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Fragmentation in European Financial Markets: Measures, Determinants, and Policy Solutions

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Fragmentation in European Financial Markets: Measures, Determinants, and Policy Solutions

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Abstract

This paper measures fragmentation in four European financial markets (interbank, sovereign debt, equity, and the CDS market for financial institutions) and develops a new measure of global fragmentation using these markets as inputs. We find that, during the recent crisis, fragmentation in the interbank market has been, on average, higher in the peripheral countries than in the core ones and it has increased particularly during periods of financial stress. Among the most significant factors that contributed to the high fragmentation levels observed are counterparty risk and financing costs (overall factors), and country-specific factors such as banking sector openness, the debt-to-GDP and the relative size of the financial sector. We also study the short-run effect of the ECB programmes and announcements and find a significant decrease in the daily levels of fragmentation immediately after the implementation of the SMP, 3Y-LTROs and the second CBPP of the ECB as well as key announcements relative to banking union and the OMT. These helped restore investors' confidence in the euro and confirmed the ECB's support for tackling the challenges of the European sovereign debt crisis. Nevertheless, additional measures seem to be necessary to guarantee a new process of re-integration and thus a more stable European banking sector.

Keywords: Eurozone, financial fragmentation, Interbank market, Banking Union.

JEL: G15, G18, F36.

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1. Introduction

The European Union is a purely integrative project and one of its main goals was to achieve a truly single financial market. However, with the latest crisis its financial markets have fallen into fragmentation. This is worrisome because fragmentation is incompatible with the very nature of the European Monetary Union (EMU). Moreover, it had not been foreseen as a potential problem in the EMU's design, so possible solutions have not been explored before. As a consequence, the authorities are trying to fix it by reacting as they go along, showing that the EMU is to a certain extent a giant with feet of clay.

Over the past 30 years financial integration in the EMU had given signs of significant progress, especially after the creation of the single currency, which in turn needs a complete financial integration for it to work properly. Nevertheless, the outbreak of the crisis brought to the fore the weakness of this financial integration. Indeed, most European countries have ring-fenced their financial markets (with the local authorities sometimes even incurring in moral suasion), so the allocation of financial resources has been kept inside national boundaries. This renationalization of financial markets has even challenged the existence of the euro, given that a single monetary area cannot exist with fragmentation.

The facts highlight that fragmentation first appeared in the banking sector and only later spread to the sovereign sector, aggravating the crisis for banks, governments and the real sector as credit has not been flowing as desired. However, the very seriousness of this threat may in fact convert it into a catalyst for progress towards both banking and fiscal union as a way to restore the necessary financial integration.

The aim of this paper is fourfold. First, to develop a proper measure of fragmentation in several countries of the EU, analyse the key determinants of that fragmentation, evaluate the contribution to integration of several European Central Bank's (ECB) programmes and explore possible solutions to the persistent fragmentation.

To achieve a proper measure of fragmentation we focus, at a first stage, on the interbank market but extend our analysis to other markets that are especially relevant to explain the crisis, such as the sovereign debt, equity, and CDS markets. At a second stage we implement a global measure of fragmentation for the four abovementioned markets. This measure enables us to evaluate the level of financial market fragmentation at the EMU level but also to identify the market that is contributing most to this fragmentation.

The second aim of this paper is to analyse of the key determinants of financial fragmentation. Here we focus exclusively on the European interbank market, for various reasons. First, because, to the best of our knowledge, an analysis of the fragmentation in the interbank market and its determinants during the recent crisis is still lacking: most of the previous literature has analysed the process of integration/fragmentation in the EMU stock indexes or sovereign debt markets. Second, because it is the market which had registered the highest level of integration prior to the crisis (see Figure 3). And finally, because the interbank market has been less directly exposed to country fundamentals than others such as the sovereign bond market.

Third, the paper aims to evaluate the contribution to financial integration of several of the programmes implemented by the ECB. Here we focus on the Securities Market Programme (SMP), the 3-year Long Term Refinancing Operations (LTROs), and the Covered Bond Purchase Program (CBPP), as well as policy announcements by the European leaders (banking union) and the ECB's key actions in the summer of 2012 (Draghi's now famous speech given on 26 July, 2012 and the announcement of the Outright Monetary Transactions programme).

Finally, we explore possible solutions to the fragmentation problem, with special focus on the Banking Union project for the Eurozone and the EU Commission inquiry to rein in ring-fencing supervisory practices.

The main results of the paper are summarized in the following paragraphs.

Integration in the European interbank market, which is measured on the basis of the 3-month interbank interest rate, ended with the Lehman Brothers collapse. This event, along with the fears about the prospects for Europe in August 2011, represent the two biggest cracks in integration in the interbank market, reaching its maximum level by the summer of 2012.

Fragmentation in the interbank market differs at country level but moves together during special distressed periods. Moreover, the fragmentation in the peripheral countries has been, on average, higher than in the core countries during the recent crisis. This difference was most noticeable around periods such as the misreporting of Greek statistics (November 2009), the Greek bailout (May 2010) and the S&P downgrades affecting all the peripheral countries (January 2012). The lack of convergence observed in the interbank market during the crisis has also been observed in the banking sector CDS, the stock indexes, and the sovereign debt markets.

Our findings show an increasing trend to fragmentation over the sample period with two peaks around the Lehman Brothers collapse and the bailout of Greece in the spring of 2010. To prepare this global measure of fragmentation we have used an index of spillovers to identify the market in which fragmentation was originated. This index shows that before the end of 2010 most of the fragmentation spillovers came from wide differences in credit risk in the banking sector, but in the last quarter of 2010, coinciding with the EU-IMF bailout of Ireland, the sovereign debt market became the main driver of fragmentation.

Among the most significant factors that contributed to the high levels of fragmentation observed in the interbank market are counterparty risk and financing costs (overall factors) and country specific factors such as banking sector openness, the debt-to-GDP and the relative size of the financial sector. Fragmentation has affected peripheral countries more negatively due to their greater dependence on external funding, higher levels of public debt, worse economic situation, and higher levels of risk in their financial institutions. On the other hand, we conclude that the announcement of the SMP programme (despite the fact that it has not been operational) led to a significant temporary decrease in the level of fragmentation. This can be explained due to the twin effect of the SMP, given that besides the liquidity the banks might get by selling sovereign debt to the ECB, the programme helped decrease the levels of sovereign risk by increasing confidence in the euro and the EMU.

To evaluate better the short-term effect of the SMP together with other programmes and announcements implemented by the ECB on the interbank level of fragmentation, we have carried out an event study analysis based on daily rather than monthly information. The results show a significant decrease in the daily levels of fragmentation immediately after the implementation of the SMP and 3Y-LTROs. Regarding the CBPP programmes, we only observe a significant effect of the second programme, which was implemented after the major turbulence during the summer of 2011; the first programme that was implemented even before the beginning of the European sovereign debt crisis had a non-significant effect. Moreover, the announcements of banking union and the OMT together with Draghi's speech given on 26 July led to a significant decrease in the levels of fragmentation. These announcements helped to restore investors' confidence in the euro and at the same time to confirm the ECB's support to tackling the challenges of the European sovereign debt crisis.

In view of the above results, banking union seems to be a necessary condition to limit the high levels of fragmentation. Nevertheless, additional measures appear necessary to guarantee a new process of re-integration and a more stable European banking sector. First of all, on top of the policy agenda, there are the measures aimed at guaranteeing a proper flow of credit to the real economy. Second, probably more as a medium-term objective, a fiscal union would help consolidate a new period of integration, provided it was built on a solid legal base (so that it was compatible with the no-bail-out clause implied by article 125 of the TFEU). At the end of the journey the outcome should be a truly consolidated European-wide banking system made up of a limited number of big pan-European players.

This paper is structured as follows. Section 2 reviews the evolution of financial integration in the EU and provides a review of the literature. Section 3 describes the data employed in the subsequent analysis. Section 4 explains the measurement of fragmentation for the interbank market, sovereign debt market, credit risk market for financial institutions, and stock market in the EMU. Section 5 includes the analysis for the determinants of fragmentation in the interbank market. Section 6 contains an analysis of the effect of the ECB programmes and announcements on the level of fragmentation. Section 7 explores possible solutions to the fragmentation problem. Section 8 presents the paper's main conclusions.

2. Literature review: the evolution of financial integration in the EU

This section contains a description and a review of previous literature on the evolution from the rapid financial integration of the 2000s to a gradually increasing fragmentation, especially as a consequence of the aggravation of the European sovereign debt crisis in late 2011 and certain supervisory ring-fencing practices.

Financial integration has always been a focal point of the European Union (EU) project. As such, it has been a priority for its leaders since the late 1980s, when a single banking licence was introduced and all capital accounts were opened. A few years later, in 1992, the Maastricht Treaty formally abolished all barriers to cross-border financial integration and, most importantly, paved the way for the creation of a Monetary Union (ECB 2012).

With the introduction of the euro in 1999, money markets became highly integrated as exchange-rate fluctuations in trade between the euro zone countries disappeared, currency risk plummeted and nominal convergence increased among EMU Member States (Kalemli-Ozkan et al 2010). As a consequence, during the 2000s, impressive advances took place towards financial integration, especially in the wholesale domain, as evidenced by many economic and market indicators (ECB 2012, COM 2012).¹ This would last for more than a decade, assisted by enhanced pan-European market infrastructures (SEPA, TARGET) and a significant regulatory convergence promoted under the Financial Services Action Plan.²

According to the IMF (2013), between 2000 and 2008 total intra-EU foreign exposures to non-residents grew by more than 200%, with more than 40% of this amount corresponding to a combined increase in exposures by the core euro-area (EA) economies and the UK to the EA periphery countries. In the bond markets cross-border holdings accounted for 54% of total holdings of EU bonds by late 2007, whereas in the interbank markets some 40% of the EA's interbank claims stood against non-domestic EU banks at the same date. In the equity markets the level of integration achieved was less impressive but still remarkable, with 25% of equity holdings of EA banks being in other EU countries by the end of 2007. There was also a strong convergence in funding costs in all these markets, with tiny differences both across countries (in sovereign spreads and bank CDS spreads) and very low dispersion between rates of both secured and unsecured repo lending rates.

