A tale of fragmentation: Corporate funding in the euro-area bond market

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A B S T R A C T

Corporations of different euro-area countries faced noticeably different costs of funding in the bond market during the prolonged period of financial instability which started in 2007. We identify the determinants of corporate bond yield spreads in order to isolate country-specific effects, as indicators of market fragmentation. Our evidence hints at a disorderly process of reassessment of corporate credit risk since 2007 with country-specific spreads *vis-à-vis* Germany becoming strongly positive for issuers located in other euro-area countries (Ireland, Italy, Portugal and Spain, in particular). After the introduction of the non-conventional monetary policy tool named OMT, the spreads declined considerably, but fragmentation disappeared only in the latest period characterised by the expectations and the actual deployment of the ECB quantitative easing.

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1. Introduction

In the euro area the establishment of the monetary union in 1999 was a milestone on the road to more integrated financial markets, since it eliminated once and for all the exchange rate risk within the new currency area. In addition, legal and institutional reforms, along with the development of new financial instruments and trading platforms, facilitated the integration process leading to a significant increase in capital and trade flows among countries (Hartmann, Maddaloni, & Manganelli, 2003; Baele, Ferrando, Hördal, Krylova, & Monnet, 2004). Well integrated financial markets are a fundamental pillar of a monetary union, since they are essential in safeguarding that the common monetary policy decisions are transmitted in an effective and equal way to all member countries (ECB, 2013). However, the burst of the global financial crisis in 2007 and the unfolding of the euro-area sovereign debt crisis from 2010 called into question the extent to which financial markets in the euro area are actually integrated.

While the empirical literature has extensively focused on analysing the emergence of price anomalies in the sovereign debt market of both emerging markets (Beirne & Fratzscher, 2013; Buraschi, Menguturk, & Sener, 2015; Du & Schereger, 2016) and

advanced economies (Dewachter, Iania, Lyrio, & de Sola Perea, 2015; Georgoutsos & Migiakis, 2013; Giordano, Pericoli, & Tommasino, 2013), and on assessing the degree of integration/fragmentation in the interbank market (Angelini, Nobili, & Picillo, 2011; Garcia de Andoain, Hoffmann & Manganelli, 2014; Mayordomo, Abascal, Alonso & Rodriguez-Moreno, 2015), the corporate bond market has only recently attracted attention. This is surprising, given its importance as a funding source for both financial and non-financial corporations and its role as a link to the real economy, especially in a period of significantly declining loans from banks (if not a proper credit crunch). The few existing contributions (De Santis, 2016; Horny, Manganelli, & Mojon, 2016; Zaghini, 2016) find that a certain degree of market fragmentation emerged in the euro area during the global financial crisis, increased in the years of the sovereign debt crisis and significantly decreased since 2012, when several non-conventional monetary policy instruments were introduced. However, the quoted works focus only on non-financial corporations and rely on different groups of countries, making a comparison of the results almost impossible. In addition, there is no agreement whether at the end of the time sample (end of 2014/beginning of 2015) there is already a return to perfect market integration. Finally, they do not include (or include only partially) the period characterised by the expanded asset purchasing programme (EAPP), the ECB quantitative easing, which, most likely, is the most important non-conventional monetary policy measure implemented so far in the euro area.

Adding to this scarce literature, the aim of this paper is threefold: i) to investigate the causes of the different yields paid by euro-area corporations over the subsequent phases of the global financial crisis, including the most recent period of ECB quantitative easing; ii) to precisely assess the degree of market fragmentation for an enlarged group of euro-area countries; iii) to evaluate the differences in the cost of funding via bonds between banks and non-financial corporations.

In particular, we build on the traditional model proposed by Morgan and Stiroh (2001) and Sironi (2003) on the determinants of bond spreads at origination. We conveniently add to the standard set of exogenous variables (i.e. those tracking bond, issuer and market characteristics) the interactions of country and time dummies. In this way, it is possible to identify and follow over time the role of purely country-specific factors. Whenever country-specific effects are statistically significant we have a violation of the law of one price, which is at the base of the definition of perfect market integration, and thus we can claim that the market is fragmented.

We find that in the tranquil period before the burst of the global financial crisis (2005Q1–2007Q3) the euro-area corporate bond market was well integrated. Instead, the two waves of the global financial crisis (the crash of the US sub-prime mortgage market and the default of Lehman Brothers, 2007Q4–2010Q2) significantly affected the market by breaking the integration and determining a deterioration of the funding ability of corporations in several countries. However, it is during the sovereign debt crisis (2010Q2–2012Q2) that corporate fragmentation became a pressing policy issue, with corporations from almost all countries experiencing a significant disadvantage with respect to Germany, which we set as the reference country. After the *whatever-it-takes* speech of the ECB President Mario Draghi and the introduction of the new OMT (outright monetary transactions) tool, market tensions started to ease, even though market fragmentation was still evident in the bond market (2012Q3–2014Q2). It is only in the most recent period, characterised by the expectations and the actual implementation of the ECB quantitative easing (2014Q3–2015Q4), that the market returned to a level playing field with country-specific effects *vis-à-vis* Germany disappearing also in the most troubled countries.

Finally, as concerns the different cost of funding across sectors, we find that, with the exception of Finland and Italy, banks in the euro area suffered more than firms the fragmentation in the bond market, paying, *coeteris paribus*, a higher spread. Again, it is only in the latest period of quantitative easing that banks and firms were able to face the same funding cost in the corporate bond market.

The rest of the paper is organised as follows. In Section 2 we discuss the contributions on market fragmentation; in Section 3 we describe the dataset; in Section 4 we introduce the econometric methodology; in Section 5 we analyze the factors determining bonds' risk premium at origination and assess the degree of market fragmentation; in Section 6 we distinguish between banks and firms; in Section 7 we provide several robustness checks; in Section 8 we draw the conclusions.

2. Literature review

An important consequence of the turmoil in the euro-area sovereign debt market was the transmission of the crisis to the corporate bond market. Eventually, not only banks but also firms were involved in the crisis via the "transfer risk" phenomenon, experiencing a deterioration of their funding abilities (Bedendo & Colla, 2015). However, the deterioration was unequal across countries and led to an increasing market fragmentation and segmentation along national borders. Corporate risk premia soon reached unprecedented levels and the heterogeneity across countries increased significantly leading to a worrying widening in the yield spreads between bonds

issued by corporations headquartered in the countries most involved in the crisis and those issued by corporations headquartered in countries with sounder public finances. This market evolution, together with diverging banks' lending rates, was conflicting with the smooth transmission of the common monetary policy. Thus eliminating financial fragmentation was at the base of the interventions of the ECB in 2012, often via non-conventional monetary policy measures (Durré, Maddaloni, & Mongelli, 2013).

