

ARTICLES

THE DETERMINANTS OF EURO AREA SOVEREIGN BOND YIELD SPREADS DURING THE CRISIS



Sovereign bond yields play a key role in the transmission of the ECB's monetary policy to euro area financial markets and the real economy. Therefore, the study of the determinants of sovereign bond yield spreads in the euro area is important in order to identify heterogeneity and potential impairments in the transmission mechanism of monetary policy across individual countries. From the inception of the euro to mid-2007, sovereign bond yields were very similar across euro area countries, despite large differences in fiscal positions. With the benefit of hindsight, it can be argued that investors were underpricing sovereign credit risks for a number of countries during this period. Once the euro area sovereign debt crisis broke out, investors drastically repriced sovereign credit risk and became much more risk averse, notably vis-à-vis countries with further deteriorating public finances. During the most severe phase of the sovereign debt crisis, contagion effects and unfounded fears of currency redenomination added to this upward pressure on sovereign spreads, impairing the transmission of monetary policy in some euro area countries. Unconventional Eurosystem monetary policies undertaken during these times helped to influence spreads in a way that improved the pass-through of the monetary policy stance across countries and allowed it to be geared towards maintaining price stability in the euro area.

I INTRODUCTION

Sovereign bond yields are generally used as benchmark reference rates to price key interest rates, such as lending rates to households and corporations, and corporate bond yields. Therefore, the study of their determinants is important to understand the monetary transmission mechanism and its possible impairments. For example, when setting the remuneration on deposits, banks compete with yields on bonds and Treasury bills issued by the government. In countries where such yields have become less responsive to policy rates, monetary policy may be less effective in steering banks' funding costs.¹

In the first ten years of the euro, the spreads between government bond yields across euro area countries were marginal. The monetary policy stance was easily transmitted to the various financial market segments. From this point of view, financial markets appeared to be well integrated, although more recent events suggest that the very small or even negligible bond spreads observed at that time in euro area countries under financial stress might reflect, at least in part, an underpricing of their domestic sovereign risk. After the Lehman Brother's bankruptcy in September 2008 and, most importantly, the disclosure of the severe public finance situation in Greece in October 2009, doubts over the sustainability of public finances in several euro area countries grew and their sovereign yield spreads rose sharply. Sovereign markets became highly fragmented across countries through market perceptions about the different viability of fiscal balances and the monetary policy transmission mechanism was impaired. During the most severe phase of the sovereign debt crisis, unfounded fears of currency redenomination arose, which the ECB had to alleviate through unconventional monetary policies in order to preserve price stability.

The aim of this article is to identify the factors that have characterised the euro area sovereign debt crisis in order to explain the developments in euro area sovereign bond spreads. Euro area sovereign yield spreads are defined here as the difference between the ten-year bond yields of a euro area country and the ten-year German bond yields. The ten-year Bund yields are often considered benchmark yields in many academic studies because German sovereign debt has been enjoying a high credit rating for some time now and hence its returns can be seen as a good proxy for risk-

¹ See the article entitled "Assessing the retail bank interest rate pass-through in the euro area at times of financial fragmentation", *Monthly Bulletin*, ECB, August 2013.

free asset returns. For the sake of simplicity, this convention is maintained in the article although, in principle, German Bund yields are also affected by risk premia.

The remaining sections of the article are structured as follows. Section 2 provides a broad survey of the literature on the main determinants of sovereign bond spreads in the euro area. Section 3 outlines their historical developments, including the pre-crisis stability period, the turmoil experienced after the Lehman Brother's bankruptcy and the subsequent sovereign debt crisis. Section 4 discusses how the various policies introduced by the Eurosystem in order to address the attendant impairments in the monetary policy transmission mechanism influenced sovereign bond spreads. Section 5 concludes.

2 A SURVEY OF THE LITERATURE ON THE DETERMINANTS OF SOVEREIGN BOND YIELD SPREADS IN THE EURO AREA

Sovereign bond spreads are generally related to a broad spectrum of determinants of very different nature. In particular, they may reflect the premia that investors demand in order to bear the country-specific credit and liquidity risks in relation to those of a benchmark country. In turn, the sensitivity of the premia – also defined as the price of risk – to credit and liquidity risks of a specific country compared with the benchmark country depends on the willingness of investors to bear those risks (i.e. their degree of risk aversion). However, as generally is the case with asset prices, sovereign bond spreads may also occasionally present developments that are inconsistent with the more traditional categories of determinants just mentioned. For example, they may be affected by financial bubbles or by self-fulfilling beliefs. This section aims to survey the literature on the main determinants that have affected sovereign bond spreads in the euro area. However, from the outset it should be clear that, given the broad spectrum of determinants and their interconnectedness, it is usually very difficult to quantify their relative importance in observed spreads.

The credit premium is the compensation that investors demand in order to bear the risk of a government default. The variables that are used in order to monitor the risk of a default of a specific euro area country are, typically, related to its current and expected fiscal position. The sustainability of public finances is determined, inter alia, by debt and primary deficit-to-GDP ratios, interest expenditure and the debt maturity and ownership profile. Macroeconomic variables capturing the future ability of a country to repay its debt, such as GDP current and potential growth, the current account balance, consumer prices and measures of competitiveness, are also related to credit premia. The financial and sovereign crises, along with the deterioration of fiscal positions in several euro area countries, led to a heightened importance of credit risk, as perceived by financial markets, as a determinant of sovereign bond spreads in several countries. This may be partly due to the perverse feedback loops from private debt which ended up affecting public finances. Constâncio (2013)² stresses the importance of “imbalances originated mostly from pre-crisis rising private sector expenditures, which were in turn financed by the banking sectors of the lending and borrowing countries”. The resulting increase in public debt levels was caused by collapsing tax revenues and soaring social expenditures, which increased when the automatic stabilisers were triggered by the recessionary episodes. Moreover, perceptions of increased credit risk were also fostered by the dangerous feedbacks generated by the announcement of bank rescue packages which, shifting

2 Constâncio, V., “The European crisis and the role of the financial system”, speech given at the Bank of Greece conference on “The crisis in the euro area”, Athens, 23 May 2013.

risk from the private sector to the public sector, led to a reassessment of sovereign credit risk by investors (bank-sovereign nexus).³

The liquidity premium relates to the extra compensation for bearing the risk of having to sell the bond at a lower price because of difficulties in finding a counterparty that wants to buy it. The liquidity premium is typically monitored by measures reflecting the size of specific bond markets (overall outstanding amount of public debt), the costs incurred by investors to unwind asset positions (bid-ask spreads) and trade intensity (trading volumes).

In addition, the degree of risk aversion of investors can affect the euro area sovereign yield spreads (see Box 1). In fact, risk aversion typically increases in global economic downturns and may increase the sensitivity of sovereign bond yields to credit and liquidity risks.

3 Attinasi, M.G., Checherita-Westphal, C. and Nickel, C., “What explains the surge in euro area sovereign spreads during the financial crisis of 2007-09?”, *Public Finance and Management*, Vol. 10, No 4, 2010, pp. 595-645.