As Stavarek et al. (2011) state, financial integration is a process that has been taking place in the European Union for many years and that intensified after the adoption of the common currency in 1999.

1: Since September 2005 the ECB publishes a yearly report "Financial Integration in Europe", which assesses the state of euro area financial integration based on indicators that are updated biannually. The European Commission also produces, since 2007, its European Financial Stability and Integration Report (EFSIR) (previously the European Financial Integration Report, EFIR). The indicators produced both by the ECB and the European Commission give strong evidence of the integration process prior to the crisis and the ensuing dramatic deterioration afterwards.

2: The Financial Services Action Plan was an ambitious initiative launched in 1998 by the EU Commission and the EU Council (its official completion being in 2003). Under its umbrella 42 measures aimed at creating a harmonized EU financial market were developed. As a result, the EU co-legislators passed 27 Directives and 2 Regulations.

Hartmann et al. (2003) provide an overview of the structure and integration of the euro area financial systems and related policy initiatives four years after the introduction of the euro. The authors document the progress towards integration of the major euro area financial segments, namely money markets, bond markets, equity markets and banking. Baele et al. (2004) consider five key markets, namely the money, corporate bond, government bond, credit and equity markets. Their results indicate that the unsecured money market was fully integrated at that time, while integration was reasonably high in the government and corporate bond market, as well as in the equity markets. The credit market was among the least integrated, especially in the short-term segment.

Fratzscher (2002) analyses the integration process of European equity markets since the 1980s and finds that European equity markets have become highly integrated only since 1996. This integration is in large part explained by the drive towards EMU, and in particular the elimination of exchange-rate volatility and uncertainty in the process of monetary unification. Along the same lines, Mylonidis and Kollias (2010) show that the introduction of the euro epitomizes European economic integration in the major European stock markets in the first euro-decade, with the German and French markets the ones with a highest degree of convergence. This process of integration was also extended to the European financial services industry within the euro area (see Allen and Song, 2005).

This convergence of funding costs in the wholesale market translated into reduced spreads in deposit and loan rates across the EA (IMF 2013) but, despite some progress in quantitative indicators of convergence, a genuine integration process remained elusive for the retail market, mostly due to divergences in the regulatory, tax systems and national specificities of financial systems across different Member States. According to the IMF (2013), at the end of 2007, about 85% of the loans supplied by EA banks still went to domestic residents, compared to a 12% to residents of other EA countries and just 3% to residents of other EU countries.

The trend to financial integration in the wholesale markets suddenly came to a halt with the collapse of Lehman Brothers (September 2008) and the consequent loss in confidence and liquidity amid a slew of uncoordinated national responses to the emerging global financial crisis. Between 2007 and 2011 the average exposure of core EU Member banks to periphery banks dropped by 55% and the percentage of cross-border collateral used for Eurosystem credit operations dropped by one third, returning to 2003 levels (ECB 2012). But the tipping point in the fragmentation problem came in the second half of 2011, with the intensification of the EU sovereign debt crisis. Access to primary markets by the more distressed sovereigns became increasingly difficult as their cross-border yield spreads increased sharply. At this moment, the banks headquartered in these jurisdictions started to experience severe funding constraints as repo prices became extremely dependent on the nationality of the counterparties and the collaterals.

The academic literature has also shown the fragmentation trend observed in the EMU financial markets during the recent financial crisis. Battistini et al. (2013) show that according to conventional indicators, the euro-area financial integration has receded since 2007, mainly in the money market, sovereign debt market and uncollateralized credit markets. In fact, Philippas and Siriopoulos (2013) consider that the recent financial crisis indicates that the sovereign bond market convergence was temporary.

Pozzi and Wolswijk (2012) investigate the financial integration of government bond risk premiums for Belgium, France, Italy, Germany, and the Netherlands over the 1995–2009 period and finds that the idiosyncratic factors were almost eliminated by 2006 but then reappeared due to the financial crisis that started in 2007. Country-specific exposures to the common international risk factor have converged across countries, with no setback during the crisis. Still, Georgoutsos and Migiakakis (2010) document that sovereign bond markets in Europe were only partially integrated even before the credit crisis, but low volatility conditions resulted in these differences being “hidden”. One of the dire consequences of this massive deleveraging was the sharp reversal of capital flows from the periphery to the core of the EA. Between the

end of 2011 and 2012, cross-border interbank loans to banks located in distressed countries fell by 17%, compared with 2% for the rest of EA banks (ECB 2012). The situation could only be indirectly balanced by the ECB intermediation action. Between early 2009 and mid-2012, recourse by peripheral banks to ECB liquidity provision increased by 250%, both in absolute terms and measured as a percentage of assets. This also translated into a significant fragmentation of the credit and retail deposit markets, both in terms of prices and quantities, with deposit flows in Germany and France increasing at double-digit rates while those in the periphery were still falling in early 2013 (IMF 2013).

The escalating fragmentation in the different markets put several members of the EMU against the ropes as markets started to challenge the very existence of the euro. After several failed attempts to tackle the problem with partial approaches, in the summer of 2012 the situation became so dramatic that the EU authorities decided to act unequivocally in support of the EU. This required bold actions both by the EU leaders and the ECB to reiterate their strong commitment to do “whatever it takes” to avoid a disaster in the Eurozone and to overhaul the institutional failures of the Monetary Union by advancing towards a banking union and a fiscal union. As a result, the levels of financial stress and fragmentation immediately eased in the second half of 2012 but they are still high by historical standards and fragmentation persisted in the first quarter of 2013 (ECB 2013, EU Commission 2013).

One of the markets where fragmentation was most acute and evident is the European interbank market. In words of the European Central Bank (ECB) president, Mr. Mario Draghi: “The interbank market is very dysfunctional, it is not working.” In fact, the market imperfections in cross-country bank lending that could lead to persistent interest-rate differentials had already been pointed out before the recent crisis by Freixas and Holthausen (2005) who studied the effects of cross-country asymmetric information on the structure of financial markets. These authors analysed integration in unsecured interbank markets on an international framework with a model in which banks cope with liquidity shocks either by borrowing or liquidating assets. Freixas and Holthausen (2005) show that an equilibrium with integrated markets does not always exist and it may coexist with one characterized by segmentation.

The interbank market is essential for the stability and efficiency of the European financial system. It allows an optimal distribution of central bank liquidity, as its overall volume is limited and controlled by the central bank. Additionally, it is a key instrument for the transmission of the monetary policy. A proper degree of integration in the interbank market is also of special relevance in galvanizing an optimal funding structure for small firms, as shown in Popov and Ongena (2011). These authors find that integration of interbank markets resulted in less stringent borrowing constraints and in substantially lower loan rates for these firms. Popov and Ongena also find that in the most rapidly integrating markets, firms became substantially overleveraged during the build-up to the crisis.

For all these reasons, and because of the need of a better understanding of fragmentation, its measurement and its determinants in the interbank market, the main analysis of the paper focuses on this market. Nevertheless, we extend our analysis to measure fragmentation in other markets that were of special relevance during the ongoing crisis such as the sovereign debt, equity, and CDS markets.

3. Data

Fragmentation is analysed on the basis of 11 European Monetary Union (EMU) countries: Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Portugal, and Spain. The data employed in this study spans from January 2005 to November 2012.

The information referring to the EMU interbank (unsecured) market has been obtained from the European Banking Federation (EBF). The Euro Interbank Offered Rate (Euribor) is the rate at which euro interbank term deposits are offered by one prime bank to another within the

EMU zone for a certain period of time. It is based upon submissions from a bank panel which comprises a large number of active players in the Eurozone money markets of varying types, sizes and locations.³ We study the EMU interbank market by using the daily rates submitted by the Euribor's panel banks (excluding the quotes reported by non-EMU banks) with a 3-month horizon.

Although the main analysis of fragmentation refers to the interbank market, we use other markets to test the divergences across the EMU countries. These markets include: the financial institutions credit risk market, the sovereign debt market, and the equity markets.

The fragmentation at the level of financial institutions is based on their credit risk as measured by means of the CDS spreads. These spreads can be understood as an approximate measure of the cost of funding that these banks have to pay in excess of a given risk-free rate. We use the 5-year CDS spread, which is the most liquid among the different CDS maturities. This information is obtained from the data provider Credit Market Analysis (CMA).

For the sovereign debt market, we use the 10-year yields for the bonds of the above 11 countries. This information is obtained from Datastream.

Finally, we use the main stock indexes of the countries in the sample to study fragmentation in the stock market. Given that the levels differ from one index to the other we standardize all the indexes by assigning a value of 100 to the levels corresponding to January 2005. This information is collected from Datastream as well.

As for the rest of the data used in the subsequent estimations, the information employed to construct the measure of counterparty risk is computed from the CDS spreads that are obtained from CMA. The US LIBOR and the OIS rates are obtained from Datastream. The macro variables: amount of debt outstanding, gross domestic product (GDP), GDP attributable to the financial and insurance activities, and economic sentiment index are obtained from Eurostat. The data on external loans and deposits come from the international locational banking statistics of the Bank of International Settlements (BIS). The information referred to the TARGET2 system was collected from the national central banks. Finally, the data for the Securities Markets Program (SMP), the Long Term Refinancing Operations (LTROs), and the Covered Bond Purchase Programme (CBPP) were obtained from the ECB website.