However, the empirical literature has almost entirely focused on the fragmentation in the sovereign debt market neglecting the corporate segment of the bond market. In addition, while the role of banks has been extensively investigated as a link in the transmission of fragmentation from the sovereign to the real economy (Angelini, Grande, & Panetta, 2014; CGFS, 2011; van Rixtel & Gasperini, 2013) or even as a direct cause of fragmentation, when providing funds at diverging rates to non-financial corporations and households (Albertazzi, Ropele, Sene, & Signoretti, 2014; Giannetti & Laeven, 2012; Popov & Van Horen, 2015), it has been overlooked when they were funding themselves on the bond market as any other corporation. All in all, just three very recent contributions have tackled the issue of estimating the degree of fragmentation across bonds issued by euro-area (non-financial) corporations (De Santis, 2016; Horny et al., 2016; Zaghini, 2016). In what follows we will examine their approach and discuss their conclusions.

Building on the work for the US bond market by Gilchrist and Zakrajsek (2012), who introduced the concept of excess bond premium (EBP) as the difference between the duration adjusted credit spread and the spread justified by observable credit risk, De Santis (2016) expands the EBP measure to include also market risks slightly and idiosyncratic shocks. Relying on 2345 bonds issued by non-financial corporations from 9 euro-area countries over the period January 1999–March 2015 the author proposes as a measure of fragmentation the degree of dispersion across countries of domestic EBP values. He finds that fragmentation (the standard deviation of EBP) was very large till 2003 (especially for high-yield bonds), declining just before the burst of the global financial crisis, and then showing two peaks of almost identical size in the period immediately after the Lehman Brothers default and in the most acute phase of the sovereign debt crisis (2011–2012). While significantly declining after the introduction of the OMT, fragmentation slightly increased at the beginning of 2015.

Again focusing of non-financial corporation bonds (2434 primary issues from 9 euro-area countries), Zaghini (2016) introduces country dummy variables in a standard model of risk-premium determinants. He refers to the sum of the dummy coefficients as the measure of market fragmentation. In particular, only when the joint coefficient estimate is significantly different from zero the model signals fragmentation. The results suggest that, despite a certain degree of volatility in country-specific effects, the overall integration of the euro-area bond market was not affected by the first wave of the financial crisis (2007–2009). Instead, in the four years from 2010 to 2013 fragmentation was detected and the joint estimate of country coefficient was highly significantly different from zero. Finally, the return to the perfect market integration happened already in 2014.

In line with Zaghini (2016), also Horny et al. (2016) focus on country dummies to assess the degree of market fragmentation. In particular, their econometric approach is based on dummy regressions for three main drivers: i) the countries' fixed effect, ii) the bond rating, iii) the slope of the term structure. By looking over the period from 2005 to early 2015 at the secondary market pricing of 735 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. Then they rely on the sum of the country coefficients to obtain the measure of market fragmentation. They show that while

financial fragmentation remained fairly limited in the post Lehman period (2008–2009), it reached very high levels at the heights of the euro-area sovereign debt crisis in 2011 and 2012. Fragmentation receded gradually after the OMT announcement but it was still detected (50 basis points) at the beginning of 2015.

Among the findings of the three papers there is agreement on the perfect market integration achieved before the burst of the global financial crisis and the high level of fragmentation detected during the most acute phase of the sovereign debt crisis. However, there are also differences, such as the unclear effect of the first wave of the crisis on the market integration and the degree of fragmentation at the end of the time span (2014 or early 2015). In the rest of the paper we will investigate the degree of market integration/fragmentation in the euro-area bond market by taking into account, in addition to non-financial corporations, also the bond placement of banks, by extending the time horizon in order to include also the launch of the ECB quantitative easing, and by including in the analysis all the troubled economies (Ireland, Italy, Portugal and Spain), which were not taken into account all together by the previous contributions.[1]

3. Data and sample characterization

Since the aim of this paper is to analyze the determinants of the cost of bond funding for euro-area corporations, we focus on the yield at issuance of bonds. In particular, we look at the asset swap (ASW) spread paid by corporations at origination, namely on the primary market. The ASW spread is a measure of the distance between the bond yield and a risk-free asset (the rate on the asset swap contract with similar characteristics).[2] We do not follow the ASW spread on the secondary market since, after the bond launch, it reflects the market assessment of a possible trade in that moment but it does not change the face value of the bond (i.e. it does not change the actual cost for the issuing corporation). Actually, secondary market prices are only an imperfect measure of a hypothetical funding decision for that date (often being based on brokers' indicative prices or dealers' quotes) which are most of the times not coupled with an actual trade. While focusing on a single value for each bond may reduce the full exploitation of the time dimension of the dataset, it leads to a larger selection of bonds and issuing institutions.

The dataset exploited in this paper contains bonds issued over the period 2005Q1–2015Q4 by euro-area listed and non-listed corporations with life to maturity of at least 1 year. In particular, the final sample includes 8469 bonds issued by 455 corporations (149 banks and 306 non-financial corporations) from 10 countries. Table 1 proposes a snapshot of the issuance activity by country.

The number of corporations which have been tapping the bond market over the sample period goes from 100 in France to 12 in Portugal. Several corporations (115) are 1-timers, i.e. they issued only one bond; the share ranges from 7% in Finland to 39% in Belgium.[3] At the same time the largest number of bonds issued by a single country is 2787(Germany), the minimum is 112 (Portugal). The maturity at issue suggests that Belgian and French corporations are used to place bonds with longer redemption horizons (the average being over seven years), whereas Spanish, Irish and Finnish issuers prefer to place bond with shorter maturities (the average being below six years). As for the volume of the initial placement, corporations from just three countries (Spain, Portugal and Ireland) place bond tranches

Table 1
Bond characteristics by country.

Country	Issuers	1-timers	Bonds	Maturity	Tranche value	ASW
Austria	25	7	171	2379	424	80
Belgium	18	7	330	2632	456	95
Finland	14	1	114	2116	434	119
France	100	22	1966	2627	469	90
Germany	95	25	2787	2216	296	70
Ireland	15	4	150	2117	604	252
Italy	69	20	801	2383	598	164
Netherlands	39	6	1176	2360	404	68
Portugal	12	3	112	2322	609	237
Spain	68	20	862	2094	604	172
Total	455	115	8469	2353	431	101

with an average value above 600 million euros, while German corporations exhibit the smallest value (296 million euros). Given the striking heterogeneity even in the bond basic characteristics (maturity and volume), it is not surprising that the ASW spread paid by issuers headquartered in different euro-area countries shows a broad range: from 70 basis points Germany to 252 in Ireland.

