-specific regressor always shows a coefficient different from zero (even though with different statistical significance) and with the expected sign. In particular, a deterioration in the sovereign creditworthiness is reflected in an increase in the

corporate cost of funding. A downgrade of one notch in the sovereign rating is accompanied by an increase of 6 basis points in the ASW spread paid by firms; an increase of 100 basis points in the 5-year sovereign spread to Bund is accompanied by a deterioration of 16 basis points in the ASW spread; an increase in the sovereign CDS of 100 basis points is accompanied by a deterioration of 24 basis points in the ASW spread. When looking at the macroeconomic conditions, it turns out that firms headquartered in countries enjoying increasing industrial production face a smaller ASW spread on their bonds, while firms headquartered in countries with increasing inflation face a higher ASW spread.

However, the contribution to the explanatory power of the regression stemming from each added variable is rather limited. The adjusted R-squared hardly changes with respect to the baseline regression of Table 5. In addition, also the estimated degree of fragmentation derived from each regression confirms the finding of the previous section. Just the values of the fragmentation indicator computed when using the sovereign spread or the sovereign CDS are relatively smaller than those stemming from the baseline regression, suggesting a possible independent role of sovereign creditworthiness as a country-specific determinants. This in turn copes well with the evidence that the financial integration of the corporate bond market was resilient during the global financial crisis, when euro-area countries were hit (though with different strength) by the same shock and almost all countries faced a contemporaneous deterioration in the macroeconomic conditions. However, when the area was hit by an asymmetric shock (the sovereign debt crisis) the integration of the market was challenged and additional sources of price discrimination were introduced when pricing bonds at issuance.

## **7. Conclusion**

One of the most persistent consequences of the global crisis that started in the summer 2007 is the financial market fragmentation along national borders in the euro area. Even if it originated in the US subprime mortgage market, the crisis soon moved to Europe and lingers there longer than it has elsewhere. Starting from mid-2010, the second wave of the crisis, now known as the euro-area sovereign debt crisis, brings about a freeze in the interbank market, a strong dependence on the ECB liquidity and repeated spikes in the sovereign debt yields of several euro-area countries. Evidence of the reversal of the euro-area financial integration process can be found in the systematic difference in bank rates

across countries and in the “home bias” in the portfolios of financial intermediaries and households. The deterioration in the financial integration, in turn, hampers the pass-through of the policy rates leading to a breakdown in the monetary policy transmission mechanism (ECB 2013). Only after extensive monetary policy interventions, often of non-conventional nature, and the announcement by the ECB of the new OMT tool does the market sentiment change, leading 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 possibly fragile.

As for the bond market, the crisis significantly affects firms’ funding cost, 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 behind 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.

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, issuer and market characteristics. By doing so, we identify the role of purely country-specific factors, i.e. the relative advantage/disadvantage for an issuer to be located in its home country instead of Germany. Using the estimated country-specific coefficients we provide a measure of market fragmentation.

We find that the market integration process is not halted by the first wave of the global financial crisis. Fragmentation instead becomes an issue only during the sovereign debt crisis (2010-2012), when country-specific spreads to Germany and the proposed fragmentation measure spike to unprecedented levels. Thanks to the new ECB communication policy and a set of *ad hoc* measures the degree of fragmentation considerably shrinks in 2013, even though remaining significantly larger than zero. It goes back to pre-crisis levels only in 2014.

Nevertheless, the low level of estimated market fragmentation at the end of the time sample is associated with a still significant heterogeneity in actual bond spreads, challenging the consistency of the new equilibrium. A possible explanation is linked to the existence of a market mispricing of some sources of risk. In particular, in line with the findings of a recent literature (De Grauwe and Ji 2014, Camba-Méndez and Serwa 2014, Gibson et al.

2015), our empirical evidence suggests a possible additional role for the sovereign creditworthiness as an independent source of pricing – most likely started in the troubled period of the sovereign debt crisis – which may well take some time in fading out in normal times.

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.

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