EUROPEAN CENTRAL BANK

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by Simone Manganelli [2]

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In 2007 all ECB publications feature a motif taken from the €20 banknote.

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Abstract
This paper studies the determinants of interest rate spreads of euro area 10 year government bonds against the benchmark, the German bund, after the introduction of the euro. In particular, it pays attention to the question whether market discipline is advanced or obstructed by financial integration and by fiscal rules like the Stability and Growth Pact. We first argue that financial integration – by improving market efficiency – is instrumental for markets to exert their disciplinary role. Next, we discuss the relationships between market discipline and fiscal rules, arguing that these in principle may reinforce each other. Finally, we provide strong empirical evidence that spreads depend on the ratings of the underlying bond and to a large extent are driven by the level of short-term interest rates.

Keywords: Bond spreads; credit risk; liquidity risk.
JEL classification: G12, G18, C23

Non-technical summary

Interest rate spreads of euro area 10-year government bonds against the German Bund have reached historically low levels since 1999, despite many countries facing increasing deficits and debt. The lack of market reactions in the wake of these adverse fiscal developments has prompted people to argue that the euro and the ongoing process of financial integration have eliminated markets' ability or willingness to discriminate the creditworthiness of national fiscal policies.

This paper studies the determinants of euro area government bond spreads, exploring the links between market discipline, financial integration and fiscal rules. In particular, it pays attention to the question whether market discipline is advanced or obstructed by financial integration and by fiscal rules like the Stability and Growth Pact.

We first provide theoretical arguments that financial integration – by improving market efficiency – is instrumental for financial markets to provide an accurate assessment of the risk-return profile of government bonds. Accurate asset pricing implies that governments pursuing unsound fiscal policies will be forced to offer higher yields to attract risk-averse investors, in order to compensate them for the higher default risk. Via this channel, progress in financial integration will ultimately reinforce any market-driven disciplinary effect.

Next, we discuss the relationships between market discipline and fiscal rules, arguing that these in principle may reinforce each other. Negative re-assessments by financial markets are reflected in a higher interest burden for governments, which could induce steps in the excessive deficit procedure. At the same time and more importantly, fiscal rules increase awareness of adverse fiscal developments, provide guidance to financial markets, and lead to more transparent fiscal accounts. The combined effect of market and regulatory sanctions puts pressure on governments to promote sound fiscal policies.

Finally, we provide empirical evidence on the determinants of interest rate spreads in euro area government bond markets. A robust finding of the literature is that spreads since 1999 are driven by a common factor, which appears to be related to the spread of corporate debt over government debt. However, the literature remains evasive about why the common factor is best measured by corporate spreads.

With a fixed-effects panel regression, we find evidence of strong co-movements between spreads on one side, and short term interest rates and credit ratings on the other side. In addition, we find robust evidence that not only government bond spreads, but also spreads between corporate and government bonds tend to be proportional to the level of short-term interest rates.

The fact that interest rates are strongly correlated not only to government bond spreads, but also to the spreads between corporate and government bonds (both in the euro area and the US), suggests that the main driver of these spreads is the level of short term interest rates (rather than spreads between corporate and government bonds). The strong correlation between spreads and short term interest rates may be explained by the compensation structure of investment managers. When interest rates are low, investors have greater incentives to take on risk, in order to improve the expected return on their investment. If investors increasingly take on more liquidity and credit risks in the government bond market when interest rates are low, spreads will be compressed, thus generating a positive correlation between interest rates and spreads. Our estimates show that sovereigns with worse fiscal positions are forced to pay a substantial credit risk premium, suggesting that market discipline is still working in the euro area government bond market.

1. Introduction

In the run-up to the European Economic and Monetary Union (EMU), interest rate spreads of euro area 10 year government bonds against the benchmark, the German bund, have declined dramatically. Although there is almost unanimous agreement that these developments mainly reflected the introduction of the euro and the removal of exchange rate risks, the puzzling fact is that spreads continued to decline even after 1999. While at the beginning of EMU, euro area government fiscal positions improved against the background of a favourable macroeconomic climate, the most recent years have seen many countries breaking the rules of the Stability and Growth Pact, facing the excessive deficit procedure for a prolonged period. The lack of a strong market reaction in the wake of these adverse fiscal developments has prompted people to argue that the euro and the ongoing process of financial integration have eliminated markets' ability or willingness to discriminate the quality of national fiscal policies.

This paper studies the determinants of euro area government bond spreads, exploring the links between market discipline, financial integration and fiscal rules. In particular, it pays attention to the question whether market discipline is advanced or obstructed by financial integration and by fiscal rules like the Stability and Growth Pact.

We first provide theoretical arguments that financial integration – by improving market efficiency – is instrumental for financial markets to provide an accurate assessment of the risk-return profile of government bonds. Accurate asset pricing implies that governments pursuing unsound fiscal policies will be forced to offer higher yields to attract risk-averse investors, in order to compensate them for the higher default risk. Via this channel, progress in financial integration will ultimately reinforce any market-driven disciplinary effect.

Next, we discuss the relationships between market discipline and fiscal rules, arguing that these in principle may reinforce each other. Negative re-assessments by financial markets are reflected in a higher interest burden for governments, which could induce steps in the excessive deficit procedure. At the same time and more importantly, fiscal rules increase awareness of adverse fiscal developments, provide guidance to financial markets, and lead to more transparent fiscal accounts. The combined effect of market and regulatory sanctions will put pressure on governments to promote sound fiscal policies.

Finally, we provide empirical evidence on the determinants of interest rate spreads in euro area government bond markets. A robust finding of the literature is that spreads under EMU are driven by a common factor (see, for example, Codogno et al. 2003, Favero et al. 2005, Geyer et al. 2004). There is some evidence that this common factor is related to the spread of corporate debt over government debt. However, the literature remains evasive about why the common factor is best measured by corporate spreads.

With a fixed-effects panel regression, we find evidence of strong co-movements between spreads on one side, and short term interest rates and credit ratings on the other side. In addition, we find robust evidence that not only government bond spreads, but also spreads between corporate and government bonds tend to be proportional to the level of short-term interest rates.

The fact that interest rates are strongly correlated not only to government bond spreads, but also to the spreads between corporate and government bonds (both in the euro area and the US), suggests that the main driver of these spreads is the level of short term interest rates (rather than spreads between corporate and government bonds, as suggested for example by Codogno et al. 2003). One economic rationale behind the strong correlation between spreads and short term interest rates may lie in the compensation structure of investment managers, as recently suggested by Rajan (2005). When interest rates are low, investors have greater incentives to take on risk, in

order to improve the expected return on their investment. If investors increasingly take on more liquidity and credit risks in the government bond market when interest rates are low, spreads will be compressed, thus generating a positive correlation between interest rates and spreads.