The time span of our dataset allows us to follow all the phases around the global financial crisis. In particular, we refer to five time periods: i) the initial tranquil period which precedes the turmoil in the US subprime mortgage market; ii) the unfolding of global financial crisis; iii) the spread of the crisis to the sovereign bond market in the euro area; iv) the period of relative easing tensions which follows the OMT launch by the ECB; v) the period characterised first by market expectations of a quantitative easing by the ECB and then by the actual deployment of the expanded asses purchasing programme (EAPP). While providing in Section 7 several robustness checks with respect to the time framing, the initial choice follows the chronology of the most relevant episodes. The tranquil period starts in 2005Q1 and ends in 2007Q3, when BNP Paribas, France's largest bank, halts redemptions on three investment funds based on US subprime mortgage market, triggering the intervention of FED and ECB. The episode which, instead, characterises the euro-area sovereign debt market turbulence is the impossibility of Greece to tap the bond market and the request of international financial assistance on April 2010 (namely, the "global crisis" period ends in 2010Q2 and the "sovereign crisis" period starts in 2010Q3). Since the new OMT tool was announced on July 2012 by ECB president Draghi and financial markets immediately reacted positively, with sovereign and corporate spreads starting a new phase of convergence, we select 2012Q3 as our starting quarter for the "post OMT" period. Finally, we select 2014Q3 as a starting point of the "EAPP" period since, from the second half of 2014, it started to be clear across market agents that the inclusion of sovereign bonds in the standard asset purchasing programme was close to be implemented, making the programme a straightforward quantitative easing.

Relying on the above-mentioned time partition, Figs. 1 and 2 show the development over time of the ASW by country. The common effect of the global financial crisis is evident: the crisis brought about everywhere a significant increase in the premia paid by corporations (with the only exception of Finnish banks). Instead, it is also clear that during the sovereign debt crisis the financial turmoil was felt in a very different way across the euro area. The countries most involved in the crisis (Ireland, Italy, Portugal and Spain) saw a further significant increase in the cost of issuance for both banks and firms, whereas the countries less involved faced in many instances just mild adjustments (for firms in Austria, Belgium and Germany the actual cost at issuance even declined). The ASW spread dropped almost everywhere in the OMT period, but it is only in the latest phase, characterised by the ECB quantitative easing, that the tensions in the corporate bond market lessened to the extent of bringing back the ASW spread to levels similar to the pre-crisis period.

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[1] While the paucity of data does not allow to include Greece in any of the quoted analyses, out of the remaining four troubled economies, De Santis (2016) takes into account Ireland, Italy and Spain, Zaghini (2016) includes Italy, Portugal and Spain, Horny et al. (2016) rely on Italy and Spain.

[2] The ASW spread is the same yield spread used in De Santis (2016) and Zaghini (2016), while Horny et al. (2016) rely on the spread from German Bunds.

[3] The share of 1-timers is relatively similar for the four top euro-area economies (23% in France, 27% in Germany, 29% in Italy and Spain).
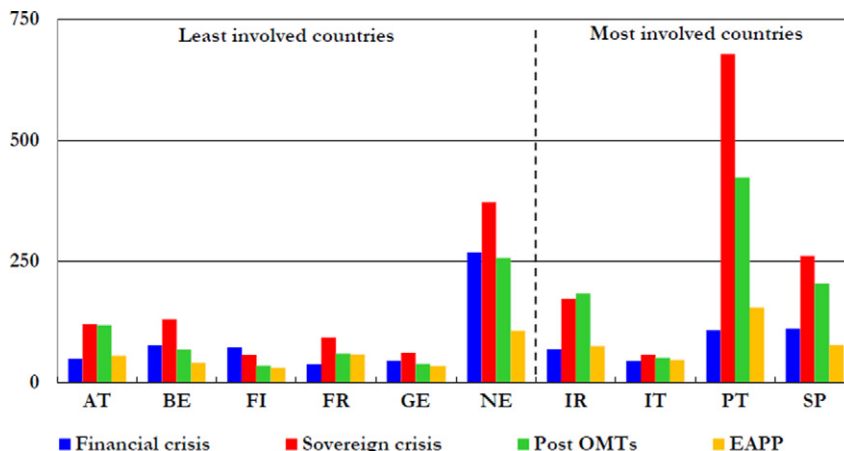
AT=Austria, BE=Belgium, FI=Finland, FR=France, GE=Germany, NE=the Netherlands, IR=Ireland, IT=Italy, PT=Portugal, SP=Spain. Tranquil period=(2005Q1-2007Q3), Financial crisis=2007Q4-2010Q2, Sovereign crisis=2010Q2-2012Q2, post-OMTs=2012Q3-2014Q2, EAPP=2014Q3-2015Q4.

Fig. 1. Actual ASW spread on bank bonds (basis points).

Another relevant aspect that emerges is the remarkably different size of the ASW spread paid by banks and firms. While the ASW spread was generally significantly higher for firms than banks in the tranquil period, the financial and sovereign debt crises made the spreads spike very much in the same fashion. Given that the crisis originated in the financial system and that the sovereign debt crisis was plagued by the vicious loop between sovereigns and domestic banks, it is not surprising that in several countries the banking system suffered larger increases in the cost of bond funding than firms.

Even though the reported evidence suggests that the corporate bond market was segmented along national borders, we still cannot label this cross-country heterogeneity as market fragmentation. While market heterogeneity is a statistical phenomenon that can be easily measured, market fragmentation is an economic concept,

which is more subtle to detect. Actually, financial fragmentation can be conveniently defined as the absence of perfect market integration. In turn, perfect integration envisages a situation in which – due to the law of one price – yield spreads are determined only by differences in the perceived riskiness of assets (related to asset features and issuer creditworthiness) and do not depend on the country of residence of the issuer (Baele et al., 2004). This means that two corporations headquartered in different countries which issue the same type of bond and which are perceived by investors as being completely equivalent in terms of riskiness (the so called *coeteris paribus* condition), should face the same cost of funding. Thus, whenever the *coeteris paribus* condition holds, also the ASW spread should be the same.

Can we say that the *coeteris paribus* condition holds for the bonds issued by the 455 corporations in our sample? Certainly not. Not only
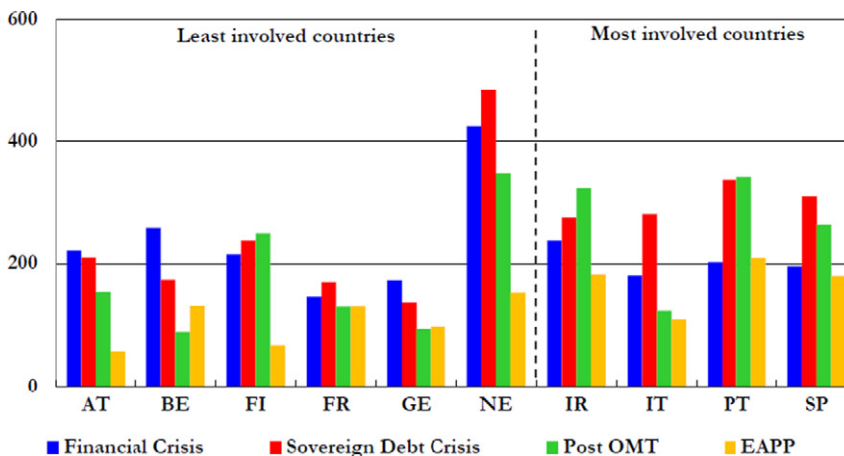
AT=Austria, BE=Belgium, FI=Finland, FR=France, GE=Germany, NE=the Netherlands, IR=Ireland, IT=Italy, PT=Portugal, SP=Spain. Tranquil period=(2005Q1-2007Q3), Financial crisis=2007Q4-2010Q2, Sovereign crisis=2010Q2-2012Q2, post-OMTs=2012Q3-2014Q2, EAPP=2014Q3-2015Q4.

