WHICH FACTORS AFFECT CORPORATE BONDS PRICING? EMPIRICAL EVIDENCE FROM EUROBONDS PRIMARY MARKET SPREADS

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ABSTRACT

The question of which factors are relevant in determining corporate bonds pricing is empirically investigated by analyzing the issuance spreads of eurobonds completed by Canadian, European, Japanese and U.S. companies during the 1991-2001 eleven year period. A unique dataset of spreads, ratings and other relevant bond variables is used for a sample of 3,403 eurobonds issues. Four main results emerge from the empirical analysis. First, the ratings of corporate bonds are the most important determinant of spreads between the yield to maturity of bonds and that of equivalent Treasury securities. Second, bond investors' reliance on rating agencies judgements has increased over time during the sample period. Third, while a bond's expected tax treatment represents a relevant factor explaining spreads cross-sectional variability, the primary market efficiency and the expected secondary market liquidity appear as poor explanatory variables. Finally, empirical evidence shows that rating agencies adopt a different, "through the cycle", evaluation criteria of obligors' creditworthiness with respect to the forward looking one adopted by bond investors.

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1. INTRODUCTION

The ability of major credit risk pricing models to explain the actual behavior of bonds' yields spreads over treasury securities has recently gathered significant attention as numerous academics and regulatory economists have suggested that bank supervisors should allow banks to rely on their own internal risk measurement models for capital adequacy purposes. While the recent proposals by Basel Committee on Banking Supervision (Basel, 2001) to reform the capital adequacy framework have not allowed banks to use their internal full portfolio models as a means of computing their credit risk capital requirements, this possibility has been explicitly considered as a future option once a higher data availability and model reliability are achieved. In addition to that, whatever the future evolution of credit risk capital requirements, the relevance of these empirical studies aimed at testing credit risk models lies in the calibration of these models which can then be used for risk management, pricing and capital allocation purposes.

Credit risk models can be divided into two main approaches: (i) structural-form models, and (ii) reduced-form models. Structural-form models are based on the original framework developed by Merton (1974) using the principles of option pricing. In such a framework, the default process of a company is driven by the value of the company's assets and the risk of a firm's default is therefore explicitly linked to the variability in the firm's asset value. Although the line of research that followed the Merton approach has proven very useful in addressing the qualitatively important aspects of pricing credit risks, it has been less successful in practical applications[1]. In response to such difficulties, an alternative approach has been proposed which still adopts the original framework developed by Merton as far as the default process is concerned but removes one of the unrealistic assumptions of the Merton model, namely, that default can occur only at maturity of the debt when the firm's assets are no longer sufficient to cover debt obligations. Instead, it is assumed that default may occur any time between the issuance and maturity of the debt and that default is triggered when the value of the firm's assets reaches a lower threshold level. These models include Kim, Ramaswamy and Sundaresan (1993), Nielsen, Saà-Requejo and Santa Clara (1993), Longstaff and Schwartz (1995) and others. Despite these improvements with respect to the original Merton framework, structural-form models still suffer from three main drawbacks, which represent the main

[1] The standard reference is Jones, Mason and Rosenfeld (1984), who find that, even for firms with very simple capital structures, a Merton-type model is unable to price investment-grade corporate bonds better than a naive model that assumes no risk of default.

reasons behind their relatively poor empirical performance[2]. First, they still require estimates for the parameters of the firm's asset value, which is non-observable. Second, they cannot incorporate credit-rating changes that occur quite frequently for default-risky corporate debts. Finally, most structural-form models assume that the value of the firm is continuous in time. As a result, the time of default can be predicted just before it happens and hence there are no "sudden surprises".

The attempt to overcome the above mentioned shortcomings of structural-form models gave rise to reduced-form models. These include Litterman and Iben (1991), Jarrow and Turnbull (1995), Madan and Unal (1996), Jarrow, Lando and Turnbull (1997), Lando (1998), Duffie (1998), and Duffie and Singleton (1999)[3]. Unlike structural-form models, reduced-form models do not condition default on the value of the firm, and parameters related to the firm's value need not be estimated to implement them. In addition to that, reduced-form models introduce separate, explicit assumptions on the dynamic of both PD and RR. These variables are modeled independently from the structural features of the firm, its asset volatility and leverage. Reduced-form models fundamentally differ from typical structural-form models in the degree of predictability of the default. A typical reduced-form model assumes that an exogenous random variable drives default and that the probability of default over any time interval is nonzero. Default occurs when the random variable undergoes a discrete shift in its level. Empirical evidence concerning reduced-form models is rather limited. Using the Duffie and Singleton (1999) framework, Duffee (1999) finds that these models have difficulty in explaining the observed term structure of credit spreads across firms of different qualities. In particular, such models have difficulty generating both relatively flat yield spreads when firms have low credit risk and steeper yield spreads when firms have higher credit risk.

The approach followed in this paper is different from the one adopted by the above mentioned empirical studies. Rather than examining the ability of currently available credit risk models to explain the actual behavior of secondary market yields or spreads, the attention is here focussed on the factors affecting bonds' primary market pricing. No theoretical model is assumed to lie behind bond pricing. As a consequence, an agnostic approach is adopted and the empirical analysis

[2] An empirical analysis of structural-form models can be found in Eom, Helwege and Huang (2001).

[3] During the second part of the nineties, both banks and consultants started developing credit risk models aimed at measuring the potential loss, with a predetermined confidence level, that a portfolio of credit exposures could suffer within a specified time horizon (generally one year). These vaue-at-risk (VaR) models include J.P. Morgan's CreditMetrics® (Gupton, Finger and Bhatia, 1997), Credit Suisse Financial Products' CreditRisk$^+$® (1997),

investigates which factors affect bond issuance spreads rather than testing any theoretical model. While some studies have examined losses from defaults (Altman and Kishore, 1996), the systematic risk premia on bond returns (Elton et al., 2001), the determinants of secondary market spread changes (Elton et al., 2000), the term structure of credit spreads (Collin- Dufresne and Goldstein, 2001), and the relationship between bond spreads over Treasury yields and the level of interest rates (Collin-Dufresne et al., 2002)[4], to the best of our knowledge no study has empirically examined the relevance of different factors in determining corporate bonds' issuance spreads.

More specifically, this study differs from previous empirical research in three main respects. First, data on eurobond issues completed by almost 600 major corporations from 15 economically developed countries during the eleven year period from 1991 to 2001 have been empirically analyzed. Therefore, rather than focusing on the debt issued by each country's domestic capital market and denominated in the domestic currency by national firms, the empirical analysis is based on internationally issued eurobonds denominated in different currencies.

Second, issuance spreads rather than secondary market ones are used as the dependent variables. This has two main advantages. First, yields on new issues reflect actual transaction prices rather than brokers' "indicative prices", estimates derived from pricing matrices or dealers' quotes. As such, they provide a more accurate measure of the actual risk premium demanded by investors. Second, primary market spreads represent a better measure of the actual cost of debt faced by bond issuers.

Finally, this study examines the effects on bond primary market spreads of factors that, to the best our knowledge, have not been considered by previous empirical studies. These factors concern three main aspects: (i) the primary market efficiency, investigated by variables such as the number of managers and the total amount of fees charged to the bond issuer, (ii) the issuance technique, analyzed by variables such as the bond pricing (fixed-pricing versus open-pricing), and the use of private placement versus public issue, and (iii) some issue characteristics, such as its being a registered security versus a bearer one, and the presence of specific clauses such as negative pledge, cross-default and *force-majeure*.

McKinsey's CreditPortfolioView® (Wilson, 1998), and KMV's CreditPortfolioManager®. These models can largely be seen as reduced-form models. See Gordy (2000).

Several interesting results emerge from the empirical analysis. First, the ratings of corporate bonds whether provided by Moodys' or Standard & Poors' are the most important factor determining the spreads between the yield to maturity of corporate bonds and that of equivalent Treasury securities. Indeed, ratings explain a significant portion of eurobonds spread cross-sectional variability. Second, bond investors' reliance on rating agencies' judgements has increased over time during the sample period. Third, while a bond's expected tax treatment - as measured by variables such as its annual coupon and its being a registered or a bearer bond - represents a relevant factor explaining spreads cross-sectional variability, the primary market efficiency - as measured by variables such as the amount of fees charged to the issuer, the number of managers in the bond issuing syndicate, and the issuance process (private placement versus public issue and fixed-priced versus open-priced ones) - and the expected secondary market liquidity appear as poor explanatory variables. The same poor result emerge for variables measuring specific bond's clauses, such as negative pledge, cross-default and *force majeure*. While in some cases statistically significant, these variables appear to be relatively poor in explaining corporate bonds cross-sectional issuance spread variability. Fourth, empirical evidence shows that rating agencies adopt a different, "through the cycle", evaluation criteria of obligors' creditworthiness with respect to the forward looking one adopted by bond investors. Fifth, even after controlling for bond ratings, subordinated bonds tend to pay higher spreads than senior ones. This indicates that bond investors require a higher premium to subordinated bonds than the one implicit in the downgrading technique used by rating agencies. However, this effect decreased during the nineties, indicating that rating agencies improved their evaluation of subordinated bonds. Finally, rating agencies discordance, as measured by a different numeric equivalent value of the assigned rating notch, appears to be perceived by bond investors as a sign of (or simply reflects) a higher degree of uncertainty concerning the issuer's default risk.

This paper proceeds as follows. Section 2 presents the methodology of the empirical analysis. Section 3 describes the data sources and summarizes sample characteristics. Section 4 presents the empirical results. Section 5 concludes.