4. Measuring fragmentation

In this section we measure fragmentation in the EMU interbank market from two different perspectives: a general approach and a country-specific approach. The former refers to the overall fragmentation in this market while the latter focuses on divergences at country level. Additionally, under the general approach we also measure fragmentation in the financial institutions credit risk market, the sovereign debt market, and the equity markets. This extension to other markets enables us to compare the evolution of fragmentation in those markets with that observed in the interbank market.

4.1. Fragmentation in the interbank market

4.1.1. Interbank market fragmentation at the EMU level

Fragmentation can be measured on the basis of both (i) prices and (ii) volume. In this study we assume that any fragmentation affecting quantities should ultimately materialize in a violation of the law of one price and accordingly, we analyse fragmentation only in terms of prices. In this sense, fragmentation is reflected by a high dispersion in the prices contributed by the different market participants, who cannot infer a fair price from these quotes.

3: <http://www.euribor-ebf.eu/assets/files/Euribor%20FAQs%20Final.pdf>

We measure global fragmentation on the basis of the coefficient of variation (CV). To do this, for every day in the sample we first estimate the quoted interbank rates at the country level (CQIR) as the average of the quoted rates (QR) provided by banks belonging to the same EMU country (i) as described in Equation 1.

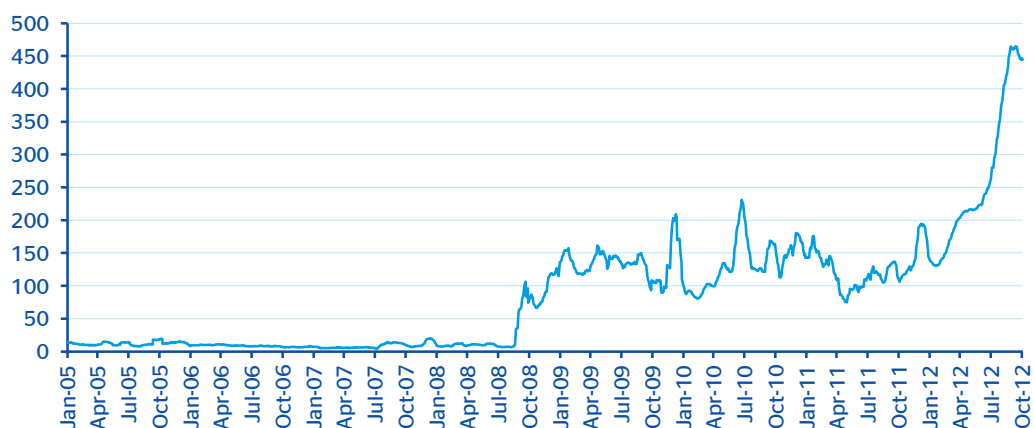
$$CLQUIR_{i,t} = \frac{1}{N_{i,t}} \sum_{j=1}^{N_{i,t}} QR_{j,t} \quad \text{for } i=1, \dots, 11 \quad (1)$$

We next measure fragmentation from the CV, which is defined as the ratio between the standard deviation of the eleven CQIR and their average, as reported in Equation 2.

$$Glob.Frag_t = \frac{SD(CQIR)_t}{Mean(CQIR)_t} \quad (2)$$

By doing so we measure fragmentation as the dispersion across the country level quoted rates describing their standard deviation as a percentage of their average. In the interest of the comparability of this measure with the fragmentation measures for the other markets, we have standardized the global fragmentation measure (Glob. Frag) dividing it by its standard deviation over the whole sample period and then multiplying it by 100. The fragmentation measure for the EMU interbank market is reported in Figure 1. This figure shows the monthly moving average of the daily standardized CV.

Chart 1
Global Fragmentation in the EMU Interbank Market



Source: authors

We observe that the full convergence in the EMU interbank rate reported by the financial institutions of the different countries ends with the Lehman Brothers collapse, in late September 2008. From this moment on, the fragmentation remains at relatively high levels with some occasional periods of sudden increases. These include two peaks coinciding with the information about the misreporting of deficit data by the Greek authorities in November 2009 and the bailout of Greece in May 2010. From the summer of 2011 onwards, coinciding with the aggravation of the EU sovereign debt crisis, we observe a steepening of the trend in the level of fragmentation, reaching its maximum level in the summer of 2012. In view of the previous figure it seems quite obvious that there exists fragmentation in the interbank market.

Once we have formally tested that there is a significant fragmentation in the interbank market we try to identify the periods at which this fragmentation exhibits a structural change at the EMU level. For this purpose we estimate the algorithm described in Bai and Perron (2003) for simultaneous estimation of multiple breakpoints and find two breakpoints in the 3-month

interbank interest rate. The first break occurs after the Lehman Brothers collapse and the second one is observed in August 2011 due to the persistent fears and alarms about the European and the world economic outlook that were materialized in the falls in European stock market markets and downgrades of European banks. In September 2011 the IMF urged the EU leaders to act decisively on Greece to stem the debt crisis and the US president said that the debt crisis was "scaring the world". On 29 September, 2011 the Bundestag expanded the EU bailout fund, reducing market concerns.

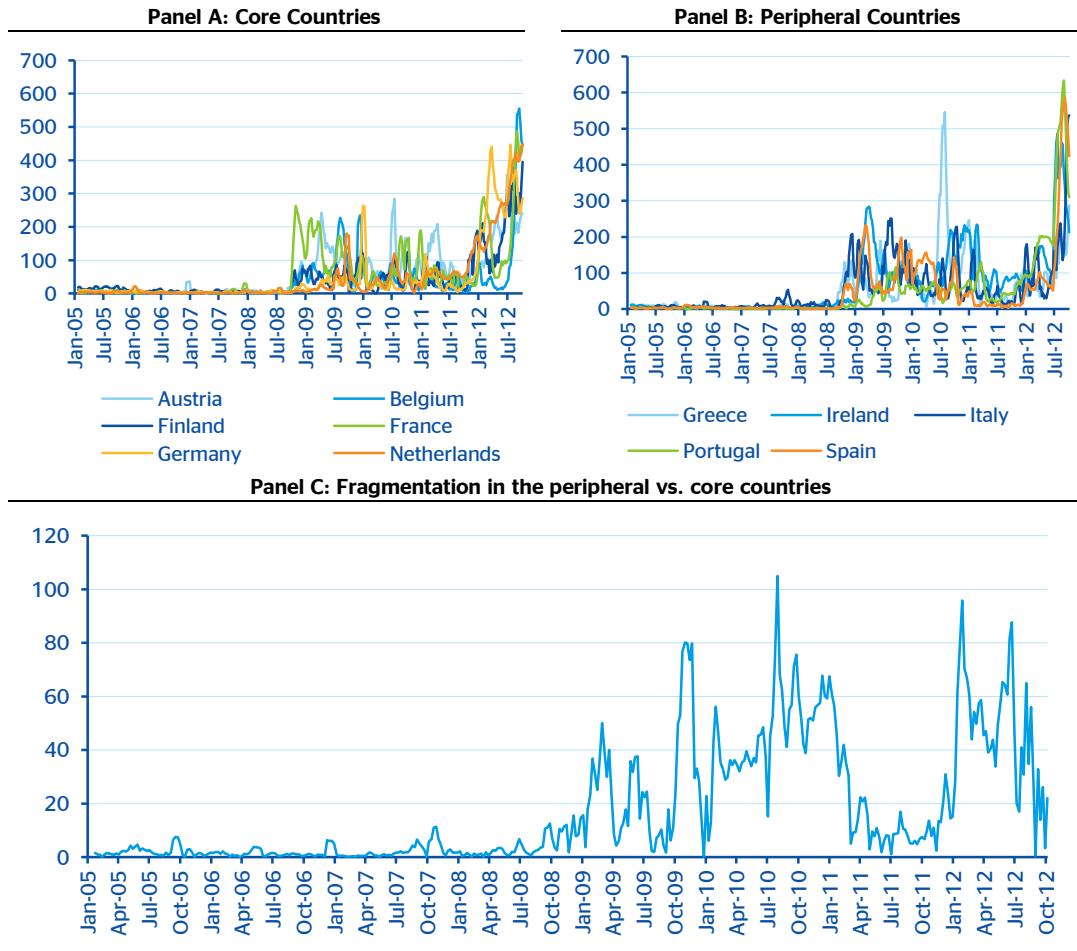
4.1.2. Interbank market fragmentation at the country level

We next measure the level of fragmentation in the interbank market at the country level by computing the median of the CQIR across the 11 countries in the sample ($Median(CQIR)_t$) (and defining fragmentation as the ratio of the absolute value of the distance between the country-specific interbank rates and the median of the distribution to the median of the distribution):

$$CLFrag_{t,i} = \frac{|CQIR_{i,t} - Median(CQIR)_t|}{Median(CQIR)_t} \quad \text{for } i=1, \dots, 11 \quad (1)$$

We use the absolute value because both deviations, above and below the median, could be considered as violations of the law of one price. In the interest of comparability, we standardized the country measures of fragmentation (CLFrag) dividing them by their standard deviation over the sample period and then multiplied by 100. Results are summarized in Panels A, B, and C of Figure 2. Panel A reports the levels of fragmentation for the core countries, Panel B reports the levels of fragmentation for the peripheral countries, and Panel C shows the absolute value of the average difference in the levels of fragmentation between the core and the peripheral countries.

Chart 2
Country-Specific Fragmentation in the EMU Interbank Market



Source: authors

In Panels A and B we observe that fragmentation differs at country level but it moves together during particular distressed periods of time. As reported in Section 4.1.1 the Lehman Brothers collapse broke the almost full integration of the EMU interbank market, with the French market being particularly hit at this stage due to the uncertainty of the French banks with respect to subprime assets. In the case of the Greek banks we observe a significant increase in the level of fragmentation after the Greek bailout. In fact, the maximum level of fragmentation for Greece was reached around May-June 2010 while for the other ten countries the most acute period of fragmentation took place during June-July 2012. After that distress period, we observe a generalized decrease in fragmentation levels coinciding with the ECB's determination to fight any speculation of a euro break-up.