Fig. 2. Actual ASW spread on firm bonds (basis points).

the characteristics of the bonds are seldom similar, but also the riskiness of the issuers varies a lot. Thus, the effect (if any) of the residence of the issuer is at best mixed up with the other price determinants. The rest of the paper aims at disentangling the different drivers of the ASW spread, in order to assess whether country-specific effects are indeed at work, whether they change over time and whether they differ between banks and firms.

4. The model

In order to empirically assess the determinants of the risk premium on the primary bond market, we build on the model proposed by Morgan and Stiroh (2001) and Sironi (2003). Their model simply divides the drivers of the bond spread in three sets of variables: those related to the bond features, $\left(V_l^{bond}\right)$, those characterizing the issuing corporation $\left(V_l^{issuer}\right)$ and those taking into account the market conditions at the time of issuance $\left(V_z^{market}\right)$. Analytically:

$$spread_i = \alpha_0 + \sum_k \alpha_k V_{i,k}^{bond} + \sum_l \alpha_l V_{i,l}^{issuer} + \sum_z \alpha_z V_{i,z}^{market} + \sum_j \alpha_j D_{i,j}^{frag}$$

(1)

where $spread_i$ is the ASW spread at origination and $D_{i,j}^{frag}$ is an additional set of variables, which includes country dummies, period dummies and their interactions. The latter group of variable is needed to explicitly allow for country-specific effects and test the assumption of perfect market integration. 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 (*coeteris paribus* condition). If instead there is evidence that the risk premia differences are due to the country in which the issuing corporation is headquartered, we have a fragmented market. In particular, by excluding a reference country from the set $D_{i,j}^{frag}$, the estimated α_j coefficients and their standard errors will show, for each country, the difference with respect to the reference country and the statistical accuracy of the estimates. In this way the null hypothesis of perfect market integration (i.e., absence of fragmentation) can be conveniently set as all country coefficients being equal to zero.[4]

Following Morgan and Stiroh (2001) and Sironi (2003), all exogenous variables belonging to the first three groups are taken at time t (the exact issuance day), with the exception of balance sheet data which are lagged by one year (i.e., they refer to the latest annual balance available at t). Thus the model has a cross-section structure and its estimation can be thought of as equivalent to a standard pooled OLS panel estimation.

The initial choice of the regressors is based on the traditional drivers of the risk premium provided by an abundant empirical literature.[5] In particular, the bond features which are taken into account in $V_{i,k}^{bond}$ are: the time to maturity at origination; the amount issued (single tranche); the currency of denomination, the bond

risk category. With regard to the time to maturity of the bond, we expect that issuing corporations may find more difficult to place longer-term bonds, due to the roll-over risk associated to the longer redemption horizon, hinting at a positive relation with the ASW spread. Concerning the volume of the issue, there might be two effects at work going in opposite directions. While issuing corporations may face higher costs to generate a sufficiently large demand for their placements, a larger issuance volume may imply improved liquidity for secondary market trades. It follows that the relation between the bond volume and the ASW spread is ex-ante ambiguous. In addition, in order to better take into account the liquidity of the bond, we use an indicator of the relative size of issue: the ratio of each bond value over the monthly average.[6] 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-). We expect that investment grade bonds pay a smaller ASW spread than high yield bonds. Finally, among the bond characteristics we also take into account whether the bond is a covered bond or not by introducing an *ad hoc* dummy variable.[7]

The set $V_{i,l}^{issuer}$ includes measures of the creditworthiness of the corporations, an indicator of their size and whether issuing corporations are 1-timers or have issued more than one bond in the period under consideration. We also take into account the industry sector.[8] As for the creditworthiness, we rely on a two-pronged approach. On the one hand, we use the official rating of the issuer, which is a measure of the perceived credit risk of the issuing institution as assessed on a professional basis by rating agencies. In particular, first we average the available ratings provided by Moody's, Fitch and Standard&Poors by linearising them between 1 (CC/Ca) and 20 (AAA/Aaa), then we create a dummy for each of the 20 categories. On the other hand, we rely on firm specific variables and use the total equity over total liabilities ratio (EL_ratio) and the total debt over total assets ratio (DA_ratio). We expect that a higher leverage (i.e., lower EL_ratio and higher DA_ratio) is associated with a larger ASW spread. On the contrary, the size of the issuing company (log of total assets) is expected to negatively affect the bond spread: given their diversified activities large corporations 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 would not allow large banks or firms to go bankrupt if their failures were to 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 sustained financial stress (Mishkin, 2006).

Finally, as proxy of the euro-area market sentiment we use the CISS Index, which is the financial market stress indicator for the euro area proposed by Hollo, Kremer, and Lo Duca (2012) and regularly

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[4] From an econometric point of view the procedure is equivalent to run a regression including also the reference country, then compare the coefficients of each country with those of the reference country, and finally test the significance of the differences.

[5] In addition to the quoted works by Morgan and Stiroh (2001) and Sironi (2003), the interested reader is referred to the seminal contributions by Campbell and Taksler (2003), Collin-Dufresne, Goldstein, and Spencer Martin (2001), Elton, Gruber, Agrawal, and Mann (2001). More recent empirical analyses are instead proposed by Ahmed, Anderson, and Zarutskie (2015), Anginer and Warburton (2014), Santos (2014).

[6] Other indicators of liquidity are employed in the robustness section. Note that standard measures of bond-specific liquidity used when analysing secondary market yield spreads (e.g. the number of trades per day or the bid-ask spreads), cannot be used when dealing with the bonds issued on the primary market since just the data concerning the originating trade is available (Bao, Pan, & Wang, 2011; Dick-Nielsen, Feldhutter, & Lando, 2012; Wang & Wu, 2015).

[7] Covered bonds are collateralized bonds typically issued by banks. In the sample there are around 1600 such bonds. While they are expected to pay a smaller ASW spread than comparable bonds, their exclusion from the regressions do not change quantitatively or qualitatively the results of the paper on the the degree of market fragmentation.