[4] Collin-Dufresne et al. (2002) investigate the relation between corporate bond yields over Treasuries and find that yield spreads fall when the level of the Treasury term structure rises. This effect is apparently larger for lower rated bonds than for top-notch rated bonds.

2. RESEARCH METHODOLOGY

The empirical analysis presented in this study is restricted to eurobond issues – for which data on ratings and spreads were available or computable - completed by Canadian, European (Austrian, Belgian, Danish, Dutch, French, German, Italian, Norwegian, Spanish, Swedish, Swiss and UK), Japanese and U.S. companies during the 1991-2001 eleven year period. The choice of eurobonds as the target debt instrument of the empirical analysis is based on two main factors. First, eurobonds are issued in relatively large amounts in a highly competitive market where different kind of investors (mostly institutional ones) from different countries actively participate[5]. These factors in turn enhance the market efficiency and liquidity and minimize the risk of price anomalies which would make spread comparisons more difficult. Second, the eurobond market is a relatively unregulated one where issues are not subject to queuing or other costly procedures, listing only occurs for a minority of the issued amount in order to meet institutional investors needs, investors are not subject to withholding tax, and bonds are mostly in bearer form. All these factors significantly enhance bond spreads comparability.

Eurobonds issuance spreads over the corresponding maturity Treasury bonds reflect investors' perception of the risk of loss and of the bond primary and secondary market efficiency and liquidity conditions. As such, they are a function of five main factors:

(1) the bond issuer default risk[6];

(2) the bond's expected recovery rate in case of default;

(3) the expected liquidity of the secondary market of the bond issue;

(4) the expected tax treatment to which investors will be subject;

(5) the bond's primary market efficiency conditions.

Following this reasoning, our empirical analysis involves regressions[7] of the following form:

[5] See Levich (2001) for a general overview of the eurobond market.

[6] The term default risk is here used to indicate both a specific risk component ("default premium") and a systematic risk component ("risk premium"). Recent empirical studies indicate that a significant part of the spread between corporate and Treasury bonds cannot be explained by a default premium and should be attributed to a risk premium (Elton et al., 2001; Collin-Dufresne et al., 2002). These studies find a common systematic factor to be a major determinant of corporate bond spread changes. Using secondary market spreads on U.S. bonds for the 1987-1996 ten year period, Elton et al. (2001) explain this risk premium with the fact that bond spreads and returns vary systematically with the same factors that affect common stock returns.

(1) $$SPREAD_i = f\left(DEFAULT_i, RECOVERY_i, LIQUIDITY_i, TAX_i, EFFICIENCY_i\right) + \varepsilon_i$$

where:

$SPREAD_i$ = the difference between the yield to maturity at launch of issue i and the yield to maturity of a corresponding currency Treasury security[8] with a similar maturity;

DEFAULT = the default risk of issue i;

$RECOVERY_i$ = the expected recovery rate in case of default of issue i;

$LIQUIDITY_i$ = the expected secondary market liquidity of issue i;

TAX_i = the expected tax treatment of issue i;

$EFFICIENCY_i$ = the efficiency of the primary market for issue i.

Note that, in contrast to most of the studies conducted using bonds' spreads data, this study is based on primary market spreads. The use of secondary market spreads is avoided because of the relatively poor liquidity of the secondary market for some minor eurobond issues. In addition to that, yields on new issues reflect actual transaction prices rather than brokers' "indicative prices", estimates derived from pricing matrices or dealers' quotes[9]. As such, they provide a more accurate measure of the actual cost of subordinated debt for banks and of the risk premium demanded by investors. Using primary market spreads also permits use of "fresher" ratings because ratings of new issues reflect the raters' assessment near the time of issuance.

Following this approach, the independent variables used in the empirical analysis can be grouped according to their ability to proxy one of the above mentioned factors.

(1) Default and Recovery Risk

These two factors are examined jointly as the most relevant explanatory variable of a bond's default risk, the bond's rating, is also a function of its expected recovery rate in case of default. The following variables are used as proxies for the bonds' default and recovery risk.

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[7] Despite the cross-sectional nature of the empirical analysis, some temporal variation is present as many banks issued SND more than once over the sample period. Regressions with the inclusion of fixed effects are also estimated.

[8] Interpolated yield curves are used when no Treasury security of similar maturity is available. Spreads for Euro denominated issues are computed using either the French OAT or the German Bund yield curve, depending on the closest available maturity.

[9] Secondary market prices can even be misleading if dealers quote strategically. Assume a dealer does not want to buy a specific bond. She would quote a higher price which would in turn signal high demand and a lower spread. For more on the problems related to secondary market prices and spreads, see Hancock and Kwast (2001).

RATING Rating dummies. Each dummy variable is equal to 1 if the average Moodys' and Standard & Poors (S&P) rating[10] has the corresponding numeric grade and zero otherwise[11]. These dummy variables should capture the difference in both issuers' creditworthiness and bonds' seniority and security structures[12].

SUBO A dummy variable that equals 1 if issue i is a subordinated one and zero if it is a senior one. This variable controls for the seniority of the issue. The expected coefficient sign is positive, as subordinated issues have a lower expected recovery rate in case of default than senior bonds and therefore require a higher return. However, its statistical significance could be poor as subordination is already reflected in the rating of a bond issue[13].

BANK A dummy variable that equals 1 if the issuer is a bank and zero otherwise. This variable should control for the presence of implicit government guarantees, such as too-big-to fail ones, that are not already incorporated into an issue rating.

BUILD, CHEM, COMP, ELE, ENE, ENGI, FINANCIAL, FOOD, HEALTH, HOTEL, INDU, INSU, MANU, MEDIA, OIL, RAIL, RETAIL, TELE, TRANS, OTHERINDU[14] – Industry dummies equal to 1 if the eurobond issuer's main activity is in the corresponding industry, 0 if not. These variables should capture investors'

[10] These are ratings assigned by one or both rating agencies to the single issue at the time of issuance. As such, they reflect both the issuing company creditworthiness and the bond seniority and security structure.

[11] Empirical results are based on the average numerical value of the ratings assigned by S&P and Moody's when both ratings are available (rating scales are presented in Table 12). When this average value is not an integer number, rounding to the lower (less risky) value has been applied. An alternative based on the lower integer value has been tested and found to produce similar results.

[12] Ratings have been shown to present relevant limitations as leading indicators of credit quality. Using equity and liability data for US firms, Delianedis and Geske (1999), construct alternative credit risk measures and compare their forecasting performance to that of ratings. They find these accounting based measures to increase well in advance of rating downgrades and conclude that ratings are slow in reacting to new evidence. Comparing actual market values and ratings for a large number of dollar-denominated international bonds, Perraudin and Taylor (1999) report highly persistent inconsistencies between ratings and prices (a bond's price is defined as inconsistent with its rating if it is above/below the price it would have if it were valued using yields corresponding to a higher/lower rating category. However, these empirical studies are based on the use of spread changes and tend to focus on the limitations of ratings as leading indicators of credit quality. Since our attention is focussed on the cross-sectional variability of issuance spreads, these limitations should be much less relevant.

[13] Rating agencies tend to rate subordinated issues one notch below the corresponding issuer senior debt rating if the latter is investment grade and two notches below if it is speculative grade.

[14] Each industry's complete name is reported in Table 7. The OTHERINDU variable includes industries for which less than 10 observations were available. These include airlines, aerospace, agribusiness, consultancy, education, iron & steel, luxury goods, mining, real estate, tobacco, textile, packaging, glass and ceramics, metals and ores. The OTHERINDU dummy variable has been dropped to avoid collinearity in the data.

expectations concerning specific industries evolving economic conditions that are not already implicitly reflected in the average rating of those industries. A positive coefficient would indicate that investors' perception concerning the industry's prospects are worst than the ones implicit in the corresponding issues ratings, and viceversa.

MATU The time to maturity (in years) of the issue. This affects the bond's default risk premium (Merton, 1974). A positive coefficient is expected as longer maturity bonds require, *ceteris paribus*, a higher spread.

In addition to the above ones, the following three variables, only available for a portion of the sample eurobond issues (see Table 2), are used in one regression specification as additional proxies for a bond's default and recovery risk.

PLEDGE A dummy variable that equals 1 if the bond issue has a negative pledge clause and zero otherwise[15]. A negative coefficient sign is expected as investors would benefit from such a clause.

CROSS A dummy variable that equals 1 if the bond issue has a cross-default clause and zero otherwise[16]. A negative sign is expected as investors would benefit from such a clause.

FORCE A dummy variable that equals 1 if the bond issue has a *force majeure* clause and zero if not[17]. A positive coefficient sign is expected as investors would be penalized by such a clause and would in turn require a higher return[18].

(2) Liquidity

Only one variable is available to proxy for a bond's expected secondary market liquidity.

[15] The negative pledge clause avoids the possibility for the issuer to use part of its assets as collateral for future debt obligations. No security can therefore be afforded to other creditors.
[16] The cross-default clause avoids the possibility of selective default on the part of the issuer. If the issuer is insolvent on one loan or bond issue, it is automatically considered as insolvent on all other loans and obligations.
[17] The *force majeure* clause allows the bond issuer to reimburse the outstanding bonds if a major exogenous event occur.
[18] It must be noted that 99.53% of the eurobond issues for which information is available (2,758 over 2,771) do include this clause (see Table 2).

AMOUNT The natural log of the bond issue US dollar equivalent amount (face value). A higher issue amount is generally believed to improve, *ceteris paribus*, secondary market liquidity. A negative coefficient sign is therefore expected for this variable[19].

(3) Tax

The following variables are used as proxies for a bond's expected tax treatment.