Box 1

TRADITIONAL DETERMINANTS OF EURO AREA SOVEREIGN BOND SPREADS: A SURVEY

This box surveys the literature on the traditional determinants of sovereign bond spreads in euro area countries and how their role changed during the sovereign debt crisis. Excluding the most recent part of the sovereign crisis (Boxes 2 and 4 have a more specific focus on the sovereign crisis), the developments in sovereign bond spreads in euro area countries can be explained by two broad categories of determinants relating to credit and liquidity risk and by the interaction of the latter with the degree of investors' risk aversion. While credit and liquidity risks are mostly linked to country-specific features, the willingness of investors to bear risk, i.e. the degree of risk aversion, reflects global factors and is seen as the most relevant driver of the co-movement observed in the euro area sovereign bond spreads. The relevance of these determinants is likely to be affected by the state of the economy and, hence, it can vary over time.¹ In particular, in periods in which risk aversion is high, investors are less willing to take risks and therefore sovereign bond spreads are more sensitive to credit and liquidity risk. A relatively robust finding of the literature on the determinants of sovereign bond spreads is that measures of a country's creditworthiness, traditionally related to credit premia, have become more relevant to explain sovereign bond spreads since the start of the financial crisis and, to an even larger extent, since the sovereign debt crisis.

The degree of investors' risk aversion is typically proxied by US stock market implied volatility (VIX)² or US corporate bond spreads. The literature³ finds a relevant role for such proxies

1 See D'Agostino, A. and Ehrmann, M., “The pricing of G7 sovereign bond spreads – the times, they are a-changin’”, *Working Paper Series*, No 1520, ECB, 2013, for an account of the time variation in the sensitivity of sovereign bond spreads to different determinants.

2 See, for example, Bekaert, G., Hoerova, M. and Lo Duca, M., “Risk, uncertainty and monetary policy”, *Journal of Monetary Economics*, Vol. 60 (7), 2013, pp. 771-788.

3 See, for example, Codogno, L., Favero, C. and Missale, A., “Yield spreads on EMU government bonds”, *Economic Policy*, Vol. 18 (37), October 2003, pp. 503-532; Geyer, A., Kossmeier, S. and Pichler, S., “Measuring systematic risk in EMU government yield spreads”, *Review of Finance*, Vol. 8 (2), 2004, pp. 171-197; Bernoth, K., von Hagen, J. and Schuknecht, L., “Sovereign risk premiums in the European government bond market”, *Journal of International Money and Finance*, Vol. 31 (5), 2012, pp. 975-995; Favero, C., Pagano, M. and von Thadden, E.L., “How does liquidity affect government bond yields?”, *Journal of Financial and Quantitative Analysis*, Vol. 45 (1), February 2010, pp. 107-134; Gerlach, S., Schulz, A. and Wolff, G.B., “Banking and sovereign risk in the euro area”, *CEPR Discussion Papers* 7833, 2010; and von Hagen, J., Schuknecht, L. and Wolswijk, G., “Government bond risk premiums in the EU revisited: the impact of the financial crisis”, *European Journal of Political Economy*, Vol. 27 (1), March 2011, pp. 36-43.

as determinants of sovereign bond yields. Manganelli and Wolswijk (2009)⁴ stress the role of monetary policy which, in particular through changes in short-term interest rates, affects global risk aversion and hence sovereign bond spreads. However, several studies point out that international factors *per se* have become relatively less relevant in recent years,⁵ suggesting a stronger role for country and regional-specific factors.

The determinants of credit premia are typically associated with proxies for the default risk of a specific country, such as variables describing their fiscal positions (debt and deficit-to-GDP ratios, structure of debt maturity, interest expenditure-to-GDP or interest expenditure-to-tax revenue ratios, etc.) and country ratings. Given that investors may be more interested in evaluating the fiscal outlook rather than current and past fiscal positions in order to assess the creditworthiness of a country, several papers use the expected (rather than historical) fiscal fundamentals as explanatory variables in sovereign bond spreads. D'Agostino and Ehrmann (2013) also extend the range of variables used in order to capture credit risk to the consensus forecasts of macroeconomic variables (current account balance-to-GDP ratio, real GDP growth, unemployment and consumer price inflation), while Maltritz (2012)⁶ considers openness and the terms of trade. Credit risk has become more important to explain sovereign bond spreads in euro area countries since the start of the financial crisis.⁷ This heightened importance for credit risk may be linked to the deterioration of fiscal positions in several euro area countries. For example, Attinasi et al. (2010) suggest that the announcement of bank rescue packages, shifting risk from the private sector to the public sector, has led to a reassessment of sovereign credit risk by investors. However, the elasticity of credit premia to fiscal fundamentals (a measure of the price of credit risk) also increased during the crisis, partly owing to an increase in the degree of global risk aversion.⁸ An example of a possible mechanism can be found in Gerlach et al. (2010), which finds that global risk interacts with measures of country default risk (captured in this study by the ratio of total assets of the banking sector to GDP), causing the relationship of the latter with sovereign spreads to vary over time.

The last broad category of determinants of sovereign bond spreads relates to liquidity premia. Typically, the overall outstanding amount of public debt, bid-ask spreads and trading volumes are used to proxy for liquidity premia.⁹ Favero et al. (2010) propose a model with endogenous liquidity demand where liquidity and aggregate risk (i.e. sources of risk which affect all investors) interact, leading to a negative dependence of spreads on the interaction of the latter source of risk and liquidity. Higher aggregate risk, by reducing the attractiveness of alternative investment

4 Manganelli, S. and Wolswijk, G., "What drives spreads in the euro area government bond market?", *Economic Policy*, Vol. 24, 2009, pp. 191-240.

5 Barrios, S., Iversen, P., Lewandowska, M. and Setzer, R., "Determinants of intra-euro area government bond spreads during the financial crisis", *European Economy - Economic Papers* 388, DG ECFIN, European Commission, 2009; Ejsing, J. and Lemke, W., "The Janus-headed salvation: sovereign and bank credit risk premia during 2008-2009", *Economics Letters*, Elsevier, Vol. 110 (1), January 2011, pp. 28-31; and Laubach, T., "Fiscal policy and interest rates: the role of sovereign default risk", in Clarida, R.H. and Giavazzi, F. (eds.), *NBER International Seminar on Macroeconomics 2010*, National Bureau of Economic Research, 2011, pp. 7-29.

6 Maltritz, D., "Determinants of sovereign yield spreads in the eurozone: a Bayesian approach", *Journal of International Money and Finance*, Vol. 31, 2012, pp. 657-672.

7 See, for example, Barrios et al. (2009); Gerlach et al. (2010); von Hagen et al. (2011); Attinasi et al. (2010); Bernoth, K. and Erdogan, B., "Sovereign bond yield spreads: a time-varying coefficient approach", *Journal of International Money and Finance*, Vol. 31 (3), 2012, pp. 639-656; Borgy, V., Laubach, T., Mésonnier, J.-S. and Renne, J.-P., "Fiscal sustainability, default risk and euro area sovereign bond spreads markets", *Working Papers 350*, Banque de France, 2011; Laubach (2011); Ejsing, J., Lemke, W. and Margaritov, E., "Sovereign bond spreads and fiscal fundamentals – a real-time, mixed-frequency approach", mimeo, ECB, 2013.