Panels A and B do not allow us to properly check potential differences between the core and peripheral countries, so we report the difference between the average levels of fragmentation in the two countries in Panel C of Figure 2. This figure shows that the fragmentation has been on average higher in the peripheral countries (we tested whether the difference between the two series is significantly different from zero and found that this difference is significantly higher than zero, suggesting a higher fragmentation in the peripheral countries). Moreover, the fragmentation in the peripheral countries increases significantly after some specific periods such as the misreporting of Greek statistics, the Greek, Irish and Portuguese bailouts, the Italian crisis (Silvio Berlusconi resigning as Prime Minister) and the S&P downgrades affecting to all the peripheral countries by January 2012. Although the level of fragmentation in peripheral

countries is always greater than in core countries, there are two episodes in which we observe a significant decrease in the level of fragmentation in the peripheral over core countries. These two episodes are: (i) December 2010, coinciding with the Irish bailout and (ii) the agreement reached on 29 June by the European Council leaders for the creation of banking union and Draghi's seminal speech on 26 July 2012.

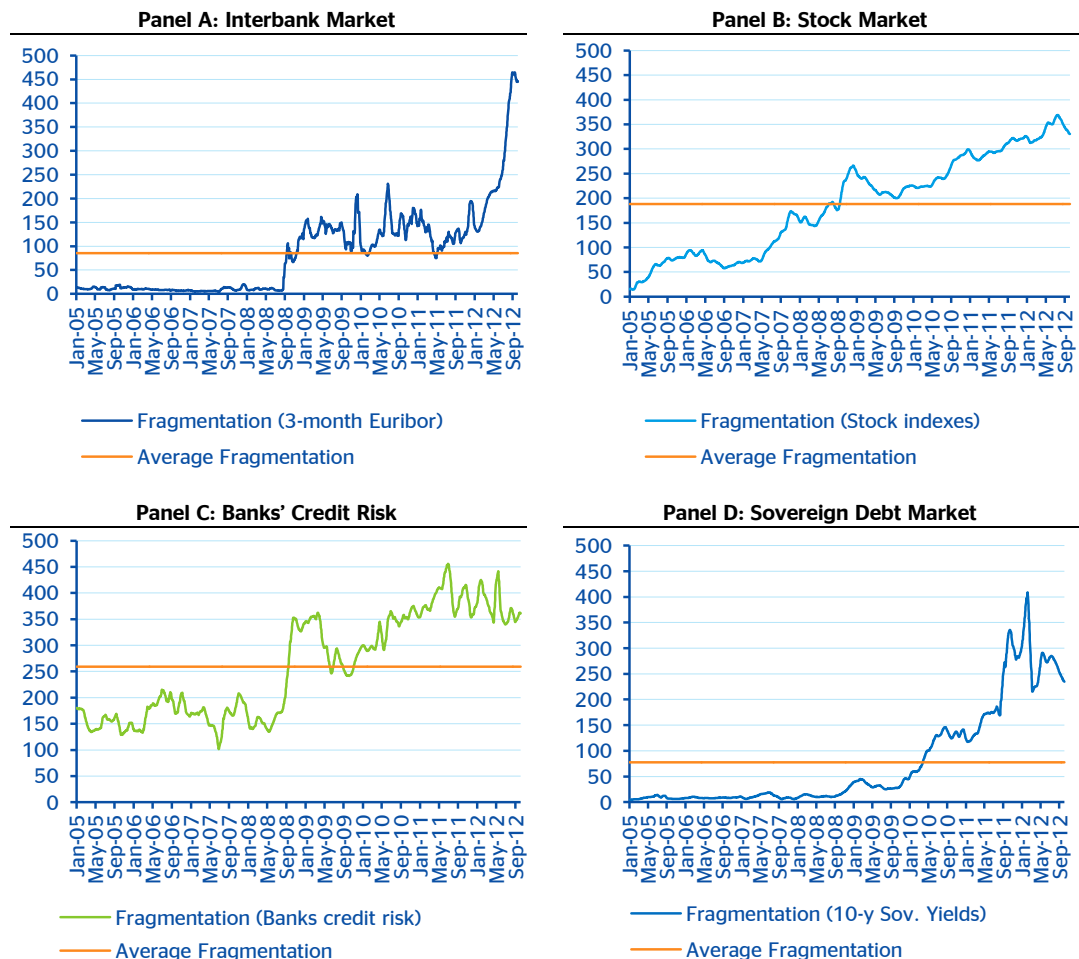
4.2 Fragmentation in the EMU financial markets

So far we have focused on the level of fragmentation in the interbank market. In this section we extend the analysis of fragmentation from a global perspective to three other markets in which significant differences emerged across the behaviour of prices in different countries. These additional markets are: the sovereign debt market, the stock market, and the CDS market for banks.

It is worth mentioning that, unlike the case with the interbank market, the concept of fragmentation followed in this study is not perfectly applicable to any of the other three markets. The reason is that the price in a given country is not necessarily the same or comparable to the one of the other countries, independently on whether the idea of convergence in prices could seem realistic after the introduction of the euro. In spite of this concern, it seems necessary to study the changes in the levels of convergence observed in these three previous markets over the main episodes of the recent financial crisis.

We measure fragmentation according to Equation 2, in which the CV is defined as the ratio between the standard deviation of the price for each country across the 11 countries of the sample and the average of the same price across the same countries. In the interest of comparability across different markets, we standardized the series of fragmentation, dividing them by their standard deviation over the whole sample period and then multiplied by 100. Results are shown in Figure 3. Panels A, B, C, and D of this figure refer to the interbank market, stock market, banks' credit risk, and the sovereign debt market, respectively.

Chart 3
Fragmentation in the interbank market, stock indexes, banks' credit risk, and 10-year sovereign yield for the EMU countries



Source: authors

In line with the theory of convergence after the introduction of the euro, we observe high (almost total) convergence in the interbank and sovereign debt markets for the first period of the sample. Nevertheless, the current levels of fragmentation are very high and in fact indicate a lack of convergence. It is important to note that the break in convergence occurred at different periods in the different markets. If we compare the average level of fragmentation in each market during the whole period (black line) we notice that in the case of the banking sector CDS, the stock indexes, and the interbank market, the break took place after the Lehman Brothers collapse. In the case of the sovereign debt market it occurred around March-April 2010, coinciding with the problems in Greece that later spread to other countries. Thus, the nature of fragmentation is different in the banking and the sovereign sector, but after the Lehman Brothers collapse it seems that one sector reinforced the fragmentation of the other.

In the fragmentation of stock indexes we observe a constant increase in the levels of fragmentation with two significant jumps: (i) in summer 2007, coinciding with the first episodes of the subprime crisis, and (ii) around the Lehman Brothers collapse, as mentioned before. The maximum level of fragmentation during the sample period is towards the end of summer 2012.

In banks, we observe a significant increase in the levels of fragmentation but, contrary to the interbank and the sovereign debt markets, there was no integration before Lehman Brothers

collapse and so the increase was less intense than in the former two markets in which data indicated a full convergence. In spite of that, the European sovereign debt crisis also had a significant effect on the fragmentation in the level of banks' credit risk due to the close relation between banks and governments. In fact, the two highest values of fragmentation correspond to the end of July 2011 and the end of May 2012, coinciding with two of the main risk episodes that affected Europe during the recent crisis.

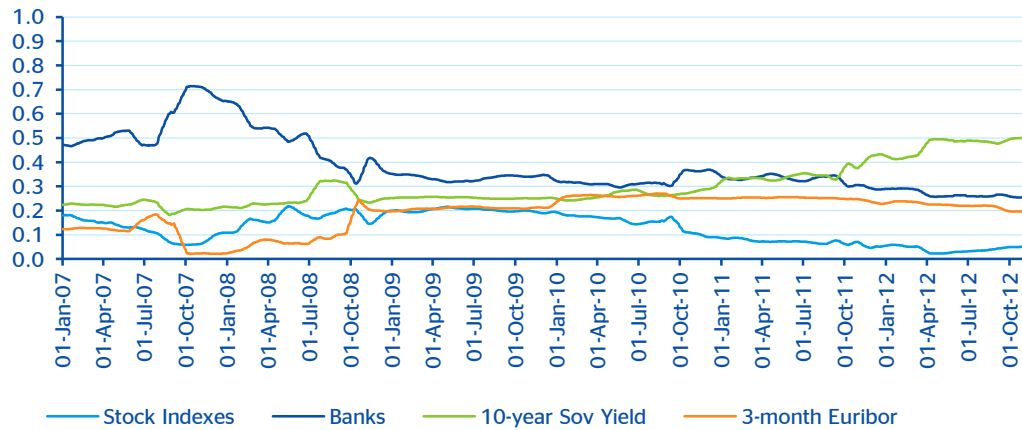
4.3. A global measure of fragmentation and spillover effects

In this section we construct a global measure of fragmentation in the EMU on the basis of the four markets studied in this report. Additionally, the methodology employed to construct this measure of fragmentation enables us to study the market spillovers that originate and transfer fragmentation to the other markets. The usefulness of the analysis is twofold: we monitor the total level of fragmentation and we can determine (at every date) the market that exerts the strongest influence on the level of fragmentation and thus the nature of the risks affecting the EMU markets.

To construct the aggregate indicator of fragmentation we use an application of basic portfolio theory to the aggregation of the level of fragmentation in the four markets. This aggregation method takes into account the time-varying causality between fragmentation measures, putting relatively more weight on situations in which fragmentation prevails in a given market and capturing the idea that the fragmentation in this market spreads to the other markets and so is the most dangerous market for the stability of the economy or the financial markets as a whole. In other words, we assign a bigger weight to the market that is causing fragmentation in the other markets.