COUPON The level of the annual coupon paid by the bond. The effect of this variable on the bond spread depends on the relative tax rates of capital gains and interest income to which eurobond investors are subject. In some countries these two tax rates are different. Given the wide range of nationalities of eurobond investors, the a priori effect of COUPON on the bond after tax value is uncertain. In addition to that, as most eurobonds are in bearer form, avoiding tax is relatively easy for investors. However, since in most countries capital gains are paid at the time of sale, bonds with lower coupons may be more valuable because some taxes are postponed until the time of sale and because the holder of the bond has control over the time when these taxes are paid (tax timing option). A positive coefficient is therefore expected.

REG A dummy variable that equals 1 if the bond is a registered one and zero if it is in bearer form. A positive coefficient sign is expected as eurobond investors would find it easier to avoid tax payments in the case of bearer bonds[20].

(4) Bond's primary market efficiency

The following variables are used as proxies for a bond's primary market conditions.

MANAGERS - The number of financial institutions participating in the bond issuance management group. These include the book runners, the lead manager, any co-lead manager, and co-managers. A negative coefficient sign is expected as this would indicate that a larger syndicate is able to achieve, ceteris paribus, a larger number of potential

[19] Another variable that is generally believed to affect a bond's market liquidity is its age. This measure rests on the belief that newly issued bonds are more liquid than bonds that have been in the market for a longer period of time (Elton et al, 2000). However, our sample bonds are all newly issued as the empirical analysis is based on issuance spreads.
[20] Only 4.67% of the sample eurobond issues (159 over 3,403) are registered (see Table 2).

investors. This would in turn result in a higher demand for the issuing bonds and in a lower spread[21].

PRIVATE A dummy variable that equals 1 if the bond issue is a private placement and zero if it is a public issue[22]. Other things equal, private placement represents a less efficient issuance process than public issues as a smaller number of potential investors is directly reached with this kind of issues. A negative coefficient is expected as investment banks are generally able to exploit a stronger placing/selling power in a private placement issue than in a public one.

FEES The amount of gross fees charged by the bond issuance syndicate to the issuer. These include underwriting fees, management fees and selling concession[23]. No clear theoretical a priori conclusion can be reached as far as the expected coefficient sign of this variable is concerned. Other things equal, a negative sign would indicate that the issuing syndicate members are able to translate the higher fees charged to the issuer to the final investors through a lower spread. On the other side, a positive coefficient sign would indicate that a sort of performance-related incentive scheme, whereby the fees paid by the issuing firm to the syndicate members are negatively related to the cost for the issuer, is in place.

FIXED A dummy variable that equals 1 if the eurobond issue is a fixed priced one and zero if it is an open priced one. While in a fixed-priced issue the investment banks of the underwriting group set the issuing price according to their estimates of the demand and supply for the issuing bonds, in an open-priced one the final investors play a role in determining the actual issuance price. As the investment banks participating in the management group take a higher underwriting risk with fixed-priced issues than with open-priced ones, a more efficient primary market would be achieved in this kind of

[21] Note that the eventual higher issuing costs for the issuer associated to a larger number of syndicate members is already captured by the FEES variables. Quite surprisingly, these two variables are correlated in a statistically significant way. Their Pearson correlation coefficient is indeed relatively low (0.306) and not statistically significant. In addition to that, MANAGERS is not statistically significantly correlated with the AMOUNT variable. Indeed, the Pearson correlation coefficient is negative (-0.114), indicating that larger issues are not associated with a higher number of managers.

[22] Only 15 of the 3,403 sample eurobonds are issued through a private placement (see Table 2).

[23] The selling concession is a fee paid by the issuer to the members of the selling group in the form of a discount on the price of the bonds.

issues. This should in turn result in a lower spread. For this reason, a negative coefficient sign is expected for this variable.

(5) Control variables

The following control variables have been included as additional independent variables in the regressions.

DEM, DFL, EURO, FFR, STG, USD, OTHERCUR – Currency dummies. Each dummy variable is equal to 1 if the eurobond issue is denominated in the corresponding currency and zero otherwise[24]. These variables should capture both the different credit standing and liquidity of the different national Treasury securities and eurobonds investors' currency preferences[25].

QI-91, QII-91, QIII-91, QIV-91, QI-92, …, QIV-01 – Quarter and year dummies. Each dummy variable is equal to 1 if issue i has been completed during the corresponding quarter and year and zero otherwise. These variables should capture the variations in bond market conditions[26].

AUS, BEL, GER, FRA, JNP, ITA, NET, SPA, SWI, UK, USA, OTHERCOU – Country dummies. Each country dummy variable is equal to 1 if the issuer nationality is the same of the corresponding country and zero otherwise[27]. These should capture cross-country differences in macroeconomic conditions[28].

Recent empirical studies indicate that several characteristics of corporate bonds beyond rating categories convey information about their pricing (Elton et al., 2000). These include maturity, coupon, time from issuance, trading volumes and face value. The empirical analysis presented is consistent with these results as it is based on cross-sectional regressions where the corporate bond issuance spread is used as the dependent variable and maturity, coupon, time from issuance, and

[24] This is a relevant factor because of the different credit standing and liquidity of Treasury securities. The spread of a eurobond issue is computed as the difference between the eurobond yield to maturity and the equivalent Treasury one. A U.S. dollar denominated eurobond issue could, other things being equal, have a higher spread than an Italian lira denominated one simply because the Italian Treasury security has a lower credit quality and liquidity than the U.S. one.
[25] The OTHERCU dummy variable has been dropped to avoid collinearity in the data.
[26] The QI-91 dummy variable has been dropped to avoid collinearity in the data.
[27] In many cases, eurobond issues are completed by wholly owned subsidiaries located in fiscal havens such as the Cayman Islands or the Bahamas. In such cases, the country of the parent company has been considered as the relevant one.
[28] The OTHERCOU dummy variable has been dropped to avoid collinearity in the data.

face value are all used as independent variables. Since time from issuance is equal to zero for all sample corporate bonds and trading volumes are not available when issuance spreads are used instead of secondary market ones, this means that all the above mentioned factors, with the only exception of trading volumes, are taken into consideration.

All independent variables are discrete with the only exception of MATURITY, AMOUNT, COUPON and FEES, which are continuous. Both regressions based on OLS and with the inclusion of fixed effects are estimated. Comparing the fixed effects and OLS estimates reveals whether variation in the independent variables *within* a corporate issuer affects the spreads differently than *between* issuers.

3. DATA SOURCES AND SAMPLE CHARACTERISTICS

The data are from two main sources: Capital Data BondWare and Moody's Corporate Default. Capital Data reports information on the major debt and equity issues worldwide. As far as eurobonds are concerned, Capital Data Bondware provides information on both issuers (nationality, industry, etc.) and issues (Moody's and Standard & Poors' rating, currency, closing date, years to maturity, spread at issuance, issue type, face value, coupon, subordination, gross fees, number of managers, cross-default and other clauses). All bonds with special features (e.g. callable bonds, perpetual bonds, floating rate bonds) that would result in their being priced differently have not been included in the empirical sample. Spreads at issuance for all issues of fixed rate, non-convertible, non-perpetual and non-callable eurobonds during the 1991-2001 were collected. This sample has 5,482 eurobonds, of which 476 were issued by companies of developing or minor countries such as Chile, Bulgaria, Malta, Mexico and Russia. Of the remaining 5,006 bond issues, 1,602 were issued by central banks, supranational institutions, central or local governments. These were not considered as the empirical analysis is focussed on corporate bonds. The remaining sample has 3,403 eurobonds issued by 590 corporations from 15 different countries (Table 4).

The resulting sample of 3,403 eurobond issues suffers from two potential selection biases. First, a relatively larger number of eurobonds has been issued during the second part of the nineties than during the first part. This is partly the consequence of a general increase in the average number of eurobond issues, and partly the consequence of the availability of Moodys and Standard & Poors ratings. Second, companies tend to issue eurobonds when the market is more receptive. The total

number of sample issues is particularly low in the third and fourth quarter of 1998, when the Russian crisis occurred, and particularly high during 1999[29], during a low interest rate environment. However, these biases should not limit the adequacy of the empirical sample as a basis for answering the key question of this study. If a variable appears to be statistically significant in explaining the cross-sectional variability of eurobond spreads, then this result should hold independently of the two above mentioned potential biases.

Moody's and S&P ratings at issuance for these 3,403 issues are either from Capital Data BondWare or from the Moody's January, 2001 release of Moody's Corporate Default Database. The latter is a complete history of Moody's long-term rating assignments for both U.S. and non-U.S. corporations and sovereigns. Both ratings on individual bonds and issuer ratings are included, as are some bond and obligor characteristics such as borrower names, locations, CUSIP identifiers, ultimate parent companies, bond issuance dates, original maturity dates, seniority, and coupon.

Eurobonds are issued either directly or through wholly owned subsidiaries located in tax havens such as Luxembourg, the Cayman Islands, the Bahamas and Jersey. Information on the parent company for these issues is either from Capital Data BondWare or from Moody's Corporate Default. Detailed information on sample characteristics is provided in Tables 1, 2, 3, 4, 5, 6 and 7. Table 11 and 12 provide information on ratings scales and ratings availability and concordance[30] for the empirical sample. Both Moodys' and S&P ratings are available for 1,581 eurobond issues which represent 46.5% of the entire sample issues. For the remaining 1,822 issues (53.5% of the sample) only one of the two ratings is available. When both ratings are available, the corresponding numerical value is the same in 70.7% of the cases (1,117 issues) and is different by one notch only in 24.9% of the cases (394 issues).