Our estimates show that sovereigns with worse fiscal positions are forced to pay a substantial credit risk premium. Given the large debt-to-GDP ratios of most euro area countries, even small spreads of a few basis points turn out to be relevant. We perform a series of robustness checks – by looking at Credit Default Swaps, as well as euro area and US corporate bonds – which give comparable estimates of the credit risk premium. We also find evidence of a significantly positive liquidity risk premium, which suggests that there is further scope for financial integration in the euro area government bond market (to the extent, at least, that the elimination of these premiums does not collide with legal requirements such as the "no bail-out clause").

The paper is structured as follows. In the next section, we define the concepts of market discipline and financial integration, discussing the links between the two. In section 3, we discuss the conditions for market discipline and the interaction between market discipline and fiscal rules. In section 4, we estimate a model on post-1998 data to disentangle the credit and liquidity risk components of the spreads in the euro area government bond market. We also provide a series of robustness checks which give further support to our findings. Section 5 concludes.

2. Financial integration and market discipline

Market discipline in the context of sovereign bond markets may be broadly defined as the influence exerted by market participants on governments by pricing different risks of default. Bonds of governments following unsound fiscal policies are characterized by higher risks. Risk-averse investors want to be compensated for bearing such extra risk and therefore demand higher

yields. Governments have to take into account these higher financing costs when planning their fiscal policies. Ceteris paribus, market discipline provides a deterrent against unsound fiscal policies, and thus supports fiscal discipline.

Market discipline is most effective in competitive and well-functioning markets. A necessary condition for financial markets to price sovereign bonds correctly is that governments have access to the capital markets on the same terms as other borrowers, and in particular that each country will ultimately bear the full financial consequences of a future default. Any direct or indirect pressure to favour government debt securities would inevitably introduce pricing distortions, thus impairing the role of markets as a disciplinary device. The Maastricht Treaty explicitly recognizes the importance of these issues in articles 101-103 (also see section 3).

The market for a given instrument may be considered fully integrated if all agents with the same relevant characteristics face a single set of rules, have equal access and are treated equally.[1] By eliminating barriers to trade and creating a true level-playing field, progress in financial integration increases the efficiency of financial markets. Efficient financial markets, in turn, provide a more accurate assessment of the risk/return profile of each bond. Therefore, financial integration reinforces market discipline, by enhancing the capacity of the markets to accurately price assets.

One argument that is sometimes used to show that the process of financial integration may be detrimental to the functioning of market discipline is the convergence in euro area government bond spreads that occurred in the run-up to the EMU and shortly after. This convergence occurred despite the deterioration of some euro area government fiscal positions. As before the monetary union large deficits were generally associated with sizeable spreads, people argue that the euro may have eliminated the capacity of bond markets to discriminate between the qualities of fiscal

[1] See Baele et al. (2004) for a more formal definition of financial integration.

policies. The strongest version of the criticism states that the EMU and the Stability and Growth Pact eliminated the necessity to discriminate between different euro area sovereign bonds.

This line of reasoning neglects the fact that spread convergence mainly reflects the progressive elimination of uncertainty about exchange rate movements before EMU, closer coordination of monetary policies across euro area countries before EMU and a single monetary policy since then, and an overall compression of risk premiums also observable in other markets and outside the euro area.

In theory, the spread between two assets with the same cash flow should be zero only if the underlying bonds have identical risk-return characteristics. Typically, however, spreads between government bonds reflect three types of risks:

1. *Exchange rate risk*, which refers to the risk for investors of an adverse exchange rate movement (which in turn could be linked to inflation differentials, credibility of monetary policies, as well as sustainability of fiscal positions);

2. *Liquidity risk*, which refers to the risk of selling less liquid assets at worse market conditions (higher transaction costs, greater price impact) than more liquid ones;

3. *Credit or default risk*, which refers to the risk of default of the issuer, who may no longer be able to pay interests and/or pay back the capital, and which is mainly linked to the sustainability of fiscal positions.

In addition, other *technical factors* (such as differences in taxation, or in the issuance, clearing and settlement procedures) may contribute to generate positive spreads.

These risks are generally affected by both monetary and fiscal policies of each country. Exchange rate risks, in particular, are affected by inflation expectations. The years preceding the

introduction of the euro have been characterized by convergence in inflation rates and coordination of monetary policies across euro area countries. These factors, coupled with the progressive reduction in uncertainty about exchange rate fluctuations, have arguably been the main drivers behind the impressive convergence of government bond spreads in the run-up to the EMU.

In principle, governments pursuing lax fiscal policies and having high debt levels may exert pressures on monetary authorities to reduce the real value of the debt by creating higher inflation. Rational agents would therefore demand higher yields in compensation of inflation and exchange rate depreciations induced by future monetization of the debt. The elimination of the risk premium associated to the lack of credibility of national monetary policies has certainly reduced the financing costs for the less virtuous Member States. To the extent that part of the eliminated risk premium was related to fiscal developments, one may argue that market discipline has indeed become less constraining for some governments after 1999. However, this reflects the elimination of a potential source of risk, rather than the effect of the ongoing process of financial integration.

3. Market discipline and fiscal rules

The economic literature points towards a number of conditions that are deemed necessary for market discipline to work (Lane, 1992):

- *Information provision*. The requirement to disclose sound statistical information on a regular basis provides markets with timely and standardised fiscal information.

- *Prohibition of monetary financing of government deficits*. This prohibition closes off the monetary way out of fiscal problems.

- *No privileged access of governments to financial institutions*. This rule forces governments to enter the capital market on broadly similar conditions as other borrowers.[2]

- *No bail-out clause*. A debt-takeover by another institution would increase the expected recovery rate and reduce the default risk premium.

However, even if these conditions are in place and credible, the market mechanism may be insufficient to guarantee fiscal discipline because "the constraints imposed by market forces might either be too slow and weak or too sudden and disruptive" (Delors-report, 1989), due to the often non-linear nature of market reactions. Furthermore, high bond supply by one country in a monetary union could spill-over to interest rates of other euro area participants given the common pool of financial resources (see, for instance, Detken, Gaspar and Winkler, 2004). On this ground, the Maastricht Treaty adopted an encompassing approach, including various safeguards to attain and maintain sound public finances. Next to rules aimed at enhancing market discipline (such as the prohibition of monetary financing of public institutions and of privileged access, the no bail-out clause), the Treaty introduced ceilings on the government deficits (3% of GDP) and debt (60% of GDP).