In order to determine the market that spills over instability and causes fragmentation in other markets, we use Diebold and Yilmaz's (2012) methodology. From this methodology, we estimate the measures of spillovers and we use a generalized VAR model that consists of four equations corresponding to the first difference of the levels of fragmentation in the four markets analyzed. The spillovers from markets A to B are defined as the degree of variation in the changes of the fragmentation in market B that are not due to past changes of fragmentation in any of the four markets, but to shocks (innovations) in the changes of the levels of fragmentation in country A. The weights are obtained as the total spillovers caused by market j divided by the maximum value of the spillovers across the four markets. Thus, the weights are equal to the percentage of spillovers caused by market j and are shown in Figure 4.

Chart 4
Spillovers in market fragmentation

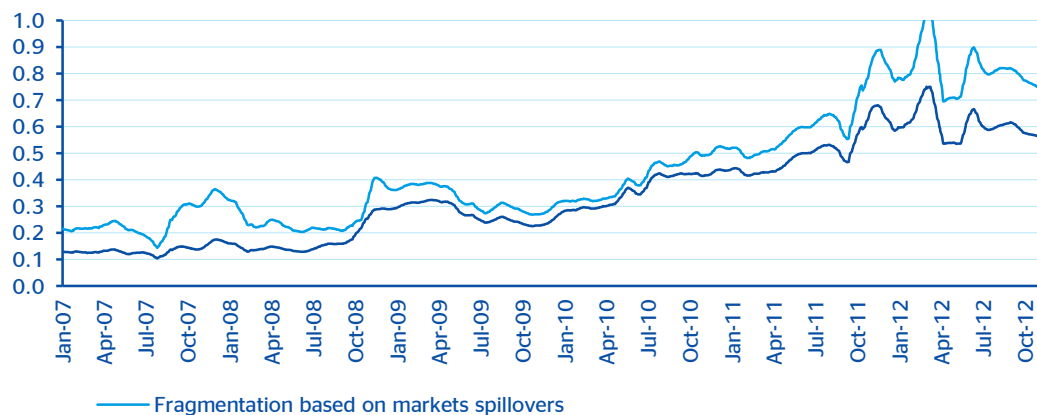


Source: authors

In Figure 4 we observe that before the end of 2010 most of the spillovers in fragmentation were attributable to the fragmentation in the levels of credit risk in the banking sector. After 2010 the main driver of fragmentation has been the sovereign debt market, coinciding with the beginning of the European sovereign debt crisis. The maximum level of spillovers in fragmentation caused by the banking sector occurred after the beginning of the subprime crisis in the summer 2007. Since then the spillovers caused by the banking sector have decreased due to the stronger influence of the interbank market and mainly to the sovereign debt market. The role of the stock market has decreased remarkably and was almost negligible during 2012, suggesting that the fragmentation in the stock market was almost completely due to the other markets and mainly to the shocks coming from the sovereign debt market.

In Figure 5 we report the aggregate indicator of fragmentation that is obtained as the product of the weights obtained for each measure and the coefficient of variation of the corresponding measure. This indicator (in blue) exhibits an increasing trend in the level of fragmentation over the sample period, with some significant increases and decreases that are analysed below.

Chart 5
Aggregate indicator of fragmentation in the EMU financial markets



Source: authors

We next use Bai and Perron's (2003) algorithm to identify the structural changes in this new indicator of global fragmentation and find three breakpoints (one more than for the 3-month interbank interest rate). As in the case of the interbank market we obtain one break after the

Lehman Brothers collapse (October 2008). However, we find two other breaks that were not found before, in June 2010 and September 2011. The break in June was due to the major uncertainty regarding the bailout of Greece. The break in September 2011 was due to the persistent fears and alarms about the European and global economic outlook that were materialized in falls in the European stock markets and downgrades of European banks.

Besides the global fragmentation index we report the index that is obtained as an equally weighted average of the levels of fragmentation in the four markets (red line in Figure 5). The advantage of the global fragmentation based on Diebold and Yilmaz's (2012) methodology is that it assigns a larger value to the market with the greatest influence in a given period of time and so it is a better indicator of the stress. Thus, we observe that the equally weighted fragmentation index exhibits a weak increase at the beginning of the subprime crisis in summer 2007. The jump following the Lehman Brothers' collapse is also weaker in the equally weighted index. Although after the summer of 2010 both measures exhibit a similar trend, the levels of fragmentation are significantly larger in the indicator based on the spillover effects.

5. Determinants of fragmentation and the role of ECB interventions and announcements

5.1 The determinants of fragmentation in the interbank market

In this section we study the effect of a set of variables that contain potentially valuable information about the process of fragmentation in the EMU interbank market. We conduct this analysis using country-level measures of fragmentation (as detailed in Section 5.1.2) by documenting the characteristics of fragmentation in that market. We classify the determinants of fragmentation in two groups: overall risk factors affecting financial institutions and country-specific factors. Additionally, we control by a set of factors related to the three main interventions during the European sovereign debt crisis that played a key role of the evolution of the financial markets.

a. Overall risk factors

- **Counterparty risk:** We test this effect by using the first principal component obtained from the CDS spreads of the main 14 banks that act as dealers in this market, as in Arce et al. (2013).⁴ The first principal component series should reflect the common default probability and, hence, it is akin to an aggregate measure of counterparty risk.⁵ Actually, the first principal component explains almost 90% of the total variance of the observed variables. In principle, the higher the counterparty risk in the banking sector the lower the confidence in the banks and so, the lower the activity in the interbank market. The expected sign is positive.
- **Financing Costs:** One would expect that the higher financing costs, the lower the demand for funding and so interbank activity. Due to the difficulty in obtaining data on institution-level funding constraints, we use the 90-day US LIBOR-OIS spread as a common proxy for the funding constraints faced by global financial intermediaries. Note that this variable is related to the funding costs reflected in the interbank market but at the same time refers to

4: The 14 main dealers are: Bank of America, Barclays, BNP Paribas, Citigroup, Credit Suisse, Deutsche Bank, Goldman Sachs, HSBC, JP Morgan, Morgan Stanley, Royal Bank of Scotland, Société Générale, UBS, and Wachovia/Wells Fargo. These dealers are the most active global derivatives dealers and are known as the G14 (see, for instance, ISDA Research Notes (2010) on the Concentration of OTC Derivatives among Major Dealers).

5: The use of the dealers' CDS spreads as a proxy of counterparty risk is based on the Arora et al. (2009) study, which analyses the existence of counterparty risk in the corporate CDS market.

the U.S. interbank market. Additionally, this variable has been widely used in previous literature (see Rodriguez-Moreno and Peña, 2012; among others) as a proxy for systemic risk. Thus, this variable could also reflect risk in the interbank market. We expect a positive sign because, the larger the systemic risk and the funding costs, the larger the level of market fragmentation should be.

b. Country-specific variables

- **Debt relative to GDP:** This variable is used as an indicator of the country solvency or creditworthiness. The higher the level of debt relative to GDP, the lower the ability of the country to bail out financial institutions, and so the larger the dispersion of the interbank rates quoted by the banks in this country from the median rates. The expected sign is positive.
- **Banking sector openness:** This variable is defined as the sum of external loans and deposits of the domestic BIS reporting banks relative to the country's GDP. The key organizational criteria of the BIS locational statistics data are the country of residence of the reporting banks and their counterparties as well as the recording of all positions on a gross basis, including those with respect to their own affiliates. The loans and deposits should include interbank borrowings and loans and inter-office balances. We use the sum of deposits and loans because our aim is to measure the total relation of the country to the global system, i.e., how open or closed the domestic financial system is. If domestic banks have access to external loans and deposits easily in a given period, the level of fragmentation in this country should be lower. For this reason, we expect a negative effect of this variable.
- **Economic sentiment:** Strong economic sentiment would indicate good credit conditions, among other positive prospects. A well-functioning credit market implies well-functioning financial institutions that would be more integrated with the other European institutions. The expected sign is negative.
- **TARGET2 relative to GDP:**⁶ This variable is defined as the monthly imbalances in the TARGET2 system relative to GDP. The Box 1 of the ECB (2012) TARGET annual report states that "before the crisis, TARGET2 balances were relatively stable because cross-border payment flows tended to be broadly balanced across the euro area. Since the start of the crisis, TARGET2 liabilities have increased considerably for some national central banks. This increase in TARGET2 negative balances is due to the fact that in the countries in question payment outflows in euros have not been matched by payment inflows in euros. At the same time, access to funding by private markets in those banking systems has become dramatically impaired. The net outflows in cumulative terms in those banking systems have required more central bank liquidity than usual. Along the same lines, Tornell (2012) argued that the Eurozone periphery has witnessed a massive increase in domestic central bank credit. This increase has been associated with the explosive path of the TARGET2 liabilities of the periphery national central banks (NCBs) vis-à-vis the ECB. Note that those NCBs that provided more liquidity than usual to their banking system in net terms are the ones that have a liability vis-à-vis the ECB, while the NCBs that provided less liquidity in net terms are the ones that have a claim vis-à-vis the ECB. So, banking systems with negative TARGET2 (i.e., liabilities) have more need than usual for recourse to monetary policy operations in order to continue lending to households and firms in their economies (ECB, 2012). So, the higher the deficit in TARGET2 (i.e. the more negative variable), the higher liability position (the higher debtor position within TARGET2) of a given country and hence, the lower the use of the interbank market by banks belonging that country. For this reason, the expected effect of this variable is negative.
- **Peripheral countries dummy:** As an alternative to using the above factors, which mainly characterize the peripheral countries in the EMU, we use a dummy that indicates whether a country is in the group of the peripherals (dummy takes value 1) or not (dummy takes value 0). We cannot use this dummy jointly with the four previous variables because the peripheral countries are the ones with higher and growing debt over GDP, negative economic sentiment, TARGET2 negative balances that are worsening during the crisis, and a different behaviour with regards to the use of external loans and deposits.