4. EMPIRICAL RESULTS

4.1. Descriptive analysis

Tables 3, 4, 5, 6 and 7 provide information on the sample eurobond issues characteristics by country of issuer, year of issuance, rating category, currency of denomination and industry of the

[29] See Figure 7.
[30] The term "concordance" is here used instead of the "agreement" one used by other studies as rating agencies do not map their rating scales to each other. For an analysis of rating agencies evaluation criteria and performance see Cantor and Packer (1994).

issuer. Table 3 reports the main features of the sample issues by year of issuance. The total amount issued per year has grown from less than 40 billion U.S. dollars in 1991 to almost 180 billion U.S. dollars in 2001, with the average issue amount growing from just over 200 million U.S. dollars in 1991 to almost 500 million U.S. dollars in 2001. Table 3 also shows that the average spread has significantly risen during the last five years, from 23.63 in 1996 to 131.16 in 2001. During the same time period the average rating has significantly worsened, from 2.51 (equivalent to AA+/AA in the S&P scale and Aa1/Aa2 in the Moodys' one) in 1991 to 4.77 in 2001 (approximately equivalent to A+ in the S&P scale and A1 in the Moodys' one).

As shown by Table 4, most of the sample issues have been completed by German, US, UK, Dutch and French issuers. Together, they account for almost 80% of the number of issues and for slightly more than 80% of the total sample eurobond amount issued. The average spread is significantly higher than the total sample average for Italian, Spanish, UK and US issuers. However, these countries' eurobond issues also have the worst average rating. This apparently indicates that the higher spread is simply a consequence of the higher default risk perceived by eurobond investors.

Table 5 reports the main features of the sample issues by rating category. Most of the sample eurobond issues have a rating in one of the first six notches (from AAA to A in the S&P scale and from Aaa to A2 in the Moodys' one). Indeed, these rating classes account for almost 90% of the sample number of issues and for over 85% of the total sample issued amount. Average spreads per rating category are monotonically increasing with rating values, with the exception of class 9, and classes 12, 19, 20 and 21, for which an irrelevant total number of issues (12) is available. This clearly indicates that spreads increase as ratings worsen. Note that bank issuers are mostly concentrated in the top four rating classes (from AAA/Aaa to A+/A1).

Table 6 reports the main features of the sample issues by currency of denomination. The majority of the sample eurobond issues are denominated in three currencies: Euro, British pound sterling and U.S. dollar. Issues denominated in these currencies account for 64.6% and 76.6% of the total number of sample issues and total amount issued respectively. Euro denominated issues have a higher than average spread (108.5 basis points compared to a sample average of 69.9 basis points), a higher that average rating (4.67 versus 3.30) and a higher than average issue amount (U.S. dollar 472.9 million versus 309.2 million). These differences are mostly the consequence of the fact that

most Euro denominated issues have been completed in the last four years (1998 to 2001), when the bond markets conditions were worst and average amounts issued were higher than in the previous sample years (see Table 3).

Finally, Table 7 reports the eurobond sample composition by industry of the issuer. The majority of the sample issues have been completed by banks (54.4% of the total number of issues and 48.8% of the total amount issued) and financial corporates (19.3% of the total number of issues and 21.0% of the total amount issued). Together with energy & utility, food & drink, and railways companies, these are also the type of issuers with the lowest average spread and the best average rating. On the opposite side, computer & software, telecom, hotel & leisure, media & publishing, and manufacturing companies are the type of issuers paying the highest average spread and having the worst average rating. Together with electronics and electrical companies, computer & software and telecom issuers also present a significantly higher average amount per issue than the sample average.

4.2. Regression analysis

Column 1 of Table 8 reports OLS estimates of regression coefficients together with standard F statistics. F test for whether rating coefficients are jointly different from zero (Fb) as well as adjusted R^2 are reported at the bottom of the table. All rating dummies are statistically significant at the 1% level (Aaa/AAA is the omitted rating category). The monotonic pattern of most dummy coefficients indicates that spreads rise when ratings worsen. MATU and REG both have strongly statistically significant coefficients with the expected signs. SUBO has a statistically significant positive coefficient, indicating that eurobond investors require subordinated bonds a higher risk premium than the one implicit in the downgrading applied by rating agencies. Many industry dummy variables have statistically significant positive (TELE) or negative (AUTO, COMP, ELE, ENE, MEDIA,) coefficients. This result is relatively surprising as ratings should already capture different industries' economic prospects. While a clear interpretation of this empirical result is difficult to provide, one possible explanation is a difference between the evaluation criteria used by rating agencies and capital markets. Rating agencies tend to evaluate firms "through the cycle" as opposed to "point in time" (Carey and Treacy, 2000), so they generally produce ratings that do not incorporate the current state and perceived prospects of the economic cycle. Rather, a borrower's "ability to repay interest and principal" is evaluated under a worst case economic cycle scenario.

However, financial markets are forward looking and tend to price bonds according to the expected financial and economic conditions of the industries in which the issuers operate. Thus, different economic prospects for different industries could explain why industry dummies have incremental explanatory power relative to ratings dummies[31].

Quite surprisingly, AMOUNT is not statistically significant. This result is consistent with previous empirical evidence[32] and could be attributed to three main factors: (i) investors do not expect the liquidity of a eurobond's secondary market to be affected by the size of the issue, (ii) eurobond investors tend to hold these securities to maturity and are therefore indifferent to their secondary market liquidity, (iii) small size bonds are sold directly to investors by the investment banks of the issuing syndicate through their own distribution networks in an oligopolistic market which in turn allows them to price these issues at lower spreads than large size ones. COUPON has a positive statistically significant coefficient as expected, indicating that eurobond investors require a higher return to higher coupon eurobond issues due to their relatively worst tax treatment[33].

All reported currency dummies (DEM, DFL, EUR, STG and USD) have strongly statistically significant positive coefficients, indicating that those currencies denominated eurobond issues have higher spreads than other currencies denominated ones[34]. This result flows from the difference in the average credit standing and liquidity of the Treasury issues of those countries (Germany, France, UK and USA)[35]. Because spreads are computed by subtracting such Treasury yields from eurobond yields, eurobond spreads tend to be higher for Euro, U.S. dollar and pound sterling denominated issues. No country dummy variable is statistically significant. Most year and quarter dummies, not reported, are statistically significant.

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[31] As will be shown later, the statistically significant coefficients of some industries either change signs or become not significant from over time. This is coherent with the above interpretation as industries' economic prospects change over time.

[32] Analyzing yield differences between corporate bonds and medium-term notes (MTNs), Crabbe and Turner (1995) find no relation between size and yields of MTNs that have the same issuance date, the same maturity and the same issuer. Furthermore, they find that bonds and MTNs have statistically equivalent yields. This evidence contrasts the idea that large issues have larger liquidity and suggests that large and small securities issued by the same borrower are close substitutes.

[33] This empirical result is consistent with the one found by Elton et al. (2000).

[34] Other currencies include Australian dollar, Canadian dollar, Italian lira, Danish krone, Norwegian krone, New Zealand dollar, Spanish peseta, and Swedish krone.

[35] French or German governments Treasuries are used to compute euro denominated bond spreads, according to which of the two closest government bonds has the closer maturity to the one of the eurobond issue.

Finally, while MANAGERS and FEES are not statistically significant in explaining cross-sectional spreads variability, FIXED has a strongly statistically significant negative coefficient as expected, indicating that eurobond issuers manage to raise funds at a lower spread through fixed-priced issues than through open-priced ones. This result is most likely the consequence of the higher degree of primary market efficiency achieved through fixed-priced issues rather than eurobond investors requiring higher returns on open-priced issues. PRIVATE has a statistically significant negative coefficient as expected, indicating that the investment banks of the bond issuance syndicate are able to obtain funds for their borrowing clients at a lower rate through private placement than through public issues[36]. This result can be explained in two different ways. First, the lower disclosure and competition of the primary market for private placements than the public issues one make bond investors to rely more heavily on the information and advice provided by the investment banks of the bond issuance management and selling group. Second, public issues are generally subject to higher regulatory costs which, given the cost faced by bond issuers, absorb part of the yield. The adjusted R^2 of 0.892 indicates that ratings and other control variables explain a significant portion of eurobonds spreads cross-sectional variability. In addition to this, the adjusted R^2 computed using rating dummy variables only (adjusted R^2b) of 0.790 indicates that ratings represent the main factor explaining bonds issuance spreads.

Column 2 of Table 8 reports regression results for the same specification of column 1 obtained with the inclusion of fixed effects. Comparing the fixed effects and OLS estimates reveals whether variation in the independent variables *within* an issuer affects the spreads differently than *between* issuers. Results do not show any significant difference between standard OLS estimates and estimates obtained with the inclusion of fixed effects, therefore confirming the main conclusions reached above.

Column 3 of Table 8 reports regression results for the specification that includes the three additional dummy variables (FORCE, CROSS and PLEDGE) measuring bonds' default and recovery risk. As mentioned above, these variables are only available for a portion (80%) of the sample issues (2,735 over 3,403). The adjusted R^2 of 0.806 indicates that these variables do not add any significant explanatory power to the variables already included in the previous specification reported in column 1, for which an adjusted R^2 of 0.89 was reported. FORCE is the only

[36] It must be noted that only 15 private placement issues are available in our sample of eurobond issues. This could

statistically significant variable, with an unexpected negative coefficient, indicating that investors require a lower return to those eurobond issues that include a *force majeure* clause. The fact that bond features such as the cross-default and the negative pledge clauses - which are relevant factors determining both the issuers' default risk and the loss given default - are not statistically significant is most likely the result of the fact that they are already taken into account by rating agencies in their rating assignment process. Other results are similar to the ones obtained in the previous specification, with the only exception of FEES, which has a statistically significant negative coefficient as expected, and PRIVATE, which is not statistically significant. This is most likely the result of the different sample composition.