There are some key differences in the way market discipline and fiscal rules operate. Financial markets assess budgetary developments with an eye to financial rewards and risks, notably the credit risk premium, with horizons typically shorter than a few years. A deficit above 3% of GDP will not by itself cause major market reactions as it does not immediately affect fiscal sustainability and credit risk. In view of very low default risks over a horizon of a few years, and assessing the costs and benefits involved, markets have little incentives to make in-depth analyses

[2] It should be noted that some government regulations may lead financial participants to prefer securities of (domestic) government, such as the capital adequacy rules, placing zero risk-weight on euro area government bonds at current ratings (compared to at least a 20% weight on corporate bonds), and exempting government bonds from the large-exposure rule. Supervisory regulation thus may implicitly favour purchases of government bonds. The same effect may stem from supervisory and accounting reforms for pension funds and insurance companies: a move to market-to-market valuation induces these investors to seek assets of long maturity to reduce a duration mismatch. Government bonds of (very) long-term maturity are a natural candidate for this demand.

of fiscal positions. The fiscal rules in place, on the other hand, have the explicit goal of containing government deficits and debt, with a view to not-hindering monetary policy, avoiding interest-rate spill-overs and preventing a testing of the no bail-out clause.

Another aspect on which market discipline and fiscal rules can be compared is their deterrent financial effect. Table 1 presents a comparison of the budgetary costs potentially involved.

Table 1. Budgetary costs of rules- and market-based 'sanctions'
(In % of GDP)

Sanction type	Stability and Growth Pact: deposit / fine	Current interest rate spreads (±30 basis points)
Budgetary impact	0.01-0.02% of GDP / 0.21-0.52% of GDP	0.05% of GDP per year

Non-compliance with the excessive-deficit procedure can lead to a non-interest bearing deposit (article 104(9)), made up of a fixed sum (0.2% of GDP), and a supplement (0.1% of GDP for every percentage point by which the budget deficit exceeds 3% of GDP), with a total maximum of 0.5% of GDP. The budgetary costs of a deposit are equal to the interest rate the government has to pay on the amount to be deposited. In the current financial environment, a deposit would annually deteriorate the national budget by around 0.01% of GDP. Continued non-compliance may lead to transformation of the deposit into a non-interest bearing fine after two years, costing a government between 0.21% of GDP and 0.52% of GDP. New sanctions will be imposed in case of continued non-compliance, only consisting of the variable supplement, up to 0.5% of GDP per year. Such sanctions therefore could add-up over time.

Financial markets, on the other hand, impose interest rate spreads of about 30 basis points in Greece and Italy – the two countries with currently the largest spreads. This implies additional

interest spending of about 0.05% of GDP per year on the basis of rules-of-thumb calculations, not taking into account any second-order effects. [3]

In interpreting these numbers, it must be noted that they compare costs of potential *future* sanctions if they are applied (fiscal rules) with *current* yield spreads (market discipline). Furthermore, persistent excessive deficits in a country at some point will also negatively affect the interest rate spread and the rating, which would increase interest payment costs closer to or even above the costs of sanctions related to the excessive deficit procedure.

Market discipline and fiscal rules do not operate in isolation but interact and may reinforce each other. As to the effects from market signals to fiscal rules, changes in interest rates following a higher credit risk premium affect government fiscal positions, usually with a negative sign. This increases chances of non-compliance with minimal consolidation efforts and of breaking the 3% limit, bringing forward the moment the corrective mechanisms of the Pact start operating, and thus the operation of fiscal rules.[4]

As to the effects in the other direction, rules give guidance to markets for monitoring fiscal developments, providing a "common language" for investors (Mosley, 2003). Publicity around cases of excessive deficit procedures increases market awareness of undue fiscal developments. Continued non-compliance with Council recommendations could also be seen as raising the small probability of the country exiting EMU, which would lift default risks and market rates.[5] Another effect is that assessing compliance with the fiscal rules brings forward more timely and comprehensive fiscal data, facilitating market monitoring. Reports by investment banks and credit rating agencies generally underline the importance of the Pact. Contrary to this, a strong belief in

[3] With debt ratios around 110% of GDP and an average maturity around 6½ years, some annual refinancing is around 17% of GDP. A 1 percent-point higher interest rate then would translate into a 0.17% of GDP higher interest bill.

[4] Bayoumi et al. (1995) proposed increasing the role of market forces in fiscal rules, for instance by using interest rates rather than budgetary data for triggering non-compliance procedures or for determining the size of sanctions

[5] Empirical evidence of non-compliance with fiscal rules and interest rate responses is mixed, as for instance shown by Afonso and Strauch (2004).

the deterrent and correcting effect of the Pact might reduce monitoring by financial markets of fiscal developments if market participants are confident that peer pressure and sanctions will lead governments to reduce budgetary positions to below the deficit and debt reference values.[6] In such case, any excess over 3% of GDP would be considered only a temporary matter, not giving rise to major concerns on financial markets. Highly credible fiscal rules therefore indeed may reduce market discipline, but in such case there will also be less need for financial markets to react.

4. Quantifying liquidity and credit risk premiums

This section aims at decomposing interest rate spreads on European government bonds into its main remaining components, liquidity and default risk premiums. Such decomposition is important from a policy perspective. Significant default risk premiums may be the result of market disciplinary forces, and therefore call for improvements in the sustainability of public finances. Large liquidity premiums, on the other hand, may be a symptom of market fragmentation and require policies aimed at fostering the ongoing integration process.

The existing literature on euro area government bond spreads employs different methodologies, as well as different countries and time-spans. Most studies include some pre-EMU years, to have a sample size sufficiently large to carry out meaningful econometric analyses (Codogno, Favero and Missale 2003, Bernoth, von Hagen and Schuknecht 2004, Gomez-Puig 2006). This requires taking into account the additional exchange rate risk component of interest rate spreads, for the period before 1999. A common approach is to deduct from the interest rate spreads the difference between 10-year swaps in the currency of the country and the DM as a measure of the exchange

[6] Poterba and Rueben (2001) report evidence for US States that tight anti-deficit rules lead to smaller interest rate increases in case of unexpected deficits than in States without such fiscal rules.

rate related premium. An alternative is to compare yields on bonds issued by different governments in the same currency, e.g. DM/euro or US dollars.

From the methodological point of view, Geyer, Kossmeier and Pichler (2004) and Menkveld, Cheung and De Jong (2004) use factor models, while Codogno, Favero and Missale (2003) and Favero, Pagano and von Thadden (2005) relate changes in spreads to changes in international risk factors. A common finding of these studies is that default risk premiums remain an important component of euro area government bond spreads even after the introduction of the single currency. Furthermore, there is consistent evidence of the existence of a common factor driving the spreads after 1999, which is related by Codogno et al. (2003) to the spreads of corporate bonds over government bonds in the United States. They interpret changes in these corporate spreads as changes in the international risk factors, but it remains unclear what is driving these changes.