6: TARGET2 stands for Trans-European Automated Real-time Gross Settlement Express Transfer System 2.

- **Relative size of financial sector:** We measure the importance or size of the financial sector as the GDP that is attributable to the financial sector relative to the total country GDP. The larger the relative size of the financial sector, the lower the ability of the government to bail out the sector in case of distress and hence, the larger the dispersion with respect to the median interest rate. The expected sign is positive.
- **Banking sector credit risk:** To measure the banking sector credit risk for every country we use the average CDS spreads of their banks. Given that this variable is closely related to the counterparty risk that was employed in the global factor section, here we focus on the credit risk that is country-specific. For this purpose we run an auxiliary regression for each country in which we regress the banking sector CDS spread on the counterparty risk variable and take the residuals plus the constant term as a proxy for the country-specific banking sector credit risk. If the interbank money market system gets frozen and the banks are not willing to lend to each other, then the most affected banks should be the ones with the higher levels of credit risk. We expect a positive effect of this variable indicating that banking sector risk leads to a higher level of fragmentation in this country with respect to the median interbank rate.

c. EMU policy factors

- **ECB non-standard measures:** When speaking about fragmentation of the European financial markets in June 2012, Mr Mario Draghi considered that the market participants and many observers make the same mistake because “they underestimate the strength of the political commitment by the euro area member countries. They underestimate the awareness that all of us have of the extraordinary benefits that the euro has brought, in both financial and political terms - in terms of perspectives and in terms of achievements, because after all, the 14 years that we have had the euro have been 14 years with great price stability, with very low interest rates.” In order to take into account the commitment of the ECB to restoring financial stability and a fully-functioning market, we include in our regression the ECB non-standard measures that complement its regular operations.
 - *Securities Market Programme (SMP):* It was designed to conduct outright interventions in the euro area public and private debt securities market with the objective of (a) addressing the malfunctioning of securities markets and fostering liquidity; and (b) restoring an appropriate monetary-policy transmission mechanism. In order to carry out such interventions, Eurosystem central banks may purchase the following: (a) on the secondary market, eligible marketable debt instruments issued by the central governments or public entities of the Member States whose currency is the euro; and (b) on the primary and secondary markets, eligible marketable debt instruments issued by private entities incorporated in the euro area. Thus, we create a variable that contains the weekly amount of debt purchased by the ECB from May 10 2010 onwards.
 - *Long Term Refinancing Operations (LTROs):* In the context of exceptional circumstances prevailing in the financial markets, the European Central Bank (ECB) complemented its regular operations (i.e., main refinancing operations (MROs) and 3-month long-term refinancing operations (LTROs)) with euro liquidity-providing operations with 1-month, 6-month, 1-year and 3-year maturity and in a full allotment mode. We include the effect of the extraordinary LTROs in our regression using as an explanatory variable the total weekly amount of refinancing used for all the possible maturities.
 - *Covered Bond Purchase Programme (CBPP):* There were two CBPP programmes, designed to purchase eligible covered bonds outright with the objective of (a) easing funding conditions for credit institutions and enterprises; and (b) encouraging credit institutions to maintain and expand their lending to clients. The first programme lasted from July 2, 2009 to June, 30, 2010; while the second programme was effective from November 03, 2011 to October 30, 2012. The variable that captures the effect of these programmes in our analysis is the defined as the weekly amount of covered bonds purchased by the ECB. We consider jointly the total amount of covered bonds purchased under the two programmes.

To estimate the effect of the previous variables, we run an Ordinary Least Squares regression with fixed-effects at the country level, time effects and bootstrapped residuals robust to

heteroskedasticity.⁷ Given that the frequency of most of the explanatory variables is monthly or quarterly, we estimate the coefficients on the basis of monthly data. Results are shown in the first Column of Table 1, in which we report the coefficients obtained in the estimation and the standard errors between brackets. The second column in Table 1 shows the economic impact of each variable when it has a statistically significant effect that is obtained as the effect of a change in each explanatory variable of a magnitude equal to one standard deviation in this variable, *ceteris paribus*, relative to the average of the dependent variable.

Table 1
Determinants of fragmentation in the interbank market

	Coefficient (Standard error)	Economic relevance	Coefficient (Standard error)
Financing costs	1.074*** (0.50)	24%	0.732* (0.44)
Counterparty risk	0.035** (0.02)	42%	0.046*** (0.02)
Debt relative to GDP	0.022** (0.01)	16%	
Banking sector openness	-0.134*** (0.03)	25%	
Economic sentiment	-0.0001 (0.00)		
Target2 relative to GDP	-4.667 (6.45)		
Peripheral countries			0.012*** (0.00)
Relative size of fin. sector	0.609*** (0.21)	16%	0.984*** (0.20)
Banking sector credit risk	0.159 (0.13)		0.090 (0.11)
SMP	-0.538*** (0.18)	25%	-0.528*** (0.16)
LTRO	0.012 (0.02)		0.015 (0.02)
CBPP	0.279 (0.90)		0.432 (0.89)
Constant	-0.025 (0.02)		-0.047*** (0.01)
Number of observations	1023		1023
R-squared	0.59		0.57

Source: authors

We observe that the two overall risk factors affecting financial institutions in the EMU and several country-specific factors have a significant effect on fragmentation. The variable with the strongest economic impact is counterparty risk. This effect confirms the importance of confidence in financial institutions for a well-functioning interbank market. The positive and

7: We correct the residuals using bootstrap because the average country banking sector credit risk is obtained in an auxiliary regression in which we regress the banking sector CDS spread on the counterparty risk and take the residuals to consider the part of the bank credit risk that is country-specific.

significant effect of financing costs confirms its effect on the demand on funding and thus on interbank activity. An increase equal to one standard deviation in the level of either counterparty risk or financing costs would lead to a respective increase in the level of fragmentation of 42% or 24%, *ceteris paribus*, relative to the average level of fragmentation observed during the sample period.

All the country-specific variables - the effect of the banking sector openness, the debt relative to GDP, and the relative size of the financial sector - have the expected sign statistically different from zero. Thus, the stronger the banking sector relation to foreign institutions the lower the fragmentation. The economic impact of this variable is remarkable: an increase of one standard deviation in the level of the banking sector openness would diminish the level of fragmentation by 25% with respect to the average level of fragmentation observed during the sample period. The relative size of the financial sector and the level of debt relative to GDP have a positive and significant effect, both statistically and economically (16%). The effect of the size of the financial sector and the level of debt relative to GDP confirm that the larger the size of the financial sector or the indebtedness of the public sector, the less ability the government has to bail out the sector in case of distress; and so the more fragmented the financial sector of this country with respect to the EMU financial institutions. For the same reasoning, although the effect is not significant, the larger the risk of financial institutions the larger the fragmentation. The higher level of risk of financial institutions would also go hand-in-hand with higher financing costs for these institutions. The effect of TARGET2 over GDP is negative but not significant. The negative sign indicates that the more negative (larger amount of liabilities) this variable, the lower the use of the interbank market and so the higher the level of fragmentation of the corresponding country. This negative effect also shows that the worse the situation of financial institutions in a given country the more fragmented their contributions to the interbank market. This is also in line with the negative although non-significant effect of the economic sentiment indicator, given that a bad sentiment is associated with a higher level of fragmentation.

Taking together all the signs and effects of the country-specific variables we infer that the peripheral countries will be more fragmented due to their higher dependence on external funding, higher levels of debt, the worse economic situation, and higher levels of risk for their financial institutions. For these reasons, we cannot use this dummy jointly with some of the country specific variables. We therefore repeat the estimation excluding the ratio debt/GDP, Target2/GDP, banking sector openness and the economic sentiment; and including a dummy variable that indicates whether a country is peripheral or not. Results are reported in Column 3 of Table 1. The effects obtained for the variables that appear in both specifications are similar in terms of sign and magnitude. The coefficient obtain for the peripheral countries dummies is positive and significant, confirming the higher levels of fragmentation in peripheral countries and thus the existence of geographical fragmentation in the EMU.

Among the ECB programmes the only significant effect in statistical (*p-value* close to zero) and economical (effect of 25%) terms is due to the SMP programme. This effect possibly indicates that the liquidity provided through the SMP has an effective double impact, given that, besides the liquidity the banks might get because of selling the sovereign debt to the ECB, the programme helped decrease the levels of sovereign risk, thus improving the confidence in the euro and the EMU. The second effect could be of first magnitude, given the levels of the spillovers from the sovereign to the financial sector documented in Figure 4. The non-significant effect of the LTRO and CBPP programmes is surprising but could be due to the fact that they have a double effect: on the one hand, they should contribute to restore the confidence on the European financial system and improve expectations about the functioning of the interbank market; on the other, by means of these two programmes the banks depend to a lower extent on the interbank market, given that they benefited from the liquidity obtained from the ECB. Due to the use of monthly information we cannot infer from the above regression whether these two programmes were positively welcomed by the markets and contributed to the decrease of fragmentation. In order to analyse this effect we need an event-study analysis based on daily rather than monthly information. This analysis will be

implemented in the next subsection and will include other announcements that could have contributed in the short term to a significant decrease in fragmentation.

In short, as confirmed by the counterparty risk variable and the SMP programme, restoring confidence seems to be the most efficient measure to avoid market fragmentation. Thus, as mentioned by IMF (2013), “strong coordination across Europe’s various supranational agencies will be critical. This will help ensure smooth decision-making and make policies consistent, especially for crisis management.” In the next section we will analyse the effect of the interventions or announcements that were carried out by the ECB during the recent crisis.