8 See, for example, von Hagen et al. (2011), Afonso et al. (2012) and D'Agostino and Ehrmann (2013), *op.cit.*

9 See, for example, Gómez-Puig, M., "Size matters for liquidity: evidence from EMU sovereign yield spreads", *Economics Letters*, Vol. 90, 2006, pp. 156-162; Beber, A., Brandt, M.W. and Kavajecz, K.A., "Flight-to-quality or flight-to-liquidity? Evidence from the euro-area bond market", *Review of Financial Studies*, Vol. 22 (3), March 2009, pp. 925-957; Attinasi et al., (2010), Favero et al. (2010), Gerlach et al. (2010), D'Agostino and Ehrmann (2013) and De Santis (2014), *op.cit.*

opportunities, implies that less compensation for liquidity risk is required for sovereign bonds. Beber et al. (2009) find that credit premia are generally more relevant than liquidity premia for euro area sovereign bonds but, in moments of heightened market uncertainty, liquidity considerations may prevail.

The experience of recent years suggests that sovereign bond yields in the euro area countries also carried premia possibly in excess of their exposure to changes in risk aversion and credit and liquidity risk. Several recent studies (surveyed in Box 2) argued that these developments in sovereign bond spreads could be in part due to financial contagion. In the current context, financial contagion refers to developments in bond yields, not necessarily related to economic fundamentals, caused by the coordination of investor beliefs on a bad outlook for a country as a result of events in another country. Moreover, during the crisis, the Eurosystem's unconventional monetary policy reaction became an important additional determinant of sovereign bond spreads (see Boxes 3 and 4). Monetary policy measures began to address the impairments in the money markets in August 2007. Since the intensification of the pressures on sovereign bond markets in the euro area, the Eurosystem has also devised a set of unconventional measures with the aim to address the impairments in monetary policy transmission through sovereign bond markets.

Box 2

CONTAGION AND MULTIPLE EQUILIBRIA IN SOVEREIGN BOND MARKETS

Several academic and non-academic accounts of recent developments in euro area sovereign bond yields refer to the concept of contagion. Financial contagion can be defined as a situation in which instability in a specific market or institution is transmitted to one or several other markets or institutions (Constâncio, 2012).¹ A crucial element of contagion is that the “transmission of the initial instability goes beyond what could be expected from the normal relationships between markets or intermediaries” (ibid. p.110). A similar definition is given in Forbes (2012).²

The concept of contagion can be linked to the notion of multiple equilibria and to the role that this phenomenon plays in explaining euro area sovereign bond spreads. A particularly severe form of contagion can be interpreted as the events in a given country leading agents to have similar expectations regarding bad equilibria in other countries.

Multiple equilibria can arise in a sovereign bond yield context as a result of self-fulfilling beliefs.³ In fact, uncertainty regarding future fundamentals, the government's inability to commit ex ante to repaying its debt and the circumstance in which investors demand risk compensation generate the possibility of an equilibrium whereby the government is forced to default even in the case of favourable developments in the fundamentals. A simple two-period model in which rational agents can invest in government debt and in a riskless asset can be used to explain the underlying

1 Constâncio, V., “Contagion and the European debt crisis”, *Financial Stability Review*, No 16, Banque de France, April 2012, pp. 109-121.

2 Forbes, K., “The big C: identifying and mitigating contagion”, *2012 Economic Policy Symposium Proceedings*, Federal Reserve Bank of Kansas City, Jackson Hole, Wyoming, 2012.

3 Azariadis, C., “Self-fulfilling prophecies”, *Journal of Economic Theory*, Vol. 25, 1981, pp. 380-396; Benhabib, J. and Farmer, R., “Indeterminacy and sunspots in macroeconomics”, *Handbook of Macroeconomics*, Taylor, J. and Woodford, M. (eds.), Vol. 1, 1999, pp. 387-448.

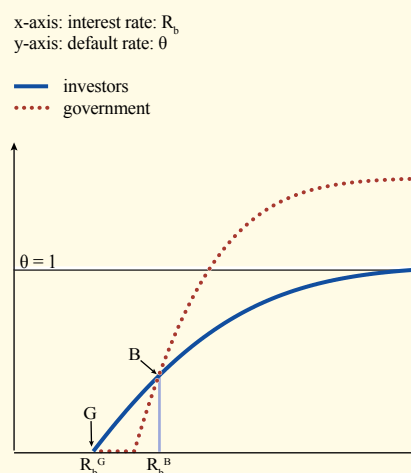
mechanism⁴. The assumption is that the government cannot credibly commit to a fiscal plan to match public expenditure and debt service. Ex post the government has the possibility to partially renege on its debt and avoid the necessary increases in the primary balance. Such a “credit event” is a costly decision for governments; its cost is proportional to the outstanding debt multiplied by the chosen “haircut” θ , i.e. the portion of debt that the government decides not to honour.

The model incorporates uncertainty regarding future fundamentals: they can either turn out to be solid or weak with known probabilities. If fundamentals are weak, then a credit event always occurs and does so for purely fundamental reasons. If fundamentals turn out to be favourable, the model shows that there are two equilibria: a “good” equilibrium with full repayment, and a “bad” equilibrium in which a credit event occurs. The chart below shows these two equilibria in the case of favourable fundamentals. In particular, the figure shows functional relationships between the default rate or “haircut” θ and the return on government bonds R_b . These relationships are shown for both investors (blue line) and the government (red line). When the government and investors interact, respectively supplying and demanding sovereign bonds, two possible equilibria might occur. These two equilibria are graphically represented by the two intersections between the two lines in the chart. In the good equilibrium (G), investors do not expect any haircut in the case in which economic fundamentals turn out to be good, and therefore the equilibrium interest rate is R_b^G , where G signifies the good equilibrium. The good equilibrium interest rate R_b^G is driven purely by fundamental factors: investors believe that only bad future fundamentals will induce the government to resort to a credit event.

In the bad equilibrium (B), investors expect that the government might decide to apply a haircut even in the case in which fundamentals turn out to be favourable. These beliefs lead them to demand a level of interest rate, R_b^B (where B denotes the bad equilibrium), which is higher than R_b^G , the level that would prevail in the absence of such beliefs. The substantially higher service of debt will indeed lead the government to resort to a credit event ($\theta > 0$) even in the case in which fundamentals turn out to be favourable. The bad equilibrium is therefore purely sustained by self-fulfilling expectations.

Multiple equilibria might arise owing to self-fulfilling beliefs regarding an economic downturn in an economy facing the zero lower bound on the nominal interest rate.⁵ Such beliefs substantially increase the cost of servicing sovereign debt and the cost of financial intermediation, leading to substantial impairment of monetary policy transmission through the sovereign risk channel.

A good and a bad equilibrium, implied by government and private sector strategic reactions



Source: Adapted from Corsetti and Dedola (2012).

4 Corsetti, G. and Dedola, L., “Fiscal crises, confidence and default: a bare-bones model with lessons for the euro area”, mimeo, University of Cambridge, 2011, and Corsetti, G. and Dedola, L., “The mystery of the printing press: self-fulfilling debt crises and monetary sovereignty”, mimeo, University of Cambridge, 2012.