[8] Corporations are classified into 10 sectors: banks, industrials, consumer goods, consumer services, utilities, telecommunications, technology, basic materials, oil & gas and health care.

updated at the monthly frequency by the ECB statistical data ware-house (SDW). We expect that higher uncertainty is detrimental for investments and thus leads to an increased ASW spread.[9]

For the assessment of fragmentation, in the next section 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 represent a large share of the sample (Table 1) , they can serve as a statistically significant benchmark.

As for the data sources, we merged information from several databases in order to have a sample of 8469 bonds issued by euro-area corporations over the period 2005Q1–2015Q4. In particular, the ASW spread is taken from Thomson Reuters Datastream, balance sheet variables are sourced from Capital IQ, issuance features come from DCM Analytics by Dealogic, the CISS Index from ECB SDW.[10]

5. Risk-premium determinants and country-specific effects

Table 2 shows the estimated results from model (1). In partic-ular, the upper panel of Table 2 reports the estimated coefficients on bond, issuer and market characteristics, while the lower panel shows the coefficients on the interaction between country and time dummies from the same regression. In each of the five periods and for each country, the coefficients in the lower panel can be inter-preted as the relative advantage/disadvantage in tapping the bond market with respect to German corporations due to the country of residence of the issuer. Only when the estimated values are not significantly different from zero, we can claim that the market is perfectly integrated.

The two basic features of life to maturity and tranche value turn out to positively affect the ASW spread. As expected, bonds with longer maturity show higher spreads to compensate investors for the higher risk that these bonds carry over the extended horizon. Instead, the positive sign of the bond size reflects both a nega-tive assessment of the increased debt burden, and the fact that, in order to place a larger issue, corporations are required to pay a higher spread to generate a sufficient demand. At the same time, the relative size of the bond is not significantly different from zero, euro-denominated bonds and covered bonds have a discount of 21 and 39 basis points, respectively. Finally, being in the "investment grade" class determines a reduction in the ASW spread of around 130 basis points.

As far as the issuer characteristics are concerned, the coefficients on both size and leverage are significant and with the expected sign. Our estimates thus confirm the possibility of a bias in favour of the 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 dimen-sion make them of (domestic) systemic relevance and beneficiary of the implicit government too-big-to-fail insurance. At the same time,

a larger leverage implies higher risk-taking and higher default risk and it is consequently associated with a larger ASW at origination. Finally, 1-timer issuers seem not be penalised with respect to usual issuers.

As expected, the ASW spread is positively correlated with the market sentiment variable: the higher the market stress, the higher the ASW spread paid on new bonds.

Focusing on the assessment of market fragmentation (lower panel of Table 2), the estimated interactions of country dummies and time dummies suggest that in the tranquil period before the eruption of the crisis, characterised by buoyant financial market conditions and accommodative monetary policy, the euro-area bond market was perfectly integrated. Country-specific effects are everywhere not significantly different from zero.[11] Our results thus confirm the find-ings of the previous literature, which reports that before the finan-cial crisis the process of financial market integration was already achieved not only in the bond market, but also in several other mar-ket segments (Baele et al., 2004; Battistini, Pagano, & Simonelli, 2014; Hartmann et al., 2003).

The financial crisis period brings about a first significant change in the relative funding cost: in several countries there is an increase in the spread to Germany. The difference is significant but still limited for Belgium, Spain and Portugal (between 28 and 35 basis points) and very large for Ireland (140 basis points), the country most hit by the first wave of the crisis. At the same time, the joint test rejects the null of perfect integration (*p*-value = 0.086).

It is in the period characterised by the sovereign debt crisis that the fragmentation in the corporate bond market becomes a policy issue. The abrupt reassessment of sovereign risk in several countries significantly weights on the funding conditions of domestic corpo-rations, increasing the segmentation along national borders. Starting from the second half of 2010, international rating agencies steadily downgrade 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 Austria and France; only Fin-land and the Netherlands are spared from it. This process spills over to the corporate market increasing the funding cost of both banks and firms (Bedendo & Colla, 2015). The estimated ASW spread differ-ences with respect to German peers attributable to country-specific effects skyrocket to 393 basis points in Portugal, 190 in Spain, 163 in Ireland and 112 in Italy. While the spread peaks in the most hit coun-tries, the relative disadvantage in tapping the bond market is evident also in other countries (Austria, Belgium and France).

Over the most acute phase of the sovereign debt crisis, the dramatic U-turn in the process of financial integration has even chal-lenged the existence of the euro currency. The fear of a euro break-up (the so called redenomination risk) starts to be priced in periph-eral euro-area securities, further increasing yield spreads to Germany of both sovereign and corporate bonds (Dewachter et al., 2015; Di Cesare, Grande, Manna, & Taboga, 2012; Klose & Weigert, 2014). The ECB deploys a series of non-conventional monetary policy tools, in particular to avoid that a distorted market assessment, plagued by the inconsistent appraisal of tail-risks, could lead to a security pric-ing which did not reflect countries' fundamentals (Durré et al., 2013). Among them the OMT scheme (announced by the now renowned *whatever-it-takes* speech by President Draghi) marks a change in the market sentiment and triggers an unwinding of the tensions.

Starting from July 2012, risk premia slowly but constantly declined. The overall reduction in the spread with respect to the German corporate cost of funding is sizable. However, especially in the most troubled economies, the improvement is not large enough

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[9] The CISS (Composite Indicator of Systemic Stress) comprises 15 market-based financial stress measures concerning five broad market segments (financial interme-diation, money market, equity market, bond market, foreign exchange market). The main methodological innovation is the application of standard portfolio theory to the aggregation of the five segment-specific stress measures into a single composite indi-cator. Given that the cross-correlation between the five sub-indexes is allowed to vary over time, the CISS gives relatively more weight to periods of systemic stress, in which several market segments are impaired at the same time. Other measures of financial market sentiments are used in the robustness checks in Section 7.

[10] We excluded from the sample the top 1% and the lower 1% of bonds according to the reported ASW spread in Datastream. We did not include in the sample bonds from Greece and Luxembourg, since corporations from those countries did not tap regularly the bond market. We also excluded from the sample all bonds issued by financial corporations other than banks.

[11] Also the test of joint significance of the country-specific coefficients (which can well be interpreted as a direct test for overall market integration) cannot reject the null of perfect integration.