5.2 The effect of the ECB interventions and announcements

Besides the three ECB programmes employed in the above regression (SMP, LTRO, and CBPP) there were announcements by the ECB that could have led to a significant decrease in the level of fragmentation such as the banking union announcement, Draghi’s speech, or the OMT announcement. Contrary to the above programmes these variables cannot be employed in the previous regression because they do not imply a certain amount of euros injected every month but just a dummy that indicates the event. Thus, the use of monthly information of the above regression would cloud significantly the real effect of these variables.

To analyse the short-term effects of these announcements jointly with the programmes used in the regression of the previous section on the fragmentation of the 3-month Euribor rate, we now use an event study around the concrete dates of these specific events. Our aim is not to analyse whether the level of fragmentation is significantly different from zero but whether these interventions had a significant effect on the level of fragmentation. For this purpose we use a mean test that compares the average level of fragmentation one month before the day in which the programme is implemented with respect to the average level of fragmentation one month after such intervention day. The use of one month of data around each specific event is due to the fact that this period was very convulsed, so we avoid the use of larger samples that could include the effect of other events. Results are shown in Table 2. Each row refers to the different programmes whose implementation or announcement date is between brackets. The first column of the table reports the difference in the levels of fragmentation between the monthly averages before and after the programme implementation or announcement dates, while the second column contains the standard errors between brackets that are used to find the level of statistical significance for each programme.

Table 2
Effect of the ECB interventions on market fragmentation

	Differences in fragmentation (-1/+1 month around the date)	Standard error
CBPP (June 4, 2009)	22.83	(16.02)
SMP (May 10, 2010)	-26.10***	(6.46)
CBPP2 (Nov. 3, 2011)	-24.78***	(7.12)
LTRO (Dec. 8, 2011)	-73.64***	(13.41)
Banking Union (June 29, 2012)	-22.92**	(10.93)
Draghi’s speech (27 July, 2012)	-64.56***	(10.95)
OMT (Sep. 6, 2012)	-52.87***	(14.76)

* p-value<0.10, ** p-value<0.05, *** p-value<0.01
Source: authors

The results show a significant decrease in the daily levels of fragmentation immediately after the implementation of the SMP and LTRO programmes. With respect to the CBPP programmes, we observe a significant effect of the second programme, which was implemented after the major turbulence during the summer of 2011; but a non-significant effect of the first programme, which was implemented even before the beginning of the European sovereign debt crisis. Thus, although the effect of the LTRO and CBPP programmes was not significant in the previous analysis we observe a short-term significant effect that led to a decrease in the levels of fragmentation due to the positive expectations that these programmes could have generated.

The announcements of the Banking Union and the OMT led to a significant decrease in the levels of fragmentation, given that they helped to restore the investors' confidence in the euro and at the same time to confirm the support by the ECB for meeting the challenges of the European sovereign debt crisis. The same effect is observed after Draghi's speech given on 26 July.⁸

Additionally, we study the role of the two stress tests (23 July, 2010 and 15 July, 2011) as potential factors reducing fragmentation.⁹ The expected effect of these factors is unclear. On the one hand they could generate further fears or risk in the European banking system, thus increasing the market fragmentation. This is especially relevant if the stress-test results are worse than anticipated by the markets. On the other, the stress-test results could help decrease the level of uncertainty about the financial system situation as a whole and about the individual banks' situation more specifically. Contrary to earlier ECB interventions and announcements, the stress tests did not contribute to decrease the levels of fragmentation, possibly because several banks failed the Tier 1 capital ratio threshold. In fact, during the month after the first stress test, the level of fragmentation was significantly higher than the level observed the month before the test.

6. Policy solutions to fragmentation: the banking union project

The need to tackle the banking crisis and stop financial fragmentation has immersed the EU authorities in a new regulatory and political endeavour: the creation of banking union. We have analysed in previous sections why banking union is needed to overcome the fragmentation problem currently affecting the EMU. In fact, certain fragmentation may be considered to some extent something usual when a financial crisis occurs. Nevertheless, this time the fragmentation registered in the EMU has gone much further. There are multiple additional factors exacerbating the fragmentation; inter alia, the weakness in the institutional design, supervisory practice barriers (through moral suasion), the scant pre-crisis integration of the retail sector or the fact that market discipline did not work properly during the boom.

Therefore, the seriousness of these risks led to a consensus that a European solution to the fragmentation problem was required, galvanizing a strong political commitment towards further integration in the form of banking union (which involves a harmonized regulation and single supervision, resolution and deposit insurance systems for all Eurozone zone banks).

The agreement on banking union is a milestone in the history of the EU and the EMU. While politically unacceptable until very recently (even at the outset of the crisis), the banking union project has become Europe's flagship in the defence of the euro and the fight against financial fragmentation in the Single Market. The challenge is twofold: first, to disentangle the sovereign

8: See <http://www.ecb.int/press/key/date/2012/html/sp120726.en.html>.

9: Of the 90 banks tested in 2010, 7 failed the 6% Tier 1 capital ratio threshold: five in Spain, one in Germany, and one in Greece. In the results for the 2011 exercises, eight out of 90 banks failed the test: five in Spain, two in Greece and one in Austria. Spain also is one of the leading countries in the list of approved banks (20), because it put up almost its entire financial sector (95 percent, against an average of about 60 percent).

and banking feedback loop; and second, to foster a truly integrated financial market, starting by streamlining the EMU's governance and institutional framework.

The first pillar of banking union is regulatory harmonization, which is already underway in the form of a single rulebook that includes key regulatory pieces such as the fourth version of the Capital Requirements Directive (CRDIV), the new EU Recovery and Resolution Directive (RRD) and a recast version of the DGS Directive. An agreement between co-legislators (the European Parliament and the EU Council respectively) for these three key pieces was announced for June 2013.

The second pillar, the single supervisory mechanism (SSM), was approved last December by the ECOFIN and will be fully operational in March 2014, 12 months after the entry into force of the new SSM regulation. The SSM will operate under the lead of the ECB, which will set the common rules and will be responsible for the correct functioning of the SSM. The ECB will also supervise directly around 140 significant banks operating in the EA with the assistance of the national supervisors, which will continue to oversee those banks not directly targeted by the ECB. The agreement and establishment of the SSM represents a milestone towards solving the euro area crisis by creating a fully functional banking union. The introduction of a common supervisory practices (or ECB charter) will help create a level playing field across European banks, avoiding regulatory ring-fencing practices and promoting a higher level of knowledge and comparability among EU institutions by market players. This is primarily a Eurozone issue that must move ahead without delay according to the agreed calendar, the main challenge being related now with the definition of the operational arrangements and the transfer of supervisory powers to the ECB.

So far, we have made progress on the first two pillars: regulatory harmonization and a new single supervisor. Certainly, this new framework is better than the situation we had in June 2012; so it is a valuable tool to deal with limited financial instability episodes. But it is far from being a powerful tool to handle severe financial turbulence. In short, for the time being we only have a weak banking union. We are halfway towards achieve a complete banking union strong enough to deal with most stress scenarios.

In this vein, it is worth noting that without a single resolution and a safety net framework, the SSM will not be able to break the vicious circle between banks and sovereigns, which is key to restoring a proper functioning of the monetary policy transmission mechanism. In addition, the Single Resolution Mechanism (SRM) becomes key in order to avoid inconsistencies from a supervision transferred to a supranational level (ECB) and a resolution maintained at a national level. Therefore, if a "strong" version of the Banking Union project is to be achieved the Eurozone should make progress on the third and fourth pillar, which include a SRM and a single Deposit Guarantee Scheme (DGS) that provides clear burden-sharing agreements and a common credible European backstop.

The SRM would involve the creation of a Single Resolution Authority and a Single Resolution Fund to be privately funded by the industry. A proposal by the European Commission for the Single Resolution Mechanism was presented on 10 July 2013. It foresees the creation of a Single Resolution Board with certain resolution powers and with the Commission having the final say on when to place a bank under resolution and the tools to be used along the process.

On 10 July the European Commission (COM) presented a draft Regulation to set up a Single Resolution Mechanism (SRM) for the Eurozone plus other Member States (MS) of the European Union that voluntarily join the Single Supervisory Mechanism (SSM). The ultimate goal of the SRM proposal is to break the vicious circle between bank and sovereigns risk by anchoring expectations that banks will be resolved primarily by private means, through a centralized and effective application of common EU resolution rules dictated by the Bank Recovery and Resolution Directive (BRRD) (still under negotiation and expected to be passed in late 2013) and common resolution arrangements.

According to the proposal the Commission would have the final decision on whether and when to place a bank under resolution but a newly created Single Resolution Board would decide how

the resolution would be done and would give instructions to national resolution authorities to implement the resolution plan finally approved. The proposal also foresees the creation of a Single Resolution Fund that would be used only after the bank's shareholders and creditors have absorbed losses. The use of public funds is therefore conceived as a (non-binding) last recourse measure that must be subject to the revised state aid rules as well as the parameters established in the BRRD and the European Stability Mechanism (ESM) rules.

The draft Regulation will have to be discussed by the Council and the Parliament with view to reach a final agreement and one of the key elements in these discussions will be the its legal basis. If a legal basis is not finally found for the SRM to incorporate a truly centralized resolution system along with the SSM, a transitional solution would need to be found for the Banking Union project not to stall and to mitigate the risks associated to the transition to a fully-fledged SRM (for example, those associated to having a single supervisor but many national resolution authorities that would ultimately be responsible for bearing the fiscal consequences of the single supervisor decisions). Efforts must be concentrated on (i) keeping the transition period as short as possible (by avoiding any delays in the agreed timetables) and, (ii) finding a way to break the vicious circle between banks and sovereigns (by tackling the problem of the existing legacy assets and by allowing direct recapitalizations by the European Stability Mechanism, ESM, once the SSM is fully effective).