5 Corsetti, G., Kuester, K., Meyer, A. and Mueller, G., “Sovereign risk and belief-driven fluctuations in the euro area”, Working Paper 13/227, IMF, 2013.

What is the empirical evidence regarding the relevance of multiple equilibria in euro area sovereign bond markets? Assessing the relevance of multiple equilibria is a difficult task, since only realised yields are observed and any empirical analysis has to be based on credible assumptions that help to disentangle the effects of changes in fundamentals from those arising from self-fulfilling beliefs.

Hördahl and Tristani (2013)⁶ use a model based on no-arbitrage pricing for bonds issued by five different euro area countries. Bond yields at different maturities, and therefore bond spreads vis-à-vis German bonds at corresponding maturities, are determined as a function of country-specific economic fundamentals. However, they can also depend on a common unobservable factor which is, by assumption, unrelated to fundamentals. Such a factor can be interpreted as reflecting movements towards a non-fundamental equilibrium. The estimation results suggest that the non-fundamental factor is economically significant and, in several circumstances, has contributed substantially to the determination of observed spreads for countries such as Italy and Spain since the beginning of 2011. Interestingly, this is not always the case in the results of the paper: the same factor is negligible in explaining Greek spreads during the same period, thus confirming that in the case of Greece spreads seem to be driven almost entirely by fundamentals.

Amisano and Tristani (2013)⁷ analyse the role of multiple equilibria from a different perspective. In their paper, euro area sovereign bond spreads are characterised as having two different regimes, one of which is a crisis regime. The crisis regime is characterised by higher and more volatile spreads. Transitions to this regime are allowed to depend on macroeconomic fundamentals, on risk aversion measures and on developments in other countries. Controlling for macroeconomic fundamentals and variation in risk appetite allows the authors to interpret cross-country effects as evidence of contagion via multiple equilibria. Estimated contagion effects strongly affect the risks of falling into the crisis regime. Taking Italy as an example, the paper finds that, allowing for contagion, the risk of falling into the crisis regime reaches 10% at the beginning of 2011, while in the absence of this effect this probability is only 3%.

De Santis (2014)⁸ argues that credit rating changes in Greece and economic news about Greece produced significant effects in other euro area countries after controlling for changes in country-specific fundamentals. This evidence can be interpreted as supporting the relevance of contagion and multiple equilibria.⁹

Multiple equilibria and the related interpretation of contagion suggest a potential role for a central bank to coordinate market participants' beliefs away from the bad equilibrium, if this is required for monetary policy purposes. However, the central bank cannot remove the root causes of instability in sovereign bond markets related to economic fundamentals. Some literature¹⁰

6 Hördahl, P. and Tristani, O., "Macro factors and sovereign bond spreads: a quadratic no-arbitrage model", mimeo, 2013.

7 Amisano, G. and Tristani, O., "Fundamentals and contagion in the euro area sovereign crisis", *Proceedings from the SIS 2013 Conference*, 2013.

8 De Santis, R.A., "The euro area sovereign debt crisis: identifying flight-to-liquidity and the spillover mechanisms", *Journal of Empirical Finance*, Vol. 26, 2014, pp. 150-170.

9 Beirne, J. and Fratzscher, M., "The pricing of sovereign risk and contagion during the European sovereign debt crisis", *Working Paper Series*, No 1625, ECB, December 2013. The paper presents evidence of contagion in euro area bond spreads, although the authors interpret contagion differently: as a mechanism, whereby agents suddenly take previously ignored fundamental developments more into consideration. For an overview of substantial new research analysing sovereign contagion, independent of whether it is associated with multiple equilibria or not, see Sub-section 4.2 of the "Report on the first two years of the Macro-prudential Research Network", ECB, October. See in addition De Santis (2014) and Beirne and Fratzscher (2013), op.cit., and the references therein.

10 Jeanne, O., "Fiscal challenges to monetary dominance in the euro area: a theoretical perspective", *Financial Stability Review*, Banque de France, No 16, April 2012, pp. 143-150.

indicates that multiple equilibria are possible only for a certain range of fundamentals. This corroborates the importance of implementing fiscal adjustments and structural reforms in order to improve fundamentals well before they reach dangerous territory.

3 EXPLAINING EURO AREA SOVEREIGN BOND YIELD SPREADS FROM THE INCEPTION OF THE EURO TO THE SOVEREIGN DEBT CRISIS

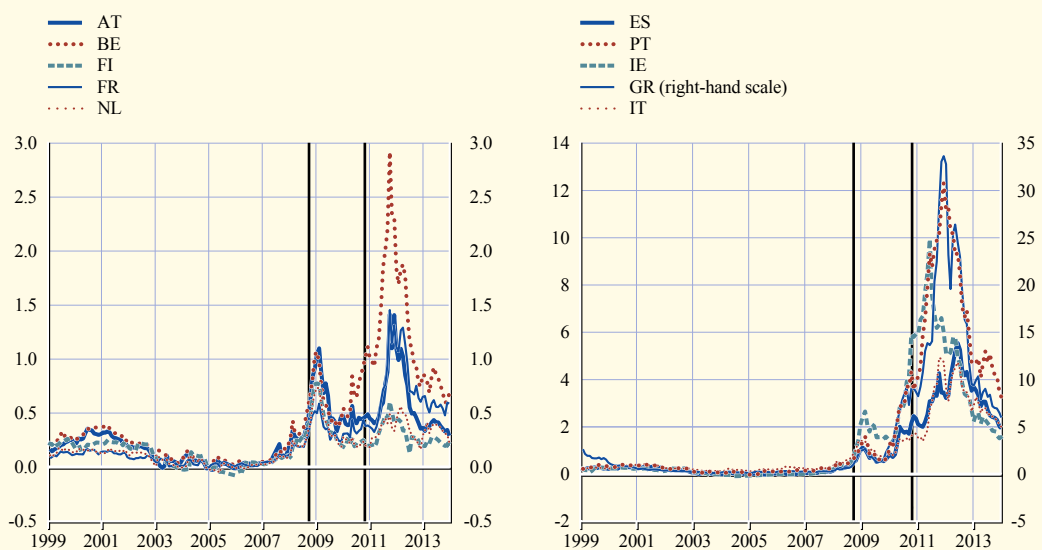
3.1 THE PRE-CRISIS PERIOD

In the run-up to the introduction of the euro in 1999, interest rate spreads between euro area government bonds declined substantially, reflecting a gradual elimination of exchange rate risk and a decline in inflation risk. In addition, the required convergence of fiscal fundamentals to minimum common standards helped to reduce credit risk.

After the launch of the euro, sovereign bond spreads were more or less stable in most cases until early 2001, followed by a period of compression of the spreads which lasted until 2007. The low level of interest rate spreads in the euro area during the period from 2002 to 2007 (see Chart 1), despite continuing large differences in fiscal positions, raised the question as to whether non-fiscal factors were playing a role. Econometric studies generally suggest that fiscal variables have an effect on interest rates (see Box 1), although their impact appeared to be marginal in this phase. It can be argued that these developments emerged mainly because of investors' underpricing of risk. In particular, the small interest rate spreads may have been, at least in part, the result of a search for yield among investors, reflecting their ability to diversify country risks within the euro area without having to accept exchange rate risk. Moreover, the fact that banks did not need to hold

Chart 1 Ten-year government bond yield spreads against Germany

(percentage points; January 1999 to February 2014)



Source: Bloomberg.