In fact, spreads in the euro area government bond market – and risk factors in general – are likely to be related to the level of short term interest rates, since the lower the rate of return on risk free assets, the higher the incentives for investors to boost their returns by taking on more risk. A compelling argument linking interest rates, investors' incentives and risk premiums is provided by Rajan (2006). He argues that the compensation structure of investment managers may induce investors to search for higher yields when interest rates are low. To see how these incentives operate, consider the typical compensation contract for a hedge fund manager. The manager earns 2% of the value of the assets under management, plus a percentage of the annual returns on the investment. When interest rates are high, compensation will be high even investing in risk free assets. On the other hand, when interest rates are low, managers will have the incentive to take on more risk, because they can boost their compensation by increasing the expected return on their investment. Euro area government bond markets constitute an ideal environment to test this hypothesis, because investors may take on more risk by simply shifting their investment towards

less liquid or lower rated bonds. If investors consistently follow this behaviour, low interest rates will determine an overall compression of spreads, thus generating a positive correlation between interest rates and spreads. Hence, a low level of interest rates may in itself result in a convergence of spreads, based purely on risk-return considerations.[7]

At the same time, it is reasonable to expect that – *ceteris paribus* – governments implementing unsound fiscal policies are forced to pay higher spreads. The reason is that these governments face higher risks of default and investors need to be compensated for bearing such extra risk. It is important to stress that it is mainly the long-term sustainability of public finances (as opposed to short-term budget deficit fluctuations) that affects the probability of default and therefore accounts for the credit risk premium. A natural proxy for such long-term sustainability is given by the assessments provided by the leading rating agencies.[8] These ratings are more forward looking than simple debt- or deficit-to-GDP ratios, as they take into account not only the current level of debts and deficits, but also their expected development, as well as factors such as the quality of the budget law, the political stability of the country and other possibly relevant factors.[9]

On the basis of these arguments, one should expect government bond spreads to be positively related to the general level of interest rates and to the credit rating. Figure 1 confirms this intuition. We plot the ECB main refinancing operation minimum bid rate (MRO) together with monthly average spreads over the 10 year German government bonds for four differently rated bonds: the French (which is rated AAA), the Belgian (rated AA+), the Italian (initially rated AA and in July 2004 downgraded to AA-) and the Greek government bond (rated A).[10] The figure

[7] In principle, this search for higher yield could also affect other financial markets like equity or real estate. However, in these markets it is more difficult to isolate the different sources of risk.

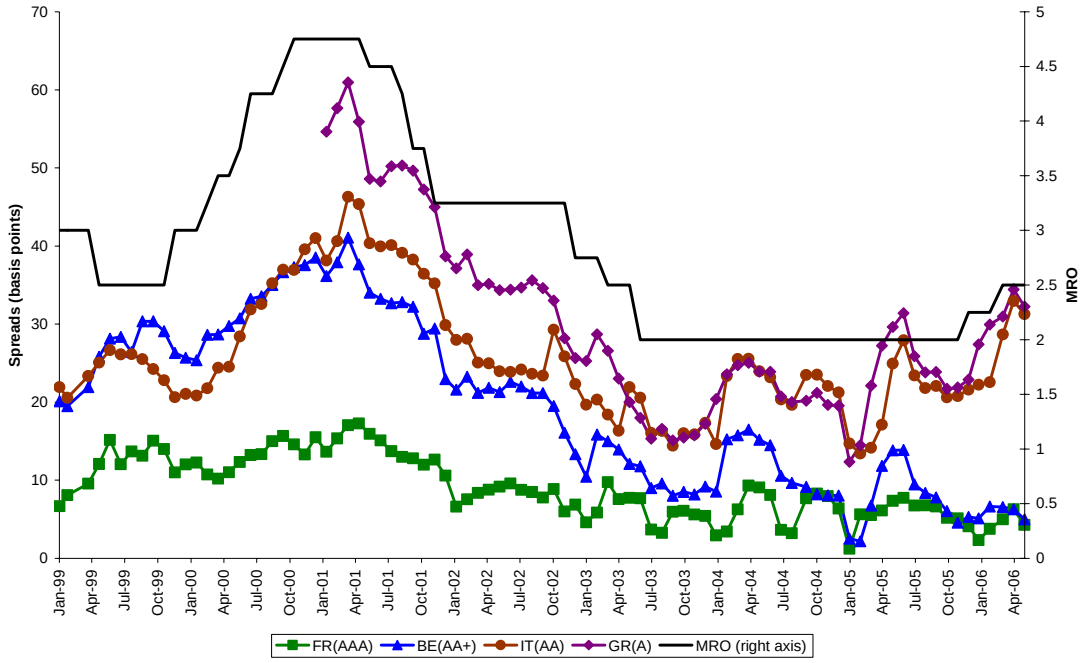
[8] Ratings have been extensively used in the literature. See, for instance, Gomez-Puiz (2006) for an application in the context of European government bond markets. Sironi (2004) uses ratings to test for market discipline in the European banking industry.

[9] See Afonso et al. (2007) for a recent empirical analysis indicating many variables affecting the rating, among which fiscal variables.

[10] We start the time series for Greece at the time it entered the euro area (January 2001).

shows that spreads are positively related to the interest rate level, with the best-rated bonds (French) offering the lowest spreads, and the lowest-rated bonds (Italian and Greek) the highest.[11]

Figure 1 – Spreads of 10 year bonds over German benchmark



The visual impression of figure 1 is confirmed for all countries by the results of tables 2 and 3, which report the correlation coefficients between the individual spreads and MRO, as well as average spreads. Table 2 shows that there is a very strong correlation between spreads and MRO. Table 3 clearly illustrates that the lower the rating of a country, the higher the average spread it has to pay on its debt.

[11] An additional factor that may explain the recent reduction in spreads could be a decrease in the rank of the German benchmark bonds. Data on Credit Default Swap rates, for instance, suggest that the default risk of German bonds has increased relative to other euro area countries in recent years.

Table 2 – Correlations between spreads of 10 year government bond yields and MRO, Jan. 1999-May 2006										
	AT	BE	ES	FI	FR	GR	IE	IT	NL	PT
MRO	0.84	0.87	0.85	0.73	0.76	0.93	0.77	0.84	0.70	0.83

Table 3 – Average spreads of 10 year government bond yields (basis points), Jan.1999-May 2006										
	AT	BE	ES	FI	FR	GR	IE	IT	NL	PT
Mean	16	20	16	14	9	30	13	26	9	21
Mid-2006 rating (S&P)	AAA	AA+	AAA	AAA	AAA	A	AAA	AA-	AAA	AA-

We disentangle credit and liquidity risk premiums via a panel regression, controlling for the general interest rate level, credit ratings and country fixed effects:

(1) $$s_{c,t} = \beta_c + \gamma_{AAA} \cdot MRO_t + \gamma_{AA+} \cdot D_{c,t}^{AA+} \cdot MRO_t + ... + \gamma_A \cdot D_{c,t}^{A} \cdot MRO_t + \phi Size_{c,t} + \varepsilon_{c,t}$$

where

$s_{c,t}$ denotes the spread at time t of a 10-year government bond in country c relative to the German 10 year government bond yield

β_c is a country fixed effect coefficient

MRO_t is the main refinancing operations minimum bid rate at time t

$D_{c,t}^{AA+},...,D_{c,t}^{A}$ are the rating dummies for country c at time t (the ratings in the sample are AA+, AA, AA-, A+ and A while AAA is used as reference; the source is Standard&Poor's)

$Size_{c,t}$ represents the relative government debt size of country c w.r.t. to the total euro area debt.