Table 10 reports the adjusted R squares and F-test results obtained running different regression specifications, including a different range of independent variables. Two main results emerge from this exercise. First, rating dummies are the most important factor in determining bonds' spreads. Indeed, the 0.858 adjusted R^2 obtained with control variables and rating dummies only compared to the 0.889 obtained with the inclusion of all independent variables indicates that ratings explain the most significant part of bond spreads' cross-sectional variability. Including other variables only slightly improves the adjusted R^2. Second, while liquidity (AMOUNT) and primary market variables (MANAGERS, PRIVATE, FEES, and FIXED) only slightly improve the adjusted R^2 obtained with control variables (from 0.194 to 0.197 and 0.262 respectively), including variables used to proxy for the expected tax treatment (COUPON and REG) significantly improves the resulting adjusted R^2 from 0.194 to 0.737. This result suggests that the expected tax treatment of a bond issue is the second most important factor in determining its issuance spread.

4.3. Has investors' reliance on rating agencies changed over time?

Separate regressions for the sub-sample of eurobonds issued between 1991 and 1996 (1,525 observations) and the ones issued between 1997 and 2001 (1,878 observations)[37] have been run in order to test for any temporal evolution in the relevant factors affecting bond issuance spreads. Results are reported in columns 4 and 5 of Table 8. Most rating dummies are statistically significant with the expected sign and the spread/rating statistical relationship is very similar for the two sub-

affect the statistical significance of this result.

[37] Separating recession years from expansion ones is difficult because of the international sample composition, with issuers from different countries with different economic cycles. A simpler separation criterion, based on the number of issues, has therefore been adopted.

samples (Figure 2). The adjusted R^2 increases from 0.708 for the 1991-1996 sub-sample to 0.902 for the 1997-2001 one, indicating that the identified independent variables improved their explanatory power over the nineties. This is mostly the consequence of the stronger explanatory power of the rating dummy variables, as indicated by the higher adjusted R^2b of the 1997-2001 sub-sample compared to the 1991-1996 one (0.824 vs. 0.424). This result indicates that investors' reliance on rating agencies judgements in order to assess the adequate risk premium for bonds has increased over time.

Five main differences between the two sub-samples emerge. First, SUBO is statistically significant in the 1991-1996 sub-sample only. This result is most likely the consequence of one or more of the following three factors: (i) a lower availability of subordinated issues in the first period (47) compared to the second one (138), (ii) the rating agencies' evaluation of subordinated bonds implied in their rating assignment process improving over time, and (iii) eurobond investors' perception of the difference in the expected recovery rate between senior and subordinated bonds decreasing over time. This in turn could be the consequence of a more informed judgement based on the more and better available information[38]. Second, most industry dummies are statistically significant in one period sub-sample and not statistically significant in the other one or they are statistically significant in both periods but with opposite coefficients' signs. This is typically the case for TELE, which has a negative and strongly significant coefficient in the first part of the nineties and a positive statistically significant coefficient in the second period sub-sample. This is most likely the result of bond investors changing their expectations concerning the economic prospects of telecommunication companies from an optimistic view of the first part of the nineties to a rather pessimistic one during the late nineties and early 2000s.

Third, while REG is not statistically significant in the 1991-1996 sub-sample, it is strongly statistically significant with the expected positive sign coefficient in the 1997-2001 sub-sample. Fourth, while MANAGERS is statistically significant in both time periods, its coefficient sign turns from negative to positive from the first to the second part of sample period. However, the coefficient of this variable is extremely low. Finally, while PRIVATE is not statistically significant in the first period sub-sample, it has a strongly statistically significant negative coefficient in the

[38] Most empirical studies on bonds' recovery rates appeared in the mid and late nineties. See Altman and Kishore (1996), Hamilton et al. (2000) and Van de Castle et al. (2000).

second period sub-sample. These final three differences are most likely the consequence of the different composition of the two sub-samples. Indeed, while most of the registered bonds have been issued during the 1997-2001 period, most of the privately placed issues were completed during the first half of the nineties[39].

4.4. Robustness checks

Variations of the specifications reported in column 1 of Table 8 were estimated in order to assess the robustness of the conclusions concerning the determinants of eurobond spreads. The first check of robustness regards the conclusion concerning the irrelevance of the issuer type reached with the use of the BANK dummy variable. This check has been performed by running separate regressions for the sub-sample of eurobonds issued by banks and other financial institutions and for the one of eurobonds issued by non-financial firms. Using a unique common sample could produce misleading results if bond investors evaluate these two type of issuers differently or if they attribute a different relevance to the same factors in the case of different issuer types. Results are reported in columns 6 and 7 of Table 8. Only few significant differences emerge between the two sub-samples. Once again, most rating dummies are statistically significant with the expected sign for both sub-samples and explain a significant portion of the spread cross sectional variability. The statistically significant rating dummies have very similar coefficients for the two sub-samples (see Figure 3). However, banks' eurobond issues are concentrated in the investment grade rating categories (from AAA/Aaa to BBB/Baa2). This result indicates that the lower perceived default risk of banks versus non-financial firms gets reflected in their better ratings. However, equally rated financial and non-financial firms are perceived by eurobond investors to have similar default risk[40]. SUBO is strongly statistically significant with a positive coefficient in the banks sub-sample only. This apparently indicates that eurobond investors perceive subordinated bonds issued by banks as more risky than what is implied in their rating. This result can be explained in two alternative ways. First, eurobond investors find it more difficult to evaluate the expected recovery rate in the case of banks' issued

[39] Only 19.5% of the registered bond issues have been completed during the 1991-1996 period (31 over 159), with 70% of them (110 over 159) having been issued during the last three sample years (1991-2001). Most of the few sample private placement issues (11 over 15) have been completed during the 1991-1994 four years period.

[40] This result is very important as far as the risk weights per rating bucket proposed by the Basel Committee for the standardized approach to minimum credit risk capital requirements are concerned (Basel, 2001). Indeed, while a different risk-weight for banks and corporates was reasonable in the original framework of the 1988 Capital Accord, this differential treatment has no economic justification once external ratings are introduced. A common, unique scale of risk-weights per rating bucket should indeed be adopted for both banks and non financial firms.

subordinated bonds because of a lower degree of disclosure and of the financial nature of most banks' assets. The higher degree of uncertainty gets translated in a higher required risk premium. Second, given the interest rate sensitivity of most banks' assets, it is more likely for banks than for non-financial firms that the same systematic factors determining insolvency also cause a decrease in the recovery rate. In such a case, the banks' default probability would be negatively correlated with the recovery. This adverse phenomenon would in turn be particularly exacerbated for subordinated bonds[41]. Finally, while no country dummy is statistically significant in the corporates sub-sample, both CAN and USA have statistically significant positive coefficients in the banks sub-sample. This is most likely the consequence of eurobond investors' perception of stronger explicit and/or conjectural government guarantees for European and Japanese banks than for Canadian and US banks (Sironi, 2002). Other minor differences between the two sub-samples, such as the statistical insignificance of PRIVATE in the banks specification[42] and the statistically insignificance of FIXED in the non-financial firms specification, are most likely the consequence of the different composition of the two sub-samples. The adjusted R^2 of 0.689 for the banks sub-sample compared to the 0.916 one for the non-financial firms sub-sample indicates that the independent variables used in the regressions explain a higher portion of non-financial firms' eurobond issues spreads variability than banks' ones. This result is mostly the consequence of the different explanatory power of rating dummies, as reflected in the different adjusted R^2b of 0.242 and 0.838 for the banks and corporates sub-samples, respectively.

Second, separate regressions using Moodys' ratings only (2,457 observations) and S&P ratings only (2,527 observations) were estimated as a check on the use of average ratings. Using the average numerical value of ratings coming from two different sources could produce misleading results if the two agencies adopt significantly different criteria in evaluating bonds' default and recovery risks. Results are reported in columns 8 and 9 of Table 8. No significant difference emerges between the two. First, most rating dummies are statistically significant with the expected sign for both sub-samples. Second, the spread/rating statistical relationship is very similar for the two rating scales (Figure 4). Third, as shown by the adjusted R^2 and by the calculated F-statistic for the null hypothesis that the coefficients on the subset of rating dummies jointly equal zero (Fb), in both cases ratings explain a significant portion of the eurobonds spreads cross-sectional variability.

[41] See Altman et al. (2001) for a literature review and an empirical analysis of this phenomenon.

SUBO is strongly statistically significant in the Moodys' sub-sample and only weakly statistically significant with a lower positive coefficient in the S&P sub-sample. This indicates that Standard & Poors' valuation of the lower expected recovery for subordinated bonds implied in its downgrading procedure is closer to the eurobond investors' perception of the recovery risk of subordinated bonds than the one implied in Moodys' rating assignment procedure. The statistically significant negative coefficients of ENE and ENGI in the Moodys' sub-sample apparently indicate that Moodys' ratings do not reflect eurobond investors' optimistic perception concerning the economic prospects of these industries. Other minor differences, such as the statistically significant positive coefficient of EUR in the S&P sub-samples are most likely the consequence of the different composition of the two sub-samples.