Notes: The first vertical bar denotes the bankruptcy of Lehman Brothers on 15 September 2008. The second vertical bar denotes the Deauville agreement on 18 October 2010.

a capital buffer against their holdings of euro-denominated sovereign bonds, irrespective of the euro area issuing country, as well as changes in supervisory and accounting regulations concerning institutional investors, may have contributed to the overall underpricing of sovereign risk by financial markets.^{4,5} The holding of a capital buffer by banks against their sovereign bond positions remains an important issue for discussion.

Sovereign yield spreads rose after August 2007 – as a result of tensions on money markets – and during the financial turmoil in the first half of 2008 (see Chart 1). This repricing of euro area sovereign risk was consistent with a general increase in risk aversion observed in global financial markets. In addition, the first signs were visible of a drying-up of liquidity in some euro area government bond markets (liquidity premium) and of perceived higher country-specific risks related to the fiscal and macroeconomic outlook (credit premium). These factors in turn contributed to an increase in the demand for those sovereign debt securities perceived as having a higher level of safety and liquidity, in particular German government bonds.⁶

3.2 FROM THE COLLAPSE OF LEHMAN BROTHERS TO THE LAUNCH OF PROGRAMMES IN GREECE, IRELAND AND PORTUGAL

After the collapse of Lehman Brothers in September 2008, the long-term government bond yields in euro area countries rose markedly in relation to the German Bund. These developments were presumably due to the associated global uncertainty and flight-to-safety tendencies, which increased the demand for the German Bund. In addition, the deep recession and the government announcements of bank rescue operations led investors to heightened perceptions of country-specific sovereign credit risk.⁷ The situation improved temporarily in the first half of 2009 as global uncertainty receded. However, on 16 October 2009, Greece's Prime Minister George Papandreou revealed the country's severe fiscal problems and, shortly afterwards, the Greek government disclosed a revised budget deficit of 12.7% of GDP for 2009, which was twice the previous estimate. These events, which led to sharp increases in sovereign bond spreads in the euro area, marked the beginning of the sovereign debt crisis. Over the period from September 2008 to May 2011, investors' risk aversion, market perceptions of country-specific credit risks, liquidity risks and contagion effects all played a key role in the rising spreads for Greece, Ireland, Portugal, Italy and Spain.

The role of investors' risk aversion and liquidity premia is revealed by the reaction of yields on highly rated sovereign securities. In fact, yields of bonds issued by countries with solid fiscal fundamentals, such as Austria, Finland and the Netherlands, also rose vis-à-vis the German Bund. These countries maintained their triple-A ratings and therefore the surge in their yields cannot be explained by increased credit risk. Since the intensification of the financial crisis in September 2008,

4 See the article entitled "Fiscal policies and financial markets", *Monthly Bulletin*, ECB, February 2006 and the box entitled "Demand for bonds by institutional investors and bond yield developments in the euro area", *Monthly Bulletin*, ECB, May 2007.

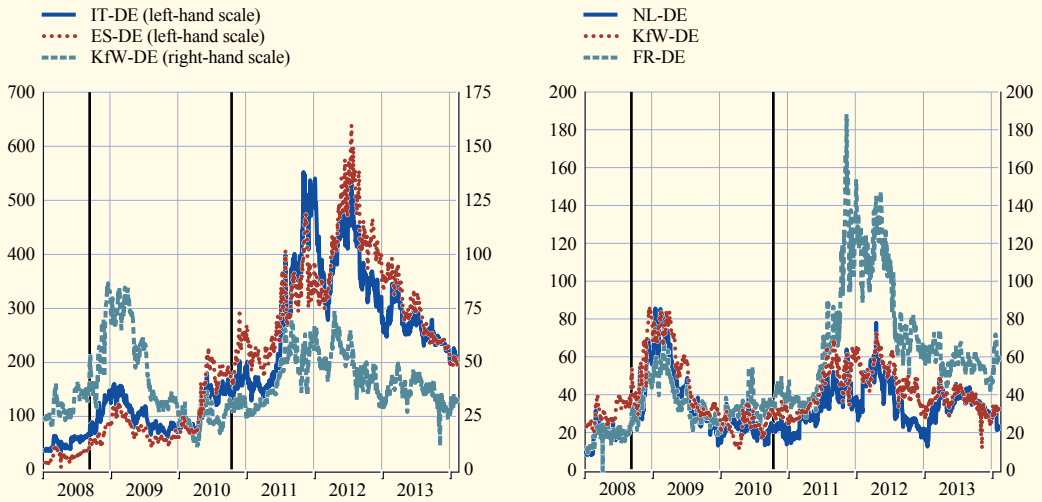
5 Institutional investors, such as pension funds and insurance companies, are major participants in capital markets, so changes in their portfolios can have a substantial impact on interest rate developments. At this time, some countries proposed new rules on the valuation of assets and liabilities for supervision purposes. This led to a strategic asset benchmark reorientation by pension funds and insurance companies, with more emphasis on long-term bonds and on hedging liabilities via swaps. Between December 2000 and March 2005, pension funds and insurance companies in the euro area invested €535 billion in euro area sovereign and corporate bonds and bonds issued by non-euro area governments. This led to an increase in the share of bonds in the total assets of these institutional investors of about 7½ percentage points. Bond purchases by pension funds and insurance companies over this period represented 6½% of euro area GDP. Government bonds with higher yields may have benefited more from these developments, thereby contributing to a compression of interest rate spreads.

6 See the box entitled "Recent developments in government bond yield spreads", *Monthly Bulletin*, ECB, May 2008.

7 See, for example, Attinasi et al. (2010), op.cit.

Chart 2 Ten-year government bond yield spreads and KfW-Bund spread

(basis points; January 2008 to February 2014)



Source: Bloomberg.