Liquidity risk premiums are identified via AAA non benchmark bonds: since these bonds have the same credit risk as the German ones, their spreads should contain no additional credit risk premium. We introduce the variable $Size_{c,t}$ to control for potential liquidity effects due to the different sizes of government debts. The country fixed effect coefficient β_c may capture other technical factors driving spreads, such as differences in taxation regimes or issuance procedures. Credit risk premiums, on the other hand, are identified via the rating dummies, and are measured by how much – in addition to the liquidity premium – countries with lower ratings need to pay to attract risk averse investors.[12]

We used monthly average spreads from January 1999 to May 2006, for on-the-run 10 year government bonds. The data were downloaded from the BIS data base. For Greece we included data starting from January 2001, when it entered the euro. We excluded Luxemburg from the analysis because its yields have an erratic behaviour.[13]

The results are reported in table 4. We computed robust standard errors using the "White period" option in EViews, which is robust to both serial correlation and heteroscedasticity.

Table 4 - Regression coefficient estimates

γ_{AAA}	γ_{AA+}	γ_{AA}	γ_{AA-}	γ_{A+}	γ_{A}	ϕ	R^2
0.067	0.016	0.027	0.048	0.047	0.056	2.07	0.77
(.008)	(.006)	(.01)	(.009)	(.007)	(.007)	(1.36)	

The relative high R^2 signals that the above model specification is able to explain most of the spread variability. We notice that all the coefficients are highly statistically significant, with the exception of the relative debt size. Since the relative debt size is changing very slowly from one

[12] Enodogeneity should not be a problem here as rating agencies take into account a broad range of factors when making up the credit rating for a country. Furthermore, the medium-term orientation of ratings should reduce any impact of current interest rates on ratings.

[13] This reflects the low government gross debt ratio in Luxembourg, standing at around 7% of GDP.

year to the next, most of the information contained in this variable comes from the cross section variation, which is already taken into account by the fixed effect coefficients.

A second interesting feature of the results reported in table 4 is that the coefficients associated to the rating dummies are all monotonically increasing, consistently with the economic intuition that lower rated governments should pay higher interest rates to compensate risk averse investors for the higher risk of default. The only exception is the coefficient associated to the A+ rating dummy whose estimate is slightly lower than the coefficient associated to the AA- rating dummy (although the difference is not statistically significant). This may partly be due to the fact that ratings are not perfect measures of the true risk of default, or to the noise introduced by the yields of the small issuers, which tend to exhibit a more erratic behaviour. Given the extremely low market share of these countries, they are likely to be more subject to country specific supply/demand factors that may bias the analysis.

We therefore re-estimated the model, dropping the size variable (which turned out to be insignificant) and eliminating three small issuer countries, all AAA-rated: Austria, Finland and Ireland. The new results are reported in table 5:

Table 5 - Regression coefficient estimates without small issuers

γ_{AAA}	γ_{AA+}	γ_{AA}	γ_{AA-}	γ_{A+}	γ_{A}	R^2
0.044	0.045	0.048	0.061	0.066	0.076	0.83
(0.005)	(0.006)	(0.008)	(0.005)	(0.005)	(0.005)	

Table 5 shows that the coefficients associated to the rating dummies are now all monotonically increasing. Comparing the point estimates of tables 4 and 5, we see that the elimination of the small issuers results in more conservative estimates of the coefficient associated to MRO_t, and higher estimates of the coefficients associated to the rating dummies.[14]

From table 5, we can derive estimates of the liquidity and credit risk premiums discussed before. An estimate of the liquidity premium is given by:

$$\hat{LP}_t = \hat{\gamma}_{AAA} \cdot MRO_t$$

where the hat denotes the estimated coefficient. This estimate quantifies the extra interest rate that governments with AAA rating have to pay with respect to Germany.

The coefficients associated to the rating dummies provide an estimate of the credit risk premium, that is, how much – in addition to the liquidity risk premium – each country has to pay for having a lower rating than Germany:

$$(3) \qquad \hat{CP}_t = \hat{\gamma}_R \cdot MRO_t \qquad R \in \{AA+, AA, AA-, A+, A\}$$

For instance, everything else equal, a deterioration of the rating from AAA to AA+ would have an additional cost for euro area governments of 4.5% of the MRO (coefficient $\gamma_{\mathrm{AA+}}$ in the table). Deterioration from AAA to AA- instead would increase the costs by 6.1% of the MRO (coefficient γ_{AA} in the table), while a deterioration from AAA to A would require a credit risk

[14] We also tried to use ratings from Moody's, a different rating agency. The results are qualitatively similar, although with Moody's ratings the coefficients associated to the AA and AA- rating dummies turned out to be lower than that associated to the AA+ rating dummy.

premium equal to 7.6% of the MRO (coefficient γ_{AA-} in the table). It is worthwhile to emphasise that all these estimates are highly statistically significant and the R^2 of the regression is very high.

The large debt-to-GDP ratios of most euro area countries imply that these results are bound to be not only statistically significant, but also economically relevant. Table 6 reports the estimates of the additional costs due to liquidity and credit risk premiums at the current interest rate levels, assuming it applies instantaneously to all debt.

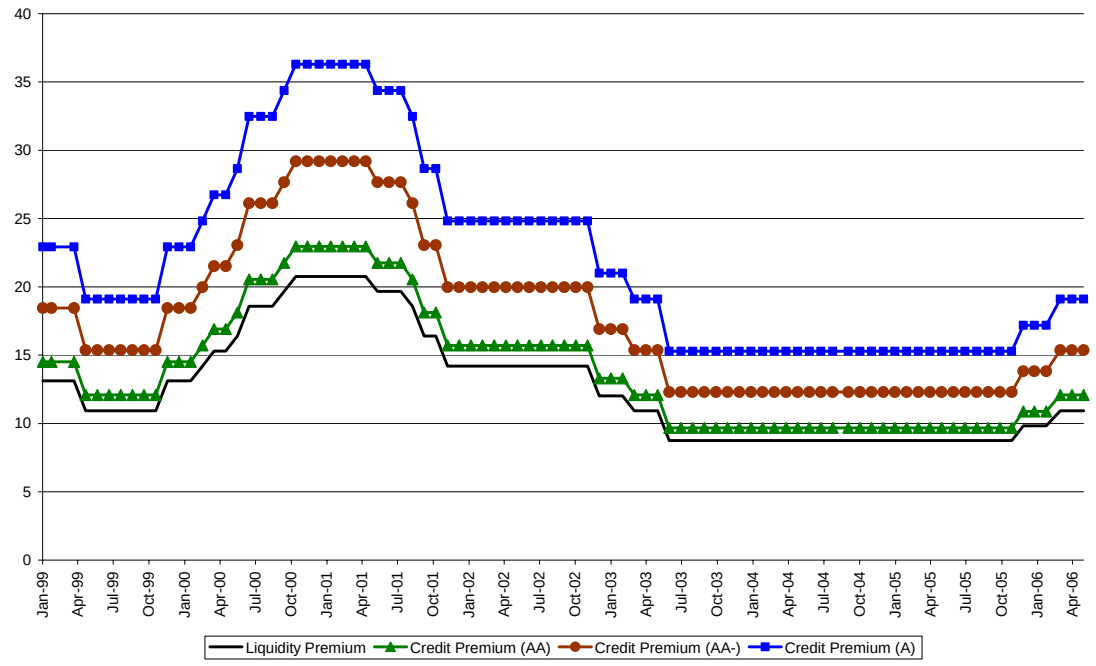
Table 6 – Additional costs for governments (in percentage of GDP) due to risk premiums