An additional regression has been run using the sub-sample of 1,581 eurobond issues for which both Moodys' and S&P ratings were available. In addition to investigating whether the regression results for this sub-sample present any statistically significant difference with respect to the ones related to the wider sample reported in column 1 of Table 8, this allows to test whether a different rating assigned by the two agencies has any statistically significant impact on bond issuance spreads. This is examined through the use of the DISCO dummy variable, which is equal to one if the two ratings have a different numeric equivalent value, irrespective of whether the difference is equal to one or more notches, and zero if they have the same equivalent value. Results are reported in column 10 of Table 8. No significant difference appears to exist as far as rating dummies' and other independent variables' statistical significance and coefficient. DISCO has a statistically significant positive coefficient, although relatively low, indicating that rating agencies discordance leads to a higher issuance spread. This is most likely the consequence of the bond investors interpreting the different rating agencies judgements as a sign of a higher degree of uncertainty concerning the default risk of the bond issuer and therefore demanding a higher risk premium.

Finally, a robustness check has been performed by running separate regressions for each G5 country issuers' eurobond issues[43]. This check is aimed at investigating whether the spread/rating relationship is different across countries and whether ratings represent the main factor determining bond spreads within every country. The results, reported in Table 9, show that the spread/rating

[42] Only six of the 1,851 banks' eurobond issues sub-sample are private placements.

relationship is both statistically significant and very similar for bonds issued by companies of G5 countries. Furthermore, most rating dummy coefficients show a monotonic pattern, indicating that spreads increase when ratings worsen. Finally, the adjusted R^2 obtained using rating dummies as the only independent variables (Adj. R^2b) is above 0.75 and very close to the normal adjusted R^2 for all countries' issues with the only exception of Japan, indicating that ratings are the most relevant factor behind bonds' issuance spreads.

5. CONCLUSIONS

This paper empirically investigated the main factors affecting corporate bond pricing. Yield issuance spreads on eurobond issues completed by almost 600 major corporations from 15 economically developed countries during the 1991-2001 period have been empirically analyzed. Five main results emerge from the empirical analysis. First, the ratings of corporate bonds whether provided by Moodys' or Standard & Poors' are the most important factor determining the spreads between the yield to maturity of corporate bonds and that of equivalent Treasury securities. Indeed, ratings explain a significant portion of eurobonds spread cross-sectional variability. Second, bond investors' reliance on rating agencies' judgements has increased over time during the sample period. Third, while a bond's expected tax treatment - as measured by variables such as its annual coupon and its being a registered or a bearer bond - represents a relevant factor explaining spreads cross-sectional variability, the primary market efficiency - as measured by variables such as the amount of fees charged to the issuer, the number of managers in the bond issuing syndicate, and the issuance process (private placement versus public issue and fixed-priced versus open-priced ones) - and the expected secondary market liquidity appear as poor explanatory variables. The same poor result emerges for variables measuring specific bond's clauses, such as negative pledge, cross-default and *force majeure*. While in some cases statistically significant, these variables are relatively poor in explaining corporate bonds cross-sectional issuance spread variability. Fourth, empirical evidence shows that rating agencies adopt a different, "through the cycle", evaluation criteria of obligors' creditworthiness with respect to the forward looking one adopted by bond investors. Finally, rating agencies discordance, as measured by a different numeric equivalent value of the assigned rating notch, appears to be perceived by bond investors as a sign of (or simply reflects) a higher degree of uncertainty concerning the issuer's default risk.

[43] These are also the only countries for which a relevant number of observations (over 150) is available.

These findings are relevant for different classes of capital market participants. First, corporations wishing to raise funds in the bond markets can get a reasonable estimate of the average spread that they would face given their rating and the maturity of their funding needs. Second, investment banks in charge of designing bonds' technical features and of fixing issuance prices can find the estimates concerning the size of each factor's impact on the issuance spread as useful tools. This is particularly true for aspects such as private placement versus public issues, registered versus bearer bonds, fixed versus open-priced issues, and bond specific clauses such as cross-default, negative pledge and *force majeure*. Third, rating agencies are provided with empirical information concerning the way their evaluations get translated into average spreads by the capital markets and, most importantly, which factors – such as subordination and industry prospects - are not adequately taken into account by ratings or perceived differently by private investors. Finally, the empirical findings of this paper are relevant for bank regulators. More specifically, the result concerning the increasing reliance of bond investors on ratings must be carefully evaluated given the weaknesses of rating agencies evaluations highlighted by recent empirical studies. Furthermore, the estimated spreads per rating category shows a much steeper risk/rating relation than the one implied in the risk-weight per rating bucket framework recently proposed by the Basel Committee on Banking Supervision for the standardized approach to credit risk capital requirements.

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Table 1 - Sample Descriptive Statistics – Continuous variables

SPREAD the difference, measured in basis points, between the SND yield (at issuance) and that of a Treasury security of comparable maturity denominated in the same currency.
MATURITY the time to maturity (in years) of the issue.
AMOUNT the U.S. dollar-equivalent amount of the issue (US$ m).
RATING the corresponding ordinal number (Table 6) of the average Moody's and Standard & Poors issue rating.
COUPON the annual coupon (percent).
MANAGERS the number of financial institutions participating in the issuing syndicate.
FEES the total gross fees (%) charged by the eurobond issuance syndicate (u/w, management and selling fees).

	Spread	Maturity	Amount	Rating	Coupon	Managers	Fees
N	3,403	3,403	3,403	3,403	3,403	3,403	3,307
Mean	69.9	7.2	309.2	3.3	6,56	13,29	1,35
Median	40.0	5.1	238.6	2.0	6,25	12,00	1,63
Mode	20.0	5.0	200.0	1.0	6,00	1,00	1,88
Min.	-13.0	1.0	0.1	1.0	0,00	1,00	0,02
Max.	1,014.0	50.0	4.597.9	21.0	16,00	54,00	3,50
Std. Dev.	113.8	5.0	300.5	3.2	1,95	9,79	0,75

Table 2 - Sample Descriptive Statistics – Dummy variables

SUBO a dummy variable that equals 1 if the issue is subordinated and zero if it is senior.
REG a dummy variable that equals 1 if the bond is registered and zero if it is in bearer form.
CROSS a dummy variable that equals 1 if the bond issue includes a cross-default clause and zero otherwise.
PLEDGE a dummy variable that equals 1 if the bond issue includes a negative pledge clause and zero otherwise.
FORCE a dummy variable that equals 1 if the bond issue includes a force majeure clause and zero otherwise.
PRIVATE a dummy variable that equals 1 if the bond issue is a private placement one and zero if it is a public issue.
FIXED a dummy variable that equals 1 if the bond issue is fixed priced and zero if it is open priced.
BANK a dummy variable that equals 1 if the bond issuer is a bank zero otherwise.

Dummy Variable	SUBO	REG	CROSS	PLEDGE	FORCE	PRIVATE	FIXED	DISCO
N. of issues for which data is avail.	3,403	3,403	2,808	2,826	2,771	3,403	3,403	1,117
N. of issues for which dummy = 1	195	159	1,722	1,727	2,758	15	2,528	464
% of Total available data	5,73%	4,67%	61,32%	61,11%	99,53%	0,44%	74,29%	41,54%

Table 3 - Sample Descriptive Statistics – Corporate Eurobond Issues by Year of Issuance

Year of Issuance	Total number of issues	% Total Number of Issues	N. of Bank Issues	% Bank Issuers	Average Spread (b.p.)	Average Rating	Total Amount (US$ m)	% Tot. Amount Issued	Average Amount (US$ m)	Average Maturity (years)
1991	189	5.6%	85	45.0%	61.64	2.52	39,248	3.73%	207.7	6.68
1992	202	5.9%	101	50.0%	51.16	2.49	48,988	4.66%	242.5	7.02
1993	254	7.5%	130	51.2%	45.85	2.57	74,720	7.10%	294.2	7.69
1994	220	6.5%	135	61.4%	29.07	2.50	51,639	4.91%	234.7	6.38
1995	218	6.4%	127	58.3%	24.52	2.30	54,054	5.14%	248.0	6.02
1996	442	13.0%	308	69.7%	23.63	2.52	106,536	10.13%	241.0	6.06
1997	347	10.2%	233	67.1%	27.41	2.69	91,776	8.72%	264.5	6.36
1998	311	9.1%	179	57.6%	72.66	3.47	94,991	9.03%	305.4	8.17
1999	504	14.8%	234	46.4%	111.81	4.29	193,696	18.41%	384.3	7.99
2000	359	10.5%	172	47.9%	129.85	4.32	118,436	11.26%	329.9	7.54
2001	357	10.5%	147	41.2%	131.16	4.77	177,960	16.92%	498.5	8.50
Total	***3,403***	***100.0%***	***1,851***	***54.4%***	***69.86***	***3.30***	***1.052.045***	***100.00%***	***309.2***	***7.21***

Table 4 - Sample Descriptive Statistics - Corporate Eurobond Issues by Country of Issuers