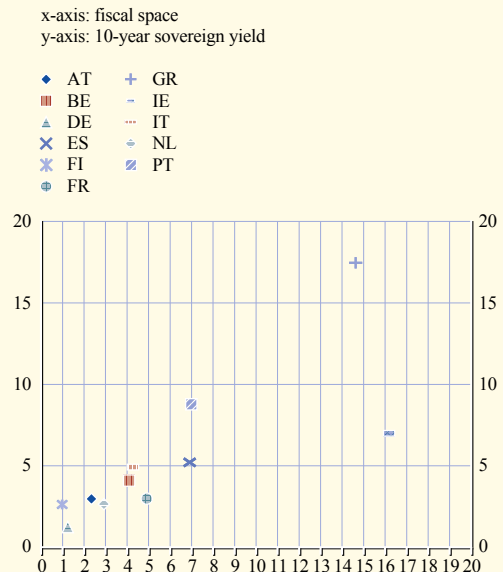
Notes: The first vertical bar denotes the bankruptcy of Lehman Brothers on 15 September 2008. The second vertical bar denotes the Deauville agreement on 18 October 2010.

flight-to-safety and flight-to-liquidity tendencies have increased demand for the Bund, affecting all euro area countries' sovereign spreads, including those for Austria, Finland and the Netherlands. A further illustration that factors other than credit risks were also at play is the tight link between the Dutch sovereign yield spread and the Kreditanstalt für Wiederaufbau (KfW) spread. KfW is a German development bank whose yield spread with respect to German government bonds is a measure of the liquidity premium which tends to increase in periods of stress and higher risk aversion (see Chart 2).⁸

However, market perceptions of credit risk also played a very important role during this period. Lower economic growth, the deterioration of international competitiveness and the weaker banking sector all negatively interacted with fiscal variables, putting upward pressure on euro area long-term interest rates. The link between euro area sovereign yield spreads and countries' creditworthiness is shown in Chart 3, where the "fiscal space" indicator, i.e. the product between

Chart 3 Euro area sovereign spreads and the fiscal space

(percentage points; period average 2010-12)



Sources: Bloomberg and Eurostat.

Note: The fiscal space is defined as the product between the government budget deficit and public debt multiplied by 100.

⁸ Note that bonds issued by KfW and the German Bund are both guaranteed by the German state and, therefore, carry the same credit risk. See also the box entitled "New evidence on credit and liquidity premia in selected euro area sovereign yields", *Monthly Bulletin*, ECB, September 2009.

the government budget deficit and the public debt relative to GDP, is employed as a synthetic measure of sovereign credit risk.

Finally, signals of contagion effects from Greece began to appear (see Box 2), contributing to developments in spreads of countries with weaker fundamentals, such as Ireland, Portugal, Italy, Spain and, to a much smaller extent, Belgium and France. Specifically, the developments in Greek sovereign spreads were transmitted to several other sovereign markets. Countries perceived to have weaker fundamentals, and in particular weaker fiscal conditions, tended to be more vulnerable to contagion (see Chart 4).

3.3 THE SOVEREIGN DEBT CRISIS SPREADING BEYOND GREECE, IRELAND AND PORTUGAL

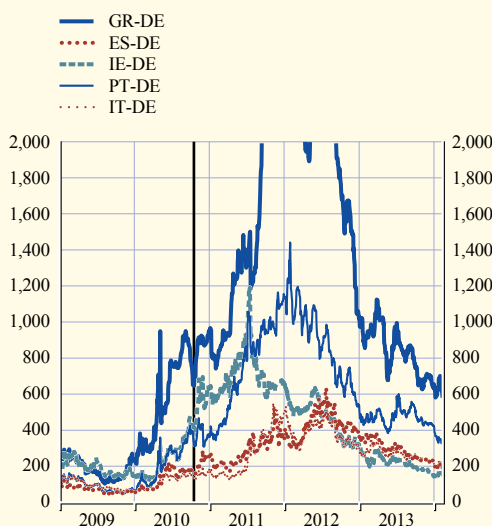
The sovereign spreads of Greek, Irish and Portuguese ten-year bonds continued to increase in the course of 2011, reaching 1,600, 1,200 and 1,100 basis points, respectively, in July 2011. Spanish and Italian spreads reached 400 basis points, while the Belgian spreads reached 200 and the French 90 basis points. Between the fourth quarter of 2010 and the second quarter of 2011, the rise in public debt relative to GDP in Greece (by 11 percentage points), Portugal (by 13 percentage points), Ireland (by 8 percentage points) and Spain (by 6 percentage points) suggested higher solvency risk for these countries, contributing to the rise in their respective sovereign spreads.

At the same time, the increase in demand for more liquid and safe assets, such as German Bunds, may explain why sovereign spreads vis-à-vis Germany widened again even for countries perceived to have similarly sound fiscal fundamentals (see Chart 2). However, in this second phase of the sovereign crisis, financial contagion contributed to developments in spreads to a larger extent, particularly for countries with weaker economic fundamentals, as implied by the literature (see Box 2). The announcements of the Deauville agreement on private sector involvement (PSI) in the resolution of Greek sovereign debt in October 2010 and the Greek debt restructuring in July 2011, at a time when an effective backstop for solvent governments was still being constructed, were among the reasons for this heightened risk of contagion. Following these developments, sovereign spreads soared in other euro area countries, in a way reflecting stronger beliefs that some sort of PSI might become a precondition for rounds of official lending to other countries. They also produced additional negative effects on banking sectors across the euro area. A negative feedback loop between banks and sovereigns ensued, as depicted by the increase in CDS spreads in both the sovereign sector and the banking sector (see Chart 5).

The developments in 2012 were even more dramatic than in 2011, with sovereign credit spreads reaching 500 basis points for Italian ten-year bonds and 600 basis points for Spanish ten-year bonds, as financial markets appeared to price the realisation of a bad equilibrium prevailing in several countries (see Box 2). This was reflected in a euro area “currency redenomination” risk premium, defined as the

Chart 4 Ten-year government bond yield spreads in selected euro area countries

(basis points; January 2009 to February 2014)



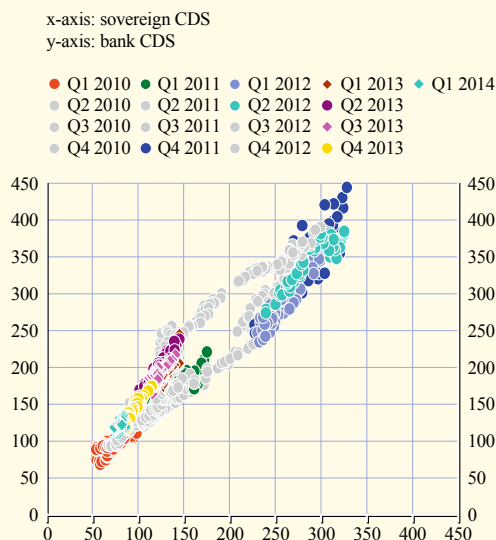
Sources: Bloomberg and ECB calculations.
Note: The vertical bar denotes the Deauville agreement on 18 October 2010.

compensation demanded by market participants for the risk that a euro asset is redenominated into a devalued legacy currency, which became a key determinant of sovereign credit spreads in 2012. Those unfounded fears of redenomination put price stability at risk, which the ECB had to alleviate through the creation of its Outright Monetary Transactions (OMT) programme, aimed at restoring the adequate pass-through of the monetary policy stance across countries.

The ECB's communication on OMTs contributed, together with other initiatives, to breaking the self-fulfilling spiral of increasing redenomination risk (see Section 4). For instance, by mid-September 2012, the Italian and Spanish sovereign yield spreads had fallen by about 250-350 basis points relative to the peak in July. Furthermore, they declined steadily during the course of 2012 as a whole.⁹ In 2013-14, Italian and Spanish sovereign spreads at ten-year maturities declined further, reaching 230 basis points in autumn 2013 and 180 basis points in spring 2014.