	AT	BE	ES	FI	FR	GR	IE	IT	NL	PT
Debt/GDP 2005	64	94	46	43	66	112	31	105	58	62
Liquidity premium	0.07	0.10	0.05	0.05	0.07	0.12	0.03	0.11	0.06	0.07
Credit premium	0.00	0.11	0.00	0.00	0.00	0.21	0.00	0.16	0.00	0.09
PM: Mid-2006 rating (S&P)	AAA	AA+	AAA	AAA	AAA	A	AAA	AA-	AAA	AA-

For example, the current liquidity risk premium would cost France about 0.07% of the French GDP. Belgium pays an extra credit risk premium for its AA+ rating roughly equal to 0.11% of its GDP. In the case of Italy, its AA- credit rating costs its government about 0.16% of its GDP more than if it had a perfect rating. The consequences of a rating downgrading after the introduction of the euro are therefore both statistically and economically significant in the long run.

Figure 2 plots the time-varying risk premiums decomposition. The behaviour of the risk premiums follows very closely that of the MRO because, according to the model, both liquidity and credit risk premiums should be proportional to the level of interest rates.

Figure 2 – Decomposition of time-varying risk premiums (basis points)



According to our estimates, most of the spreads observed in the euro area government bond market are due to credit risk. At the same time, the presence of a positive liquidity risk premium suggests that there is room for further integration in this market.

4.1 Robustness checks

To place the above results in perspective, we run a series of robustness checks. We first look at data on credit default swaps, which provide a direct measure of the credit risk premium as perceived by markets. Then we look at the behaviour of spreads in the euro area corporate bond market, and finally, we study the US corporate bond spreads.

a. Credit Default Swaps

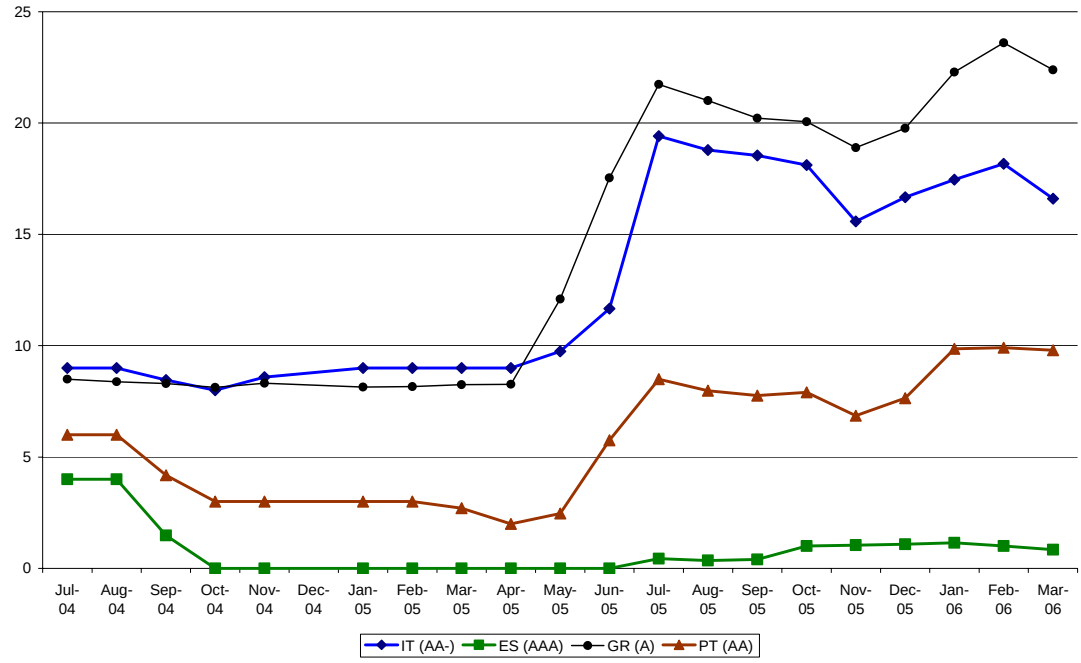
In a Credit Default Swaps (CDS) contract, the protection buyer makes periodic payments to the protection seller until the contract expires or the credit event occurs. In return, the seller promises to buy the defaulted bond at its par value, should the underlying firm or country default on its debt. CDS – by providing a direct and absolute measure of the default risk of a bond – permit to circumvent the problem of credit rating definitions in order to disentangle the liquidity and default components of the spread.

A serious limitation of this instrument in the context of the government bond market is its low market liquidity. This implies that reliable data are available only for the very recent time span and not for all euro area countries. This prevents a comprehensive, long-term analysis of spread dynamics. Nevertheless, the available data can be used to cross-check our previous results of the panel regression analysis.

In figure 3, we report the differences between Greek, Portuguese, Italian and Spanish CDS rates over the French ones.[15] The source is Bloomberg, which provide data only for these euro area countries, starting from July 2004.

[15] Even AAA bonds have a risk – albeit small – of default. Since we want to measure the credit risk premium paid in excess of the AAA bond, we take differences between CDS rates on non-benchmark and benchmark bonds. Since data on Germany are not available, we use France as its closest substitute.

Figure 3 – Spreads of Credit Default Swaps (CDS) over French CDS



A few remarks are necessary before commenting on the chart. Portuguese bonds were downgraded from AA to AA- in July 2005, while the Italian credit outlook was downgraded from stable to negative in August 2005. In addition, mid-2005 was the time of concluding the revised Stability and Growth Pact, and of the rejection of the Constitution for Europe by the French and Dutch population. These facts together explain the jump in Portuguese, Italian and Greek CDS rates that occurred in summer 2005. The fact that CDS on AAA Spanish bonds are not always equal to the French ones may be due to differences in their liquidity, but partly confirms that credit risk may vary within the same rating category. Obviously, with the credit ratings used in the panel regression, we cannot have the same granularity that can be obtained from the CDS data.