The initial proposal for an operational framework of this "temporary" stability system involving the ESM (that should desirably work in coordination with national resolution authorities until a Single Resolution Mechanism is in place), was defined by the Eurogroup in late June 2013, with clear rules regarding the burden sharing agreement. The final version will be issued in late 2013, once a final agreement on the Directive for bank recovery and resolution has been achieved with the Parliament. In this sense, it seems that the ESM will not step in to help the stressed banks cover the losses associated with their legacy assets, but rather intervene only under exceptional circumstances (allegedly with sovereigns under stress) to cover the capital shortfall of ailing banks over a 4.5% CET1 threshold (and always after domestic private and public stakeholders have covered losses up to their loss-absorbing capacity according to applicable laws). This will allow the ESM to isolate the stressed sovereigns from future unexpected losses, delinking the vicious circle between sovereign debt and future bank losses.

Finally, the fourth pillar of the Banking Union involves the creation of a Single Deposit Guarantee Scheme to provide a credible common safety net. This is more a mid to long-term objective (it was dropped from the agenda in the European Council communiqué released in December 2012) but still key to give banking union the financial stability needed to permanently break the vicious circle between banks and sovereigns in the mid to long term. It is also the more contested part of banking union project as it is seen as the antechamber to fiscal union. In this sense it is not likely that a single EU DGS would see the light before 2018 at the earliest. Until then, some steps towards a common safety net could be taken to make possible some form of risk pooling among EMU members. IMF staff (Goyal et al 2013) have proposed a reinsurance scheme for national DGS that would be funded through industry levels and contributions from MS, complemented with an ex-ante agreement on the burden sharing between national DGS and the EU fund in case of deposit payouts. It seems clear now that a banking union is a necessary but not sufficient condition to restore financial integration. The agreements reached until now on banking union represent historic steps on the governance and institutional design of the EMU and have helped correct the intense financial instability of the past few months.

Notwithstanding this, more ambitious measures are required for the EMU to break the vicious circle between bank and sovereign debt. At the height of this perverse dynamic, only decisive action by the ECB to provide a credible backstop against very adverse scenarios in the Eurozone has calmed the markets. Ever since there has been a slight improvement in the fragmentation indicators, which nonetheless still remain at very high levels, jeopardizing the stability of a Monetary Union where financial integration is essential to preserve the integrity and effectiveness of ECB monetary policy (IMF 2012).

Hence, ideally the process has to be culminated first with the completion of banking union and then with additional measures such as to kick-start credit flowing to the real economy and SMEs in particular and to build a fiscal union, which is another cornerstone of the European leaders' strategy to get the EU out of the crisis, but on which progress has been far more disappointing than on the banking union front.

7. Conclusions

The integration of the wholesale financial markets in Europe advanced at a fast pace during the 2000s, driven by regulatory harmonization and a common currency. This brought several benefits to the EU in terms of risk management, competition and efficiency,¹⁰ but for the Eurozone it also contributed chiefly to financial and price stability by creating strong and profound financial markets that, together with banks, provided a safe channel for the ECB monetary policy.

However, with the outbreak of the crisis the integrative process stalled, giving way to a dramatic reversal of the capital flows that hit the Eurozone full on, in particular its periphery. Fragmentation first appeared in the banking sector and only later spread to the sovereign sector. Whichever way, fragmentation has affected all financial markets, and has also aggravated the crisis for banks, governments and for the real sector as credit has not flowed as desired.

Among the most significant factors that contributed to the high levels of fragmentation observed in the interbank market during the crisis are overall factors (counterparty risk and financing costs) and country-specific factors (banking sector openness, debt-to-GDP and the relative size of the financial sector). It has also been shown that fragmentation affected more to the peripheral countries due to their higher dependence on external funding, higher levels of debt, worse economic situation, and higher levels of risk in their financial institutions.

This fragmentation is harmful for the EU as a whole; but for the EMU is simply incompatible, because it jeopardizes the integrity and effectiveness of the ECB's monetary policy. This is why the ECB took decisive action in late 2011 and in the summer of 2012, when the European leaders showed their strong commitment towards more integration on the fiscal and structural front (with the announcement of reinforced fiscal and macro frameworks and the creation of long-term roadmaps towards a fiscal union) and on the financial front (with the creation of banking union and the definition of a framework for direct recapitalizations of banks by the ESM).

Banking union is a necessary but not sufficient condition to restore financial integration and so credit flow into the real economy (and SMEs in particular); fiscal union is also relevant in the process toward financial re-integration.

The end of the process after the new policies are implemented should be a Eurozone that is integrated from a monetary, banking, fiscal and eventually political standpoint. This new institutional framework will make the European banking sector more stable and allow a more efficient allocation of resources. Bigger cross-border entities are likely to emerge, both wholesale and retail, so competition policy becomes increasingly important to address potential risks of fewer entities. Another consequence that should follow once the process is completed is a change in the home bias in asset holdings.

There is really no alternative to banking union if the euro is to survive. There is no Plan B. The survival of the euro requires overcoming fragmentation. Today, this is fully understood by the major players and policymakers and there lies the best hopes for a quick progress towards an ambitious reform of the institutional design and governance of the EMU.

¹⁰ The benefits of financial integration are well known and documented and include among others, enhanced risk-sharing and diversification, deeper and more liquid markets and higher competition levels (due to cost efficiency). Financial integration can also allow for a more efficient allocation of capital, improving productivity and leading to a higher, sustainable, economic growth (de Santis et al, 2006).

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Appendix A

The spillover effects in the level of fragmentation are obtained from a variance decomposition associated with an N -variable vector autoregression (VAR) following the methodology employed in Diebold and Yilmaz (2012). These authors measure directional spillovers in a generalised VAR framework that eliminates the possible dependencies of results on ordering. In particular, we first consider a covariance stationary N -variable VAR (p):

$$X_t = \sum_{i=1}^p \Phi_i X_{t-i} + \epsilon_t \tag{A.1}$$

where X_t denotes a vector of stationary changes in the levels of fragmentation in the four markets and $\epsilon \sim (0, \Sigma)$ is a vector of independently and identically distributed disturbances such that the moving average representation is:

$$X_t = \sum_{i=0}^{\infty} A_i \epsilon_{t-1}$$

where the $N \times N$ coefficient matrices A_i obey the recursion $A_i = \Phi_1 A_{i-1} + \Phi_2 A_{i-2} + \dots + \Phi_p A_{i-p}$ with A_0 an $N \times N$ identity matrix and $A_i = 0$ for $i < 0$. Thus, the error from the forecast of X_t at the H -step-ahead horizon, conditional on information available at $t-1$, can be expressed as:

$$\xi_{t,H} = \sum_{h=0}^H A_h \epsilon_{t+H-h}$$

and the variance-covariance matrix of the total forecasting error is computed as:

$$\text{Cov}(\xi_{t,H}) = \sum_{h=0}^H A_h \Sigma A_h'$$

where Σ is the variance-covariance matrix of the error term in equation (A.1), ϵ_t .

We rely on variance decomposition of the moving-average coefficients, which allows us to parse the forecast error variances of each variable into parts attributable to the various system shocks.¹¹ By means of this decomposition we can obtain the proportion of the H -step-ahead error variance in forecasting X_i that is due to shocks to X_j , $\forall j \neq i$, for each i .

We first compute the variance shares which are defined as the fractions of the H -step-ahead error variances in forecasting X_i due to shocks to X_i , for $i = 1, 2, \dots, N$, and cross variance shares, or spillovers as the fractions of the H -step-ahead error variances in forecasting X_i due to shocks to X_j , for $i, j = 1, 2, \dots, N$ such that $i \neq j$. The H -step-ahead forecast error variance decompositions are denoted by $\theta_{ij}^g(H)$, for $H = 1, 2, \dots$:

11: The variance decomposition requires orthogonal innovations, but the VAR innovations are generally contemporaneously correlated. The use of generalized VAR instead of the Cholesky factorisation avoids using arbitrary ordering assumptions.

$$\theta_{ij}^g(H) = \frac{\sigma_{ii}^{-1} \sum_{h=0}^{H-1} (e_i' A_h \Sigma e_j)}{\sum_{h=0}^{H-1} (e_i' A_h \Sigma A_h' e_i)} \tag{A.2}$$

Where Σ is the variance matrix for the error vector ϵ , σ_{ii} is the standard deviation of the error term for the i^{th} equation and e_i is the selection vector with one as the i^{th} element and zeros elsewhere. The sum of the elements of each row of the variance decomposition table is not equal to 1, i.e.

$$\sum_{j=1}^N \theta_{ij}^g(H) \neq 1$$

Each entry of the variance decomposition matrix can be normalized such that the elements of each row sum 1 as:

$$\tilde{\theta}_{ij}^g(H) = \frac{\theta_{ij}^g(H)}{\sum_{j=1}^N \theta_{ij}^g(H)} \tag{A.3}$$

The spillovers show the degree of variation in the changes of the level of fragmentation, which is not due to the historical information of the changes in the level of fragmentation in this market but to shocks (innovations) in the changes of the fragmentation in the other markets. The sum of the normalized variance decomposition matrix across the dimension i divided by four gives the percentage of spillovers caused by market j :

$$\tilde{\theta}_{\cdot j}^g(H) = \frac{\sum_{i=1}^N \theta_{ij}^g(H)}{4} \tag{A.4}$$

This methodology is used to estimate the spillovers between the levels of fragmentation in different markets and so, the weights employed to create the aggregate measure of fragmentation. This indicator takes higher values as the intensity of the fragmentation in one market has a stronger effect in the other markets. In the extreme case in which there are no spillovers from the fragmentation in one market, the indicator series is equal to zero.

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