Chart 5 Feedback loop between euro area bank and sovereign CDSs

(basis points; January 2009 to March 2014)



Sources: Thomson Reuters and ECB calculations.
Notes: Five-year CDS, daily data. Bank CDS is calculated as the premium for the biggest bank per country, where available, weighted by the ECB capital key. Sovereign CDS is weighted by the ECB capital key. Greece is excluded.

4 THE IMPACT OF EUROSISTEM UNCONVENTIONAL MONETARY POLICIES ON EURO AREA SOVEREIGN BOND YIELDS

During the most severe phase of the sovereign debt crisis, contagion effects and unfounded fears of currency redenomination put price stability at risk, which the Eurosystem had to address through unconventional monetary policy actions, aimed at restoring the adequate pass-through of the monetary policy stance across countries. In particular, non-standard monetary policy measures also encompassed outright purchases of sovereign bonds within the ECB's Securities Markets Programme (SMP), which provided depth and liquidity to dysfunctional markets.¹⁰ Finally, decisive communication on the possibility of undertaking Outright Monetary Transactions (OMTs) successfully helped to counter market participants' unfounded beliefs regarding euro break-up scenarios. The SMP and the OMTs are different programmes. This implies that their respective roles in affecting euro area yield spread developments also need to be studied separately.

4.1 THE IMPACT OF THE SECURITIES MARKETS PROGRAMME

In May 2010 the Governing Council decided to conduct interventions in some euro area government bond markets in order to mitigate impairments to the monetary transmission mechanism. The impact of SMP asset purchases on the ECB's provision of central bank money to banks was sterilised.

⁹ See, for example, Altavilla, C., Giannone, D. and Lenza, M., "The financial and macroeconomic effects of OMT announcements", *CSEF Working Papers*, No 352, 2014.

¹⁰ See, for instance, González-Páramo, J.M., "Sovereign contagion in Europe", speech delivered at the European Economics and Financial Centre in London on 25 November 2011.

The SMP had a clear and measurable effect on market depth and liquidity, and in part through this channel also on sovereign yield spreads, yield volatility and yield contagion. However, an accurate estimation of its financial market impact is particularly difficult in the case of the SMP, as it is challenging to construct the counterfactual of what would have happened without the policy. For example, it could be argued that the SMP had a lasting impact in that it was effective in reducing the perceived risk of fire sales of sovereign bonds issued by stressed euro area countries, but it is very difficult to assess the likelihood of this type of counterfactual. The literature has adopted different and complementary strategies to cope with the fundamental issue of assessing the effects of the SMP. Box 3 surveys the recent research literature on the yield impact of asset purchases undertaken within the SMP. Overall, the available evidence suggests that the SMP was effective in containing impairments to the monetary policy transmission mechanism, even if reductions in the levels of country-specific sovereign spreads did not automatically produce corresponding reductions in country-specific lending rates.

Box 3

THE IMPACT OF ASSET PURCHASES WITHIN THE ECB'S SECURITIES MARKETS PROGRAMME

On 10 May 2010 the Governing Council of the ECB decided to conduct interventions in euro area public and private debt securities markets within the Securities Markets Programme (SMP). The objective of this temporary programme was to address the malfunctioning of securities markets, ensuring depth and liquidity in the affected market segments and thus helping to restore an appropriate monetary policy transmission mechanism. From 2010 to 2012, Greek, Irish, Portuguese, Italian and Spanish public debt securities were purchased, for a total book value of €211 billion.

This box summarises the main findings of recent studies that investigate the yield impact of asset purchases within the SMP. Overall, the research evidence available suggests that the SMP was very likely to have been effective in containing impairments to the monetary policy transmission mechanism by leaning against spiralling yields, surges in yield volatility and yield contagion.

The estimation of the yield impact of bond market interventions is a complicated task. A cursory look at bond yields and bond purchases within the SMP may, as suggested by some, give the impression that the programme was generally ineffective. In particular, yields rose over time as purchases were being implemented. Statistically, yield changes and SMP purchase amounts at a daily frequency are positively correlated over time for the five countries in which the Eurosystem intervened. As a result, simple regression-based techniques that relate yield changes to purchase amounts lead to positive impact coefficients. However, these approaches ignore the presence of a common third factor – the escalating sovereign debt crisis, which contributes to both the rising yields and the activation of the non-standard monetary policy measure. The issue of “impact identification” is thus of crucial importance.

In Eser and Schwaab (2013),¹ identification is based on panel data techniques and is yielded from the cross-sectional dimension of the data. In their set-up, it does not matter that yields rise over time in many euro area countries during the sovereign debt crisis, when yields were high,

1 Eser, F. and Schwaab, B., “Assessing asset purchases within the ECB’s Securities Markets Programme”, *Working Paper Series*, No 1587, ECB, September 2013.

rising and volatile owing to reasons other than central bank purchases. Instead, what matters for identification is that yields rise relatively less in markets in which purchases were undertaken on a given trading day. In addition to large and economically significant announcement effects, the authors find an impact per €1 billion of bond purchases of approximately -1 to -2 basis points (Italy), -3 basis points (Ireland), -4 to -6 basis points (Spain), -6 to -9 basis points (Portugal) and up to -17 to -21 basis points (Greece), at the five-year maturity. The impact depends on market size, market conditions and possibly a confidence signal, and is approximately -3 basis points at a five-year maturity for purchases of 1/1,000 of the respective debt market. In addition, the authors find that bond yield volatility is lower on intervention days for most SMP countries, owing to less extreme movements when the Eurosystem is active as a buyer.

These results are in line with the findings of De Pooter et al. (2013),² which contribute to the literature in two ways. First, they provide a theoretical search-based asset pricing framework that rationalises short-term and long-term price effects from recurring bond market interventions. Second, they empirically test whether the SMP had an impact on sovereign bond liquidity premia. The authors find an average impact of -2.3 basis points for purchases within the SMP of 1/1,000 of the respective outstanding debt. Both transitory and long-term effects from purchases are documented.

Ghysels et al. (2013)³ analyse the yield impact of SMP asset purchases by considering the high-frequency (intraday) dynamics of bond yields and asset purchases, rather than relying on data sampled at a daily frequency. By estimating regression models based on data sampled at 15-minute intervals, they minimise the bias that is introduced by unobserved third-factor effects. Over time, the authors find that, on average, a €100 million intervention has an immediate impact on bond yields of between -0.1 and -25 basis points, depending on the debt market and timing. Based on volatility time-series models, their study also suggests that SMP purchases have helped to reduce the volatility of targeted government bond yields.

Trebesch and Zettelmeyer (2013)⁴ focus on the yield impact of SMP purchases of Greek government bonds in May and June 2010. Their identification strategy, which compares bonds that were bought with bonds that were not bought, is based on cross-sectional regressions at the bond level. Purchased bonds show a much larger drop in yields after the start of the SMP. The authors document that purchases of €1 billion resulted in a drop of yields by up to -204 basis points during the first eight weeks of the programme.

Finally, Beetsma et al. (2014)⁵ investigate the impact of the SMP on the volatility and co-movement of sovereign bond yields in the euro area, as captured by realised volatility and correlation measures from intraday data. The authors find statistically and economically large effects, and conclude that the SMP announcement and purchases contributed to a weakening of the observed positive co-movement of yields among distressed countries during the euro area crisis, and reduced flight-to-safety capital flows from distressed countries to non-distressed countries.