It is reassuring, however, that a cross-checking of the results gives a consistent picture. According to figure 3, the credit risk premium for AA- rated bonds should be around 10 basis points (as can be seen from the Italian CDS before summer 2005 and the Portuguese CDS after summer 2005).

This figure is very close to the estimated credit risk premium associated to AA- bonds reported in figure 2, which between July 2004 and December 2005 was around 12 basis points.

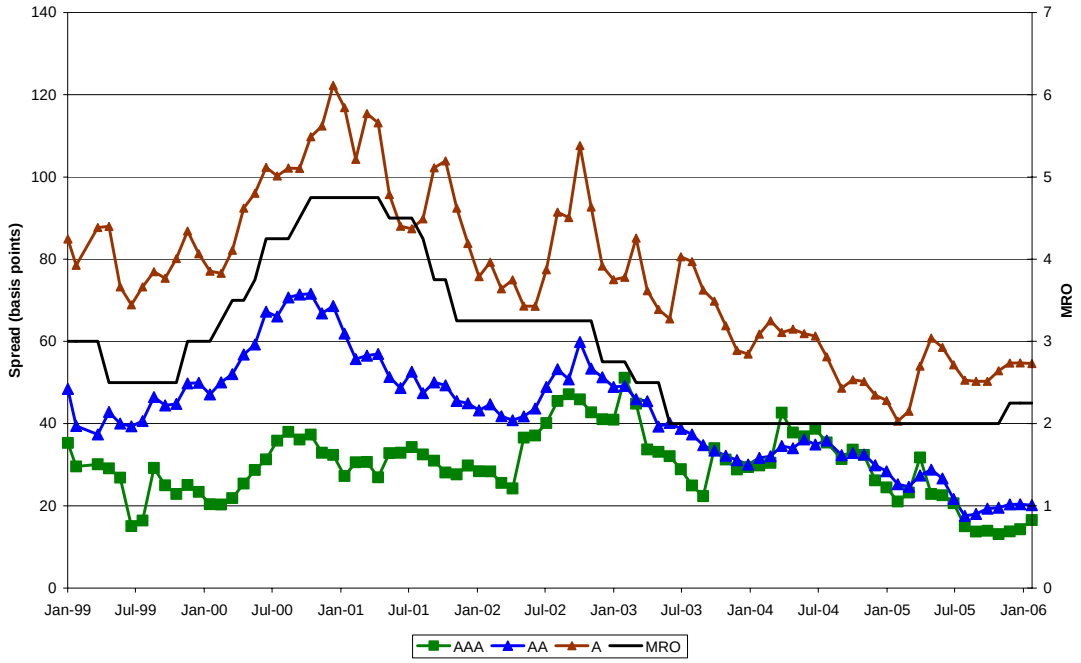
Similarly for Greece, CDS data suggest a credit risk premium oscillating between 10 and 20 basis points, while the estimates from figure 2 indicate an estimated credit risk premium associated to A ratings equal to 15 basis points for the period 2004-2005 and raising to about 20 basis points in the last few months of the sample.

b. Euro area corporate bonds

It is sometimes argued that the low spreads observed in the euro area government bond markets reflect the non-credibility of the "no bail-out" clause. To the extent that ratings across different asset classes are comparable, a strategy to test the validity of this proposition is to estimate an analogous panel regression on euro area corporate bond spreads. Since corporate bonds are not subject to any bailing-out, the credit risk premium in these markets should be free from this distortion. Similar credit premiums estimates in government and corporate bond markets can be therefore interpreted as evidence against the non-credibility of the no bail-out clause.

We used indices from Datastream for 7 to 10 year corporate bonds for three rating categories, AAA, AA and A. We used the corresponding index for 7 to 10 year euro area government bonds to compute the spreads, which are plotted in figure 4.

Figure 4 – Spreads of -10 year euro corporate bonds



We observe an overall pattern similar to the one seen in figure 1 for the euro area government bonds. Spreads tend to follow the overall level of interest rates, with high levels in 2000-2001 and lower levels towards the end of the sample. The spikes between 2002 and 2003 occurred in the aftermath of the ENRON and other corporate scandals that shook the financial world, and reflect a temporary change in the risk assessment of the corporate bond market. That spreads between AAA and AA categories cross in the second half of the sample is due to the fact that some of the bonds in the AAA index were kept in the index even though they were expected to be downgraded (and some of the AA to be upgraded).

Spreads of corporate bonds are, as expected, slightly higher than those on government bonds of comparable ratings. This may be explained by the relatively higher liquidity of government bond markets. In addition, it cannot be ruled out that governments may be perceived as safer than any other asset class due to its taxing-capability.

Table 7 shows that correlation coefficients between the individual spreads and MRO are also very high, except for the AAA bonds which may have suffered most from the corporate scandals effect.

Table 7 – Correlations between 10-year euro corporate spreads and MRO

	AAA	AA	A
MRO	0.26	0.85	0.88

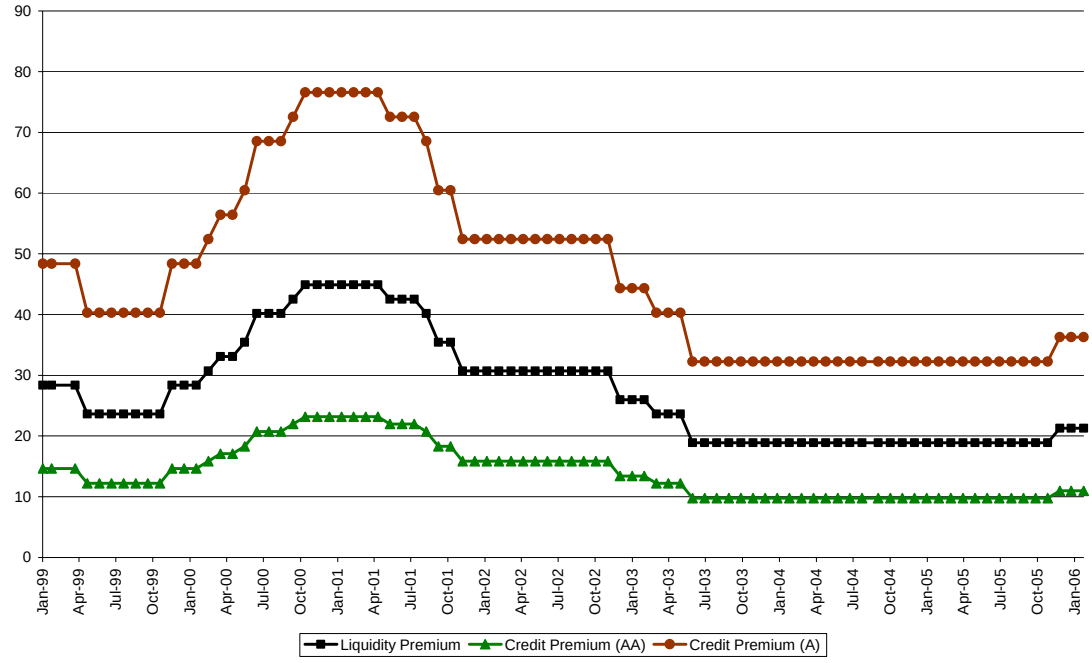
The close relationship between spreads and interest rate levels is further confirmed by the panel regression estimates, reported in table 8.