Table 2
Regression results.[1]

	Coefficient	Std. err.	P-value		Coefficient	Std. err.	P-value
Maturity	0.010	0.001	0.000	Issuer size	−4.02	2.018	0.047
Value	0.007	0.005	0.095	EL_ratio	−45.6	28.058	0.099
Relative value	0.109	2.029	0.957	DA_ratio	37.0	12.404	0.003
Issuance in euros	−20.86	4.134	0.000	1-timer	8.29	11.72	0.480
Covered bond	−39.05	8.493	0.000	Market stress	212.6	17.866	0.000
Investment grade	−129.4	23.88	0.000				

	Austria	Belgium	Finland	France	Ireland	Italy	Netherlands	Spain	Portugal
Tranquil period	−26.2	10.4	−47.1	−24.1	−20.7	−24.6	−12.0	−11.3	−9.8
Global crisis	−27.5	35.0*	18.7	−20.0	139.5***	3.9	−43.0**	33.0***	27.5*
Sovereign crisis	57.0***	72.3***	13.9	18.5**	162.9***	112.2***	−14.3	189.6***	393.4***
Post OMT	38.8**	21.7*	8.2	0.2	47.9*	113.3***	−7.2	104.5***	162.0***
EAPP	−8.6	16.4	7.8	2.2	−11.0	−0.8	−1.9	0.3	12.6

[1] Dependent variable: ASW spread; included observations: 8469; robust standard errors are clustered by issuer; regression includes FE by sector and by issuer rating; Adj Rsquared=0 .775; symbols ***, ** and * denote statistical significance at 1%, 5% and 10%, respectively. ASW spread is the difference between the bond yield and the fixedleg rate of a swap contract with the same maturity (basis points); Maturity is the bond maturity at issuance (days); Value is the tranche value of the bond issuance (millions of euros); Issuance in euros is a dummy which takes the value 1 for eurodenominated bonds and 0 otherwise; Covered bond is a dummy which takes 1 for covered bonds and 0 otherwise; Investment grade is a dummy which takes the value 1 for bonds rated BBBor above and 0 otherwise; Issuer size is the log of the balance sheet value of all assets (millions of euros); 1-timer is a dummy which takes 1 for corporations which issued only one bond over the period 2005Q1–2015Q4 and 0 otherwise, Market stress is the CISS Index proposed by Hollo et al. (2012); EL_ratio is the total equity to total liabilities ratio; DA_ratio is the total debt to total assets ratio.

to fully offset the deterioration recorded during the sovereign debt crisis. In the post OMT period, the estimated difference in the ASW spread is still large and significant for Ireland, Italy, Spain and Portugal (between 48 and 162 basis points), it is positive for Austria and Belgium (39 and 22 basis points, respectively) and it is no more significantly different from zero in France.

From the second half of 2014, in the context of a still unequal cost of corporate and sovereign funding across countries, a weak growth outlook for the euro area and an increasing risk of deflation, agents' expectations of a quantitative easing from the ECB gathered momentum. The possibility of a direct purchase of sovereign bonds started driving domestic yields towards historical minima, well in advance of the official announcement and launch of the programme.[12]

Even though the purchase of bonds is proportional to the sovereign participation in the ECB capital, the most indebted and less creditworthy countries benefited the most from the EAPP, since the programme helped them reducing the sovereign risk. This effect is evident also at the corporate level. For all the countries in the sample, the cost of corporate funding drops to a level comparable to German peers. The joint test of fragmentation suggests that the null hypothesis of perfect market integration can not be rejected (p-value = 0.727).

All in all, our evidence hints at a disorderly process of reassessment of the corporate credit risk over the extended period of the global financial crisis, the great recession and the sovereign debt crisis, which halted the process of financial market integration in the euro area. However, in the most recent period, the progress in restructuring 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 pre-crisis levels.

As a further step of the analysis of market integration, in the next section we will investigate whether the above-mentioned process of risk overhauling has been equal for banks and firms. In other words, we want to check whether in addition to cross-country heterogeneity there is also evidence of sector heterogeneity.

6. Are banks different?

To investigate the possibility of a different behaviour of firms and banks over the sample period, we first regress model (1) with the inclusion of a dummy variable which takes 1 if the issuer is a bank and 0 otherwise. The coefficient on the bank dummy is 29.3 and significantly different from zero (p-value = 0.014).[13] It thus seems *prima facie* that there is a structural difference between euro-area banks and firms in their ability in tapping the bond market, with banks being worse off. Is this true for all countries or just for a subset of economies? Is the additional spread constant or does it change over time? In order to answer these questions we have to adjust model (1). In particular, we include in the set $D_{i,j}^{frag}$ also: i) the interactions of all country dummies with the dummy tracking the banking sector; ii) the interactions of country, period and bank dummies. In this way we are able to assess the sector heterogeneity at the country level and its development over time.

The first line of Table 3 shows the estimates of a regression in which only the interactions of country and bank dummies are included. The results support the view that only for few countries (Belgium, Ireland and Spain) there is a significant "structural" difference in the cost of funding between banks and non-financial corporations, with the former paying an additional spread in the range 25–60 basis points.

To further analyze the issue, the lower panel of Table 3 reports the results of a regression in which all the interactions among country, period and bank dummies are included. When we expand the analysis to the time dimension, different country patterns emerge. Just for Finland and Italy there are no differences in any of the 5 periods. For all other countries, there is a significant difference in the funding cost between banks and firms, at least in one period. In the tranquil period before the global financial crisis, for Belgium and Germany we have that banks were penalised by 48 and 60 basis points, respectively, with respect to non-financial corporations. At the same time in Ireland and Portugal it was exactly the other way around: banks were able to issue on the bond market at a discount with respect to firms. This evidence suggests that the productive structure of the

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[12] The extension of the existing asset purchase programme to bonds issued by euro-area central governments, agencies and European institutions in the secondary market against central bank money was announced on the 22nd January 2015. The public sector purchase programme (PSPP), as part of the expanded asset purchase programme (EAPP), officially started on the 9th March 2015.

[13] Note that in the baseline regression reported in Table 2 fixed effects by sector were included. Instead, in the regressions in this Section, only the bank dummy is used as a regressor in order to differentiate the financial from the non-financial sector of the economy.

Table 3
Estimated differences between banks and firms.[1]

	Austria	Belgium	Finland	France	Germany	Ireland	Italy	Netherlands	Spain	Portugal
2005 Q1–2015Q4	−4.3	24.7*	7.8	19.7	7.4	60.0*	−16.81	−6.1	27.5**	15.5
Tranquil period	48.3	47.7	37.3	14.8	59.5***	−29.9*	7.2	−51.8***	15.7	−23.7***
Global crisis	−35.8**	−26.3	−7.86	−22.1	−20.9	67.8	−37.7	−49.6*	29.4*	−14.06
Sovereign crisis	−21.7	109.3***	−21.0	23.8	15.0	169.0***	10.0	−37.8	92.5***	199.0***
Post OMT	18.6	38.5	12.2	32.5*	−0.6	107.0***	−33.1	22.3	17.4	−46.8
EAPP	1.3	−4.2	23.2	22.4	19.5	−34.0	−22.0	21.1	−40.2	9.0

[1] The table reports in the top panel the coefficients of the interaction of country dummies with a bank dummy (a dummy taking 1 when the issuing corporation is a bank and zero otherwise) in a regression according to Model (1). The table reports in the lower panel the interaction of countries dummies, period dummies and the bank dummy. Dependent variable: ASW spread; included observations: 8469; robust standard errors are clustered by issuer; symbols ***, ** and * denote statistical significance at 1%, 5% and 10%, respectively. See footnote on Table 2 for the description of the regressors.

single economies provided a different support to domestic issuers. For instance, in Ireland the financial sector of the economy was more developed than the industrial sector, with banks tapping more regularly the bond market and acting as a sort of "national champions" . In Germany instead, several small Sparkassen with regional demarcation might have been considered more opaque than equivalent industrial peers and thus penalised, *coeteris paribus*, when issuing bonds.