2 De Pooter, M., Martin, R. and Pruitt, S., “The effects of official bond market intervention in Europe”, *Working Paper Series*, Federal Reserve Board, September 2013.

3 Ghysels, E., Idier, J., Manganelli, S. and Vergote, O., “A high frequency assessment of the ECB Securities Markets Programme”, *Working Paper Series*, No 1642, ECB, 2014. See also Manganelli, S., “The impact of the Securities Markets Programme”, *Research Bulletin*, No 17, ECB, winter 2013.

4 Trebesch, C. and Zettelmeyer, J., “ECB interventions in distressed sovereign debt markets: the case of Greek bonds”, *Working Paper*, December 2013.

5 Beetsma, R., de Jong, F., Giuliodori, M. and Widijanto, D., “The impact of news and the SMP on realized (co)variances in the Eurozone sovereign debt market”, *Working Paper Series*, No 1629, ECB, January 2014.

4.2 THE IMPACT OF THE OMT COMMUNICATIONS

Before OMTs were first announced in August 2012 (see Box 4), financial fragmentation had created widely divergent borrowing costs for firms and households across euro area countries.¹¹ As a result, monetary policy impulses were not transmitted evenly across countries and adequately along the yield curve.¹² In addition, adverse self-perpetuating dynamics emerged, i.e. the unfounded risk that expectations of one or more countries exiting the euro would be the main force driving public and private debt financing costs in these countries to higher levels (see Box 2). In such a context of multiple equilibria and redenomination risk, the Eurosystem announced that it could undertake OMTs if certain conditions were met. The goal of OMTs is to safeguard an appropriate monetary policy transmission and the singleness of the monetary policy. As explained in Box 2, the OMT programme would be able to eliminate the unfounded and self-reinforcing fears of a euro area break-up that have undermined the ECB's ability to effectively conduct monetary policy in the pursuit of price stability. Looking at a variety of indicators, the communication on the functioning and prerequisites/preconditions of the OMTs, in conjunction with the European Council decision of June 2012 to take steps towards a banking union to break the vicious feedback loop between weak sovereigns and weak banks and bolstered by progress with fiscal and structural reforms in the programme countries, was clearly very effective in counteracting the destructive market turmoil in the summer of 2012. These desirable effects materialised relatively quickly after these policy announcements.¹³ The announced OMT programme was able to address the impairments of the monetary policy transmission mechanism by reducing financial fragmentation. It has eliminated fears of destructive scenarios (see Box 4 on the significant effect of the OMT communications on sovereign tail risks in the euro area) and removed the related currency redenomination risks.

11 See the article entitled "Assessing the retail bank interest rate pass-through in the euro area at times of financial fragmentation", *Monthly Bulletin*, ECB, August 2013.

12 See Cœuré, B., "Outright Monetary Transactions, one year on", speech at the conference "The ECB and its OMT programme", Berlin, 2 September 2013.

13 For additional details on the design of OMTs and how they are designed to limit moral hazard and risks to the ECB's balance sheet, see Cœuré, B., "Central banking, insurance and incentives", speech at the ECB conference "Debt, growth and macroeconomic policies", Frankfurt, 6 December 2012. For an evaluation of the likely effects of the OMTs on macroeconomic variables, see Altavilla et al. (2014) *op. cit.*

Box 4

THE IMPACT OF THE OMT COMMUNICATIONS ON SOVEREIGN TAIL RISK PERCEPTIONS

This box investigates the impact of the OMT communications on sovereign tail risk perceptions in the euro area. It presents a framework¹ that permits assessing the probability of joint or conditional credit events based on observed prices of credit default swaps (CDSs) on sovereign debt. Tracking these joint and conditional probabilities over time helps to assess to what extent policy announcements have impacted sovereign bond risk conditions as perceived by market participants and as priced into credit derivative contracts. Three dates are marked as vertical lines in the chart below: a speech by the President of the ECB in London on 26 July 2012, the initial communication regarding OMTs on 2 August 2012 and the communication of the full details on potential OMTs on 6 September 2012.

1 Lucas, A., Schwaab, B. and Zhang, X., "Conditional probabilities for euro area sovereign default risk", *Journal of Business and Economics Statistics*, 2014, forthcoming, and *Working Paper Series*, No 1621, ECB, December 2013. See also the *Research Bulletin*, No 17, ECB, 2013.

The chart plots the probability of the extreme (tail) possibility that two or more credit events of sovereigns will materialise in the euro area, over a one-year horizon, as perceived by market participants. The plot is at a daily frequency based on data from 1 January 2008 to 31 December 2013. The euro area is proxied by ten member countries for which liquid CDS quotes are available, i.e. Belgium, Germany, Ireland, Greece, Spain, France, Italy, the Netherlands, Austria and Portugal. Country-specific risks are estimated from CDS quotes directly, while a time-varying dependence function is inferred from the co-movement across CDS spreads. The joint probability estimate is based on risk-neutral probabilities of default, which are higher than actual or historical probabilities. The chart suggests that the perceived tail risk of multiple simultaneous credit events in the euro area, has come down considerably from very elevated levels in mid-2012. The speech on 26 July 2012 and the subsequent communication on the OMTs have effectively contributed to a visibly large decline in the joint probability.

Probability of two or more credit events as inferred from CDS prices

(percentages)

y-axis: joint probability, risk neutral (CDS-implied)

- probability (two or more credit events)
- London speech
- - - OMT announcement
- announcement of OMT details



Source: CDS data from Bloomberg; ECB calculations.

A related approach to study the impact of the OMT announcements is an event study on sovereign yield spreads directly. De Santis (2014) finds an economically significant impact of the OMT announcements on sovereign yield spreads, controlling for a large number of other variables and news. For example, the ten-year sovereign spreads declined by 10 basis points in Greece, 20 basis points in Portugal and Ireland and 40 basis points in Spain and Italy on 26 July 2012. Altavilla et al. (2014) find that the OMT announcements caused the Italian and Spanish two-year government bond yields to decrease by about 200 basis points, while bond yields of the same maturity in Germany and France remained unchanged. The results are robust to controlling for a large set of key macroeconomic and financial news released at the time of the announcements.

5 CONCLUSION

In recent years, sovereign bond spreads between euro area countries have been substantially affected by dramatic changes in risk premia. These components of sovereign bond remuneration have been characterised by magnitudes and volatilities much greater than those observed in the pre-crisis period.

After the earlier underpricing, changing market perceptions about the viability of different sovereigns played a key role in explaining cross-country sovereign bond spreads during the euro area sovereign debt crisis. This suggests that public finances should be brought under control and decisive structural reforms should be undertaken in order to improve competitiveness and support economic growth. In addition, the banking sector needs to be made more resilient.

ARTICLES

The determinants
of euro area sovereign
bond yield spreads
during the crisis

However, in the most severe phase of the sovereign debt crisis, contagion effects and unfounded fears of currency redenomination risk also characterised developments in euro area sovereign yield spreads, forcing the Eurosystem to intervene in order to restore the adequate pass-through of the monetary policy stance across countries.