Table 8 - Regression coefficient estimates for 10-year corporate spreads

γ_{AAA}	γ_{AA}	γ_{A}	R^2
0.09 (.00)	0.049 (.00)	0.16 (.00)	0.88

In figure 5, we report the time series decomposition of the various components of the risk premium.

Figure 5 – Decomposition of time-varying risk premiums for euro corporate bonds (basis points)



Comparing tables 8 and 5, we can see that – as expected – the liquidity premium tends to be higher than the corresponding premium observed in the government bond market: the estimated $\hat{\gamma}_{AAA}$ for the corporate bond market is twice the estimates for the government bond market. The credit risk premium associated to the AA rating category is instead of a similar magnitude of that estimated for the government bonds, lying between the risk premiums associated to the AA and AA- government bonds.

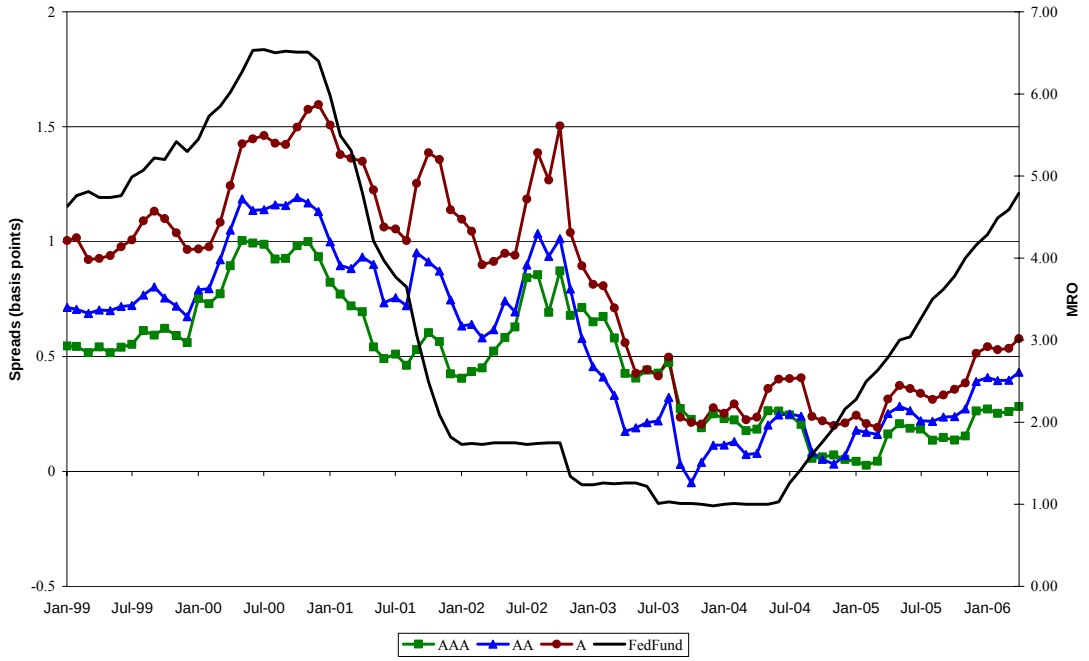
There is instead discrepancy between the estimated risk premiums associated to the A rating, with credit risk premiums in the corporate bond sector being about twice as big as those in the government bond market. This may be due to supply/demand factors specific to the Greek government market (the only A rated government in our sample), to accounting and regulatory practices (such as the special status of government bonds in the capital requirements in the Basel accord), to the fact that for the same rating category corporate bonds may be perceived as riskier

than government bonds, as well as it may be a sign that markets are discounting that the "no bail-out clause" is not fully credible.

c. US corporate bonds

As a final robustness check, we look at the behaviour of spreads in the US corporate bond market. In figure 6 we plot the spreads of 7-10 year US corporate bond indices relative to the corresponding Treasury index, for three rating categories. In the same figure, we plot for reference also the federal funds rate.

Figure 6 – Spreads of -10 year US corporate bonds



US corporate spreads are characterised by similar behaviour as the euro area corporate spreads. We confirm the overall positive relationship between spreads and interest rate levels, as well as the spread volatility induced by the corporate scandals between 2001 and 2003.

Table 9 shows that correlation coefficients between the individual spreads and the Federal Funds Rate are also very high, although less than the European ones.

Table 9 – Correlations between 10-year US corporate spreads and Fed Funds

	AAA	AA	A
FFR	0.57	0.69	0.61

The close relationship between spreads and interest rate levels is further confirmed by the panel regression estimates, reported in table 10.

Table 10 - Regression coefficient estimates for 10-year corporate spreads

γ_{AAA}	γ_{AA}	γ_{A}	R^2
0.096 (.010)	0.018 (.016)	0.066 (.018)	0.37

The estimated coefficients associated to the rating dummies are lower than the corresponding estimates for the euro area corporate bond market. The lower R^2 and the lower correlations shown in table 10 suggest that spreads in US corporate bond market may be driven by additional factors with respect to the euro area corporate bond market. These results, however, generally support the existence of a robust and positive relationship between short term interest rates and bond spreads.

5. Conclusions

This paper has analysed the relationship between financial integration, market discipline and fiscal rules in the context of the euro area government bond market.

We have argued that financial integration is a necessary condition for market discipline: the more developed and integrated the financial markets are, the higher the degree of market efficiency and the more accurate government bonds are priced. Nevertheless, lower interest rate spreads in the

run-up to EMU and after have given rise to the idea that financial market integration has resulted in less market discipline. The key factor in explaining this is the exchange rate risk that reduced over time and was completely eliminated as of 1999.

Given sometimes slow and limited financial market reactions to fiscal derailments, market discipline needs to be complemented by fiscal rules. In the context of the euro area, the Stability and Growth Pact provides guidance and a common language to financial markets, and thereby reinforces its operation. It is the compound effects of market discipline and fiscal rules – by increasing the overall costs of fiscal indiscipline – that increases the incentives for governments to promote sound fiscal policies.

The paper has finally provided an empirical analysis on the determinants of spreads in the euro area government bond market. An important finding of our analysis is that spreads tend to be driven by the level of short-term interest rates. In addition, we find that sovereigns with lower credit ratings are forced to pay a higher credit risk premium, which is confirmed by various robustness checks. Thus, we find evidence of market discipline still operating in EMU. Part of the current interest rate spreads therefore will continue to prevail as long as not all countries have achieved fiscal sustainability, regardless of the state of financial integration. We have also documented the existence of a positive liquidity risk premium, suggesting there is further scope for financial integration in the euro area government bond market.

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