In the period characterised by the global financial crisis and the great recession, the differences between banks and firms diminish somewhat. While in Austria and the Netherlands banks are better positioned to tap the bond market and in Spain firms have an advantage, for the rest of the countries there appear no significant differences in the funding cost on the bond market.

Given that the spill-over of the sovereign financial distress involved banks more than firms (Ahmed et al., 2015; Angelini et al., 2014; CGFS, 2011), it is not a surprise that the difference in the funding cost between banks and firms is the largest during the sovereign debt crisis. Banks from countries in which the government had to extensively intervene to support the domestic financial stability suffered the most. The difference ranges from 93 to 200 basis points in Belgium, Ireland, Spain and Portugal. The joint test of significance (the equivalent of the cross-country test for perfect market integration) confirms the rejection of the null of no heterogeneity (p-value < 0.001).

In addition to the reduction of market fragmentation across countries, the change in the market mood, brought about by the non-conventional monetary policy measures and the concomitant implementation of structural reforms in several Member States, has the effect of closing the gap between banks and firms in the post OMT period. However, a positive difference in the funding cost between banks and firms still prevails across euro-area countries, and the joint test of coefficients' significance still rejects the null of no heterogeneity (p-value = 0.054).

The outlook improves even further in the last period characterised by the expectations and the actual implementation of the EAPP (but also by the negotiations for the third bailout of the Greek sovereign debt). For the first time since 2005Q1 the estimated differences are not significantly different from zero in any country. The joint test confirms the absence of a significant discrepancy for the whole market (p-value = 0.851), thus suggesting a level playing field in the funding conditions between euro-area banks and firms.

7. Robustness analysis

In this section we examine how the main results concerning the degree of market fragmentation are affected by the choice of the regressors. In particular, we check whether results are robust to changes in the issuer creditworthiness, the bond grade and the variable assessing the market sentiments.

Starting from the firm rating, instead of using the full set of dummy variables (one for each rating category), we rely directly on the average values of the ratings assigned by Moody's, Fitch and Standard&Poors by linearising them between 1 (CC/Ca) and 20 (AAA/Aaa), so that a larger value of the variable is associated to a better rating. The joint test of market integration is reported in the first column of Table 4 for each period. In a second check we use the proximity of 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, firm ratings and the bond ratings are positively correlated (0.649), but far from being coincident (the two ratings are different for slightly more than half of the bonds). We thus use the bond rating (both linearised between 1 and 20 and as a set of dummy variables) as a proxy of the firm rating (column 2 and column 3, respectively).

In a further set of checks we change the variable identifying the ex-ante default risk of the bond by using directly the bond rating instead of the investment grade dummy. We first rely on the linearised version of the bond rating (maintaining also the firm rating as a linearised variable), in a second regression we employ the bond rating as a linearised 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 4, columns 4–7).

As concerns the variable used to proxy the market sentiments, we use three different indicators: i) the VSTOXX Index, which is a measure of equity market volatility in the euro area (computed relying on both call- and put- implied volatilities from the DJ Euro STOXX 50 index); ii) the VIX Index, which is the equivalent of the VSTOXX for the US stock market; iii) the index proposed by Gilchrist and Mojon (2014) which is a synthetic measure of the cost of market funding for both banks and non-financial corporations (columns 8–10). In addition, we also check for the market liquidity (column 11): we use as a regressor the average of the corporate CDS bid-ask spread for the four countries most involved in the sovereign debt crisis (Ireland, Italy, Spain and Portugal).[14] Finally, to assess whether business cycle conditions influence the results of the paper, we introduce in model (1), as separate regressors, also the unemployment rate, the industrial production and the HICP inflation rate at the monthly frequency (columns 12–14).[15]

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[14] Since Bao et al. (2011) showed that the indices of equity market volatility comove in an important way with the aggregate market (il)liquidity, the VIX Index and the VSTOXX Index already used in regressions 8 and 9 may be interpreted also as a proxy of the market (il)liquidity.

[15] Note that also all the possible combinations of the three variables have been tested with no effects on the results of the paper. Data are sourced from ECB SDW.

Table 4
Robustness of regressors: Test of market integration.[1]

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Tranquil period	−125.0	−95.1	−83.3	−95.2	−69.8	−108.9	−91.1	−112.2	−102.1	−99.0	−174.7	−173.4	−139.1	−145.6
Global crisis	171.4 **	208.6 **	319.8 ***	316.3 ***	177.6 *	199.2 **	192.8 **	146.5 **	196.3 ***	220.0 ***	165.3 *	267.6 **	233.1 **	203.5 ***
Sovereign crisis	1016 ***	999.2 ***	1,112 ***	1,106 ***	912.2 ***	960.9 ***	985.0 ***	1023 ***	1034 ***	1001 ***	1023 ***	879.1 ***	945.5 ***	972.1 ***
Post OMTs	457.8 ***	425.8 ***	602.5 ***	399.2 ***	435.6 ***	325.8 ***	457.3 ***	467.2 ***	512.0 ***	598.7 ***	483.3 ***	399.4 ***	308.8 **	418.3 ***
EAPP	−42.0	44.2	56.6	−11.2	−22.9	−37.1	−51.6	−8.2	7.0	33.0	26.9	−18.0	−57.7	−67.9

[1] The table reports the test of joint significance of the country-specific effects for 14 different regressions. Columns (1) to (3) are robustness regressions for the firm rating; columns (4) to (7) are robustness regressions for the bond rating; columns (8) to (11) are robustness regressions for the market sentiments; columns (12) to (14) are robustness regressions for business cycle conditions. Dependent variable: ASW spread; included observations: 8469; robust standard errors are clustered by issuer; all regressions include FE by sector; symbols ***, ** and * denote statistical significance at 1%, 5% and 10%, respectively.