Country	Total # of issues	% Tot. # of Issues	# of Issuers	Avg. # of Issues per Issuer	N. of Bank Issues	% Bank Issuers	Avg. Spread (b.p.)	Avg. Rating	Total Amount (US$ m)	% Tot. Amount Issued	Average Amount (US$ m)	Average Maturity (years)
Austria	80	2.4%	16	5.0	70	87.5%	49.9	2.05	19,831	1.9%	247.9	7.33
Belgium	79	2.3%	13	6.1	59	74.7%	44.0	3.30	12,512	1.2%	158.4	6.09
Canada	102	3.0%	26	3.9	36	35.3%	61.6	3.41	16,536	1.6%	162.1	5.48
Denmark	23	0.7%	7	3.3	15	65.2%	44.6	2.96	3,460	0.3%	150.4	6.84
France	420	12.3%	60	7.0	226	53.8%	52.6	2.94	141,836	13.5%	337.7	7.98
Germany	739	21.7%	59	12.5	587	79.4%	46.9	2.19	228,581	21.7%	309.3	6.28
Italy	32	0.9%	16	2.0	9	28.1%	124.7	6.63	27,540	2.6%	860.6	8.03
Japan	168	4.9%	30	5.6	81	48.2%	38.8	1.54	61,442	5.8%	365.7	6.61
Netherlands	470	13.8%	49	9.6	367	78.1%	48.2	2.22	149,643	14.2%	318.4	6.68
Norway	25	0.7%	7	3.6	3	12.0%	64.5	2.12	5,626	0.5%	225.0	6.80
Spain	46	1.4%	19	2.4	7	15.2%	107.6	5.07	19,760	1.9%	429.6	7.68
Sweden	83	2.4%	25	3.3	33	39.8%	96.1	4.69	23,778	2.3%	286.5	6.35
Switzerland	47	1.4%	12	3.9	28	59.6%	58.1	3.11	11,533	1.1%	245.4	5.59
UK	518	15.2%	136	3.8	153	29.5%	113.9	5.15	168,572	16.0%	325.4	10.26
USA	571	16.8%	115	5.0	177	31.0%	99.5	4.42	161,396	15.3%	282.7	6.37
Total	**3,403**	**100.0%**	**590**	**5.8**	**1,851**	**54.4%**	**69.9**	**3.30**	**1,052,045**	**100.0%**	**309.2**	**7.21**

Table 5- Sample Descriptive Statistics - Corporate Eurobond Issues by Average Rating Class

Rating Class	Total number of issues	% Tot. Number of Issues	N. of Bank Issuers	% Bank Issues	Average Spread (b.p.)	Std. Dev. of Spread (b.p.)	Total Amount (US$ m)	% Tot. Amount Issued	Average Amount (US$ m)	Average Maturity (years)
AAA/Aaa	1,431	42.1%	963	67.3%	31.4	26.54	422,510	40.2%	295.3	6.74
AA+/Aa1	371	10.9%	270	72.8%	34.6	27.14	95,078	9.0%	256.3	6.55
AA/Aa2	396	11.6%	245	61.9%	45.0	32.60	117,522	11.2%	296.8	6.71
AA-/Aa3	308	9.1%	171	55.5%	53.9	35.78	89,867	8.5%	291.8	7.86
A+/A1	301	8.8%	86	28.6%	72.4	42.78	96,741	9.2%	321.4	8.58
A/A2	227	6.7%	88	38.8%	91.7	40.63	76,518	7.3%	337.1	7.38
A-/A3	125	3.7%	20	16.0%	106.5	56.24	69,646	6.6%	557.2	7.75
BBB+/Baa1	72	2.1%	4	5.6%	142.4	65.57	36,782	3.5%	510.9	8.59
BBB/Baa2	33	1.0%	1	3.0%	122.0	73.42	11,545	1.1%	349.8	7.57
BBB-/Baa3	4	0.1%	0	0.0%	248.8	194.42	1,236	0.1%	308.9	8.75
BB+/Ba1	7	0.2%	0	0.0%	316.4	98.83	1,381	0.1%	197.3	10.13
BB/Ba2	5	0.1%	0	0.0%	222.2	133.77	1,153	0.1%	230.6	7.20
BB-/Ba3	9	0.3%	0	0,0%	412.5	186.12	2,399	0.2%	266.5	8.73
B+/B1	16	0.5%	3	18.8%	448.6	161.60	3,606	0.3%	225.4	8.23
B/B2	43	1.3%	0	0.0%	594.8	151.73	10,293	1.0%	239.4	9.47
B-/B3	44	1.3%	0	0.0%	609.4	173.15	13,133	1.2%	298.5	9.77
CCC+/Caa1	3	0.1%	0	0.0%	864.0	32.36	784	0.1%	261.4	10.03
CCC/Caa2	1	0.0%	0	0.0%	906.0	-	148	0.0%	147.5	10.00
CCC-/Caa3	2	0.1%	0	0.0%	594.5	96.87	460	0.0%	230.1	10.04
CC	1	0.0%	0	0.0%	442.0	-	250	0.0%	250.0	10.00
D	4	0.1%	0	0.0%	646.8	141.82	993	01%	248.2	9.50
Total	***3,403***	***100.0%***	***1,851***	***54.4%***	***69.9***	***113.81***	***1,052,045***	***100.0%***	***309.2***	***.,21***

Table 6 - Sample Descriptive Statistics - Corporate Eurobond Issues by Currency

Currency	Total # of issues	% Tot. # of Issues	# of Bank Issuers	% Bank Issues	Average Spread (b.p.)	Average Rating	Total Amount (US$ m)	% Tot. Amount Issued	Average Amount (US$ m)	Average Maturity (years)
AUS $	56	1.6%	42	2.3%	29,1	2,71	3.914	0,4%	69,9	4,64
CAN $	307	9.0%	210	11.3%	38,3	2,23	34.400	3,3%	112,1	5,49
DFL	164	4.8%	134	7.2%	20,7	2,01	35.814	3,4%	218,4	7,10
DKR	40	1.2%	35	1.9%	23,5	2,75	2.598	0,2%	64,9	6,08
DEM	232	6.8%	130	7.0%	36,6	2,64	68.002	6,5%	293,1	6,28
ECU	16	0.5%	11	0.6%	13,5	1,94	2.488	0,2%	155,5	4,54
EUR	760	22.3%	331	17.9%	108,5	4,67	359.139	34,1%	472,6	7,39
FFR	276	8.1%	166	9.0%	32,7	2,78	80.537	7,7%	291,8	8,32
NKR	17	0.5%	5	0.3%	43,9	3,65	986	0,1%	58,0	2,75
NZ$	29	0.9%	25	1.4%	51,0	2,41	1.777	0,2%	61,3	3,45
SKR	17	0.5%	15	0.8%	43,4	1,82	1.392	0,1%	81,9	4,92
STG	591	17.4%	231	12.5%	94,2	3,76	157.414	15,0%	266,4	11,58
US$	849	24.9%	484	26.1%	70,5	2,90	288.941	27,5%	340,3	5,16
YEN	39	1.1%	24	1.3%	21,8	2,79	13.598	1,3%	348,7	6,17
Others	10	0.3%	8	0.4%	49,3	2,70	1.048	0,1%	142,8	5,28
Total	***3,403***	***100.0%***	***1,851***	***100.0%***	***69,9***	***3,30***	***1.052.045***	***100,0%***	***309,2***	***7,21***

Table 7 - Sample Descriptive Statistics - Corporate Eurobond Issues by Industry of the Issuer

Industry	Total # of issues	% Tot. # of Issues	Avg Spread (b.p.)	Avg Rating	Total Amount (US$ m)	% Tot. Amount	Avg Amount (US$ m)	Avg maturity (yrs)
Automotive (AUTO)	31	0.9%	127.7	6.13	10,915	1.0%	352.1	5.08
Banking (BANK)	1851	54.4%	39.5	2.21	513,509	48.8%	277.4	6.54
Building Society (BUILD)	39	1.1%	77.9	4.36	10,569	1.0%	271.0	9.71
Chemicals (CHEM)	30	0.9%	197.8	7.47	8,580	0.8%	286.0	7.90
Construction (CONS)	16	0.5%	96.1	4.88	4,773	0.5%	298.3	8.98
Computer & Soft. (COMP)	13	0.4%	359.5	11.69	6,028	0.6%	463.7	7.62
Electronics (ELE)	25	0.7%	115.4	7.08	11,103	1.1%	444.1	6.97
Engineering (ENGI)	15	0.4%	187.8	7.93	5,225	0.5%	348.3	8.20
Energy & Utility (ENE)	153	4.5%	64.9	3.62	55,295	5.3%	361.4	10.44
Financial Corporate (FIN)	657	19.3%	65.3	3.32	221,099	21.0%	336.5	6.59
Food & Drink (FOOD)	54	1.6%	64.8	4.26	13,061	1.2%	241.9	7.03
Health Care & Pha. (HEAL)	11	0.3%	131.3	5.00	4,048	0.4%	368.0	6.77
Hotel & Leisure (HOTEL)	12	0.4%	263.8	9.92	2,420	0.2%	201.6	8.08
Industrials (INDU)	33	1.0%	65.4	4.39	11,447	1.1%	346.9	7.04
Insurance (INSU)	26	0.8%	93.3	4.12	8,583	0.8%	330.1	12.42
Manufacturing (MANU)	11	0.3%	210.7	9.18	3,860	0.4%	350.9	8.82
Media & Publis. (MEDIA)	17	0.5%	254.2	9.76	5,713	0.5%	336.0	8.37
Oil, Coal & Gas (OIL)	60	1.8%	66.6	3.68	16,524	1.6%	275.4	8.38
Retailing & cons. g. (RET)	51	1.5%	122.1	5.71	16,697	1.6%	327.4	9.02
Railways (RAIL)	58	1.7%	58.1	1.86	18,184	1.7%	313.5	12.23
Telecom (TELE)	156	4.6%	265.9	8.05	81,744	7.8%	524.0	8.46
Transport (TRANS)	20	0.6%	187.9	5.50	5,243	0.5%	262.1	12.74
Others (OTHERINDU)	64	1.9%	145.9	21.24	17,505	1.7%	273.5	9.36
Total	***3,403***	***100.0%***	***69.9***	***3.30***	***1.052.045***	***100.0%***	***309.2***	***7.21***

Table 8 – Linear Regressions of SPREAD

Reported are regression coefficients and standard errors (in parenthesis). The dependent variable is the spread between the yield on the eurobond and a Treasury security of comparable maturity denominated in the same currency. Equations are estimated by OLS and with the inclusion of fixed effects. F denotes the standard F-statistic. Fb denotes the calculated F-statistic for the null hypothesis that the coefficients on the subset of rating dummies jointly equal zero. Adjusted R^2 b indicates the Adjusted R^2 obtained when rating dummy variables are used as the only independent variables in the regression specification.