The robustness checks confirm the main results of the paper. The test of joint significance of the country-specific effects supports the interpretation provided in Section 5 for each period. The euro-area corporate bond market already achieved a comfortable degree of financial integration before the global financial crisis, which however started to become fragmented immediately after its burst. The sovereign debt crisis determined a sizable increase in the market fragmentation, which called for a decisive intervention of the ECB. The period of easing tensions in financial markets started in the summer 2012 led to a reduction of the market fragmentation, but country-specific effects continued to be priced in the bond yields of banks and firms headquartered in the most troubled economies. Eventually, the drop in the interest rates caused by the expectation and the actual implementation of the euro-area quantitative easing was able to bring back the corporate bond market to a level playing field across countries.

A second group of checks concerns the robustness of the choice of the time framing of the five periods in which the dataset has been divided. Taken as given the initial and the final quarters (2005Q1 and 2015Q4), we adjust the other ending and starting quarters of each period by ± one quarter. All in all there are 80 possible combinations of the time framing of the five periods in addition to the one chosen for the baseline regression.

For each of the 80 regressions and for each period we run the test of joint significance of the country-specific effects (test of market integration). Results are shown in Table 5 according to the p-value of test (significance at 1%, 5% and 10%). The perfect market integration in the tranquil period is confirmed in any of the 80 regressions: the test is never significantly different from zero. The start of the fragmentation in the euro-area corporate bond market is confirmed in the global financial crisis period. Even though with different degrees of significance, in none of the 80 regressions is the null hypothesis of perfect market integration accepted. The same happens for the sovereign crisis period and the post OMT period in which the existence of fragmentation is always verified at 1%, with just one exception at 5%. Finally, in the EAPP period, the null of perfect integration is rejected in just in two cases (at the 10% significance), thus confirming that the market has returned to a pricing of bonds at issuance which is not influenced by country-specific effects.

As a final check of robustness and as a way to ease the comparison with previous empirical works, we report the test of market integration when excluding Ireland and/or Portugal from the baseline regression (Table 6). Since De Santis (2016), Zaghini (2016) and Horny et al. (2016) rely on different euro-area samples of countries, we check whether their results are driven by the missing inclusion of one (or more) of the troubled economies. The most relevant evidence concerns the exclusion of Ireland from the sample (column 2). Given that Ireland was one of the most strongly hit countries in the first wave of the financial crisis, it is not surprising that the perceived creditworthiness of Irish corporations deteriorated sooner than elsewhere in the euro area. In fact, a large country-specific effect is already estimated in the global financial crisis period (140 basis points; Table 2). When excluding Ireland from the regression, the value of test of market integration drops from 166 to just 81 basis points and the test looses its statistical significance. Thus, if we were to analyze the euro-area sample made out of the remaining nine countries, we would find that the market integration was not significantly affected by the global financial crisis. Instead, the exclusion of Portugal alone is not enough to change the significance of the test, which is still signalling a break of the market integration (column 3). Given the evidence reported in Table 6 it is not surprising that both Zaghini (2016), which does not include Ireland, and Horny et al. (2016), which do not include Ireland and Portugal, find that there is not a break in the market integration in the period 2007-2009, whereas De Santis (2016) suggests the opposite, given that his sample excludes Portugal but includes Ireland. The sensitivity of the results on financial market integration in all the other time periods is instead not affected by the exclusion of Ireland and/or Portugal.

8. Concluding remarks

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 yield spreads at issuance. Starting from the assumption that in an integrated market the country of issuance of a bond should not influence the yield at origination

Table 5
Robustness of time framing: Test of market integration.[1]

	Baseline	Average	Max	Min	1%	5%	10%
Tranquil period	−165.5	−62.0	39.2	−173.1	0	0	0
Global crisis	167.1*	201.3	239.3	133.6	28	49	3
Sovereign crisis	1,005***	1,137	1,262	911.3	80	0	0
Post OMT	489.3***	480.0	719.2	334.8	79	1	0
EAPP	17.1	27.8	82.8	−22.3	0	0	2

[1] The table reports the test of joint significance of the country-specific effects for the baseline regression reported in Table 2 (column 1) and the descriptive statistics of the same test for the 80 robustness regressions concerning the time framing. Dependent variable: ASW spread; included observations: 8,469; robust standard errors are clustered by issuer; all regressions include FE by sector; symbols ***, ** and * denote statistical significance at 1%, 5% and 10%, respectively.

Table 6
Robustness of country sampling: Test of market integration.[1]

	Baseline	WO IE	WO PT	WO PT & IR
Tranquil period	−165.5	−81.2	−66.2	−48.8
Global crisis	167.1*	79.1	197.6**	33.3
Sovereign crisis	1,005***	887.2***	713***	421.4***
Post OMT	489.3***	507.1***	377.5***	303.3**
EAPP	17.1	32.0	15.9	20.3

[1] The table reports the test of joint significance of the country-specific effects for the baseline regression reported in Table 2 (column 1) and the regressions excluding Ireland (column 2), excluding Portugal (column 3) and excluding Ireland and Portugal (column 4). Dependent variable: ASW spread; included observations: 8469, 8319, 8357 and 8207, respectively; robust standard errors are clustered by issuer; all regressions include FE by sector; symbols ***, ** and * denote statistical significance at 1%, 5% and 10%, respectively.

(law of one price), we use the estimated country-specific effects as a measure of fragmentation.

Our analysis starts from the model by Morgan and Stiroh (2001) and Sironi (2003) of the determinants of yield spread on bonds at issuance. We adapt the model in two ways: 1) we take into account the possibility that also the country in which the issuer is headquartered has a bearing on the yield spread; 2) we use Germany as a benchmark in order to have a direct estimate of the differences across countries, which we use as a measure of market fragmentation.

In particular, referring to five distinct periods, we find that in the years before the burst of the global financial crisis there is no evidence of market fragmentation, i.e. the corporate bond market was well integrated. During the financial crisis, instead, the difference in the cost of funding with respect to German corporations became positive in several countries, signalling that financial agents started to include in the pricing of bonds also country-specific effects.

Fragmentation reached a worrying level during the sovereign bond crisis. The estimated difference in the cost of funding attributable to the residence of the issuer is around 400 basis points in Portugal, is in the range 160–190 basis points in Ireland and Spain and is 112 basis points in Italy. Given the perverse consequences on the monetary policy transmission and the distortions in the allocation of capital, the ECB implemented a series of non-conventional measures which were able to change the market mood. Starting from the summer 2012, yield spreads on both corporate and sovereign bonds started a steady descent. Yet, a significant difference in the cost of funding remained for the four countries most hit by the sovereign debt crisis (Ireland, Italy, Portugal and Spain). Only in the latest period, characterised by the preparation and actual deploying of a quantitative easing by the ECB, the market returned to a level playing field in which country-specific effects do not influence the corporate cost of funding on the common bond market.

Another finding of the paper stems from the analysis of the heterogeneity in the cost of funding between banks and firms. We find that with the exception of Finland and Italy, banks suffered more than firms the fragmentation of the euro-area bond market, by often paying higher risk premia. However, as market fragmentation faded, banks and firms were finally able to face a level playing field.

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