Explanatory variables are defined as follows:

RATING Rating dummies equal to 1 if the issue Moodys and S&P average rating is equal to the corresponding numerical value, 0 if not. The RATING = 1 dummy variable has been dropped to avoid collinearity.

AUS, BEL, CAN, FRA, GER, ITA, JNP, NET, SWE, SWI, UK, USA, OTHERCOU - Country dummies equal to 1 if the issuer is from the corresponding country, 0 if not. The OTHERCOU variable has been dropped to avoid collinearity. Only the statistically significant ones have been reported.

MATU the time to maturity (in years) of the issue.

AMOUNT the natural log of the U.S. dollar-equivalent amount of the issue.

COUPON the annual coupon paid by the bond (percent)

DEM, DFL, EUR, FFR, STG, USD, OTHERCUR – Currency dummies equal to 1 if the eurobond is denominated in the corresponding currency, 0 if not. The OTHERCUR variable has been dropped to avoid collinearity. Only the statistically significant ones have been reported.

SUBO a dummy variable that equals 1 if the eurobond is a subordinated one and zero if it is a senior one.

REG a dummy variable that equals 1 if the eurobond is a registered one and zero if it is a bearer one.

QI-91, QII-91, …, QIV-01 – Quarter and year dummies. Not reported. The QI-91 dummy variable has been dropped to avoid collinearity.

BANK, BUILD, CHEM, COMP, ELE, ENE, ENGI, HEALTH, HOTEL, INDU, INSU, MANU, MEDIA, OIL, RAIL, RETAIL, TELE, TRANS, OTHERINDU – Industry dummies equal to 1 if the eurobond issuer's main activity is in the corresponding industry, 0 if not. The OTHERINDU variable has been dropped to avoid collinearity. Only the statistically significant ones have been reported.

MANAGERS The number of managers in the issuing syndicate.

FEES the total gross fees earned by the issuing syndicate (percent).

PRIVATE a dummy variable that equals 1 if the issue is a private placement one and zero if it is a public one.

FIXED a dummy variable that equals 1 if the issue is fixed priced and zero if it is open priced.

CROSS a dummy variable that equals 1 if the issue has a cross-default clause and zero otherwise. Used only in sub-sample A.

PLEDGE a dummy variable that equals 1 if the issue has a negative pledge clause and zero otherwise. Used only in sub-sample A.

FORCE a dummy variable that equals 1 if the issue has a force majeure clause and zero otherwise. Used only in sub-sample A.

	OLS	*Fixed Effects*	*Sub-sample A*	*1991-96*	*1997-01*	*Banks*	*Corporates*	*Moodys*	*S&P*	*Both Ratings*
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*	*(10)*
RATING = 2	6,954***	7,777***	6,287***	4,645***	6,476**	5,659***	4,253***	6,639***	1,669	7,944***
	(1,897)	(2,163)	(1,664)	(1,676)	(3,106)	(1,609)	(4,407)	(2,091)	(2,480)	(2,694)
RATING = 3	12,138***	14,201***	10,770***	12,326***	9,130***	11,521***	10,262***	11,634***	12,007***	14,325***
	(1,869)	(2,352)	(1,748)	(1,617)	(3,086)	(1,714)	(3,667)	(2,029)	(2,298)	(2,625)
RATING = 4	17,772***	20,026***	17,264***	17,364***	14,577***	11,833***	20,038***	18,296***	18,483***	24,043***
	(1,945)	(2,322)	(1,769)	(1,735)	(3,157)	(1,853)	(3,639)	(2,099)	(2,429)	(2,848)
RATING = 5	27,353***	29,317***	24,705***	35,206***	25,625***	23,200***	25,572***	25,845***	25,473***	31,374***
	(2,356)	(2,694)	(2,179)	(2,253)	(3,814)	(2,851)	(3,782)	(2,624)	(2,735)	(3,458)
RATING = 6	38,054***	41,184***	37,395***	41,672***	40,400***	35,840***	37,981***	39,223***	42,107***	48,664***
	(2,445)	(2,913)	(2,299)	(2,639)	(3,754)	(2,773)	(4,161)	(2,597)	(2,829)	(2,968)
RATING = 7	51,205***	54,032***	50,551***	49,744***	53,950***	36,160***	46,892***	55,091***	56,704***	82,036***
	(3,151)	(3,427)	(2,809)	(3,406)	(4,819)	(4,992)	(4,654)	(3,384)	(4,182)	(4,820)
RATING = 8	74,759***	76,768***	75,091***	44,204***	79,895***	17,359	70,653***	68,623***	71,623***	91,107***
	(4,093)	(4,295)	(3,499)	(6,077)	(5,656)	(10,561)	(5,658)	(4,180)	(5,020)	(5,856)
RATING = 9	67,286***	70,063***	58,036***	32,183***	84,923***	-29,273	62,880***	106,493***	75,301***	66,010***
	(5,699)	(5,822)	(5,183)	(5,665)	(8,909)	(20,718)	(7,473)	(7,180)	(7,018)	(9,208)

RATING = 10	59,699***	61,532***	57,646***	53,844***	_	_	55,780**	30,555***	237,971***	_
	(21,751)	(21,780)	(17,571)	(13,455)			(27,021)	(10,096)	(31,753)	
RATING = 11	188,125***	190,023***	142,193***	86,259***	191,06***	_	162,120***	69,477***	197,859***	287,613***
	(15,624)	(15,700)	(17,594)	(19,132)	(22,152)		(19,654)	(28,817)	(18,560)	(19,537)
RATING = 12	79,411***	82,457***	61,694***	175,710***	60,395***	_	81,045***	277,714***	65,021***	155,021***
	(15,407)	(15,471)	(14,387)	(19,469)	(21,433)		(19,196)	(21,122)	(18,316)	(28,081)
RATING = 13	490,895***	492,723***	471,673***	_	439,846***	_	447,145***	410,641***	448,174***	463,120***
	(18,087)	(18,141)	(25,046)		(22,505)		(22,824)	(17,163)	(31,710)	(31,689)
RATING = 14	330,625***	333,577***	215,388***	230,037***	340,983***	_	333,437***	324,545***	416,960***	409,582***
	(9,508)	(9,612)	(11,271)	(10,690)	(14,936)		(14,272)	(10,166)	(13,943)	(10,714)
RATING = 15	438,823***	441,040***	368,810***	_	378,551***	_	400,979***	438,734***	429,983***	540,247***
	(8,085)	(8,281)	(10,386)		(11,878)		(11,580)	(11,215)	(8,527)	(13,336)
RATING = 16	449,325***	451,387***	354,130***	_	389,861***	_	415,677***	516,364***	456,298***	517,315***
	(7,703)	(7,891)	(11,978)		(11,674)		(11,197)	(9,325)	(8,891)	(11,889)
RATING = 17	667,161***	669,485***	_	_	573,780***	_	614,969***	_	664,253***	_
	(31,386)	(31,401)			(38,743)		(39,286)		(32,490)	
RATING = 20	342,846***	345,651***	_	_	281,263***	_	322,994***	_	341,009***	_
	(30,978)	(31,017)			(37,653)		(38,816)		(32,148)	
RATING = 21	444,030***	445,523***	_	_	383,687***	_	395,785***	_	441,098***	_
	(18,555)	(18,657)			(23,374)		(23,687)		(19,251)	
SUBO	8,842***	7,788***	17,882***	15,033***	1,831	24,005***	-7,873	10,128***	6,352*	15,757***
	(,644)	(2,708)	(2,567)	(3,239)	(3,805)	(2,374)	(5,980)	(2,883)	(3,423)	(3,699)
MATU	1,979***	2,045***	1,752***	1,275***	2,462***	1,457***	2,297***	2,028***	2,099***	2,069***
	(0,129)	(0,132)	(0,113)	(0,147)	(0,194)	(0,137)	(0,213)	(0,143)	(0,149)	(0,153)
AUTOMOTIVE	-17,495**	-16,598***	-10,741	-23,263***	-12,867	_	-29,055***	-16,548*	-14,821*	-8,180
	(6,956)	(6,343)	(6,647)	(7,855)	(9,570)		(8,857)	(7,727)	(8,686)	(9,603)
BANK	-5,533	-0,338	-5,057	-7,900**	-1,297	_	_	-7,176	-2,339	1,194
	(3,835)	(1,861)	(3,472)	(3,187)	(5,632)			(4,761)	(4,610)	(5,900)
CHEM	-9,607	-4,000	-2,332	-16,516***	-5,995	_	-11,580	-16,259	-11,685	0,562
	(6,812)	(6,218)	(6,855)	(6,247)	(10,067)		(8,669)	(8,135)	(7,639)	(8,810)
COMP	-51,653***	-51,511***	-32,016**	-9,614	-48,433***	_	-54,651***	-41,229***	-43,800***	-16,113
	(9,973)	(9,791)	(12,902)	(19,077)	(12,313)		(12,333)	(11,830)	(10,850)	(12,205)
ELE	-16,768**	-13,320*	4,416	-6,751	-10,332	_	-22,999**	-15,587*	-27,339***	-22,590**
	(7,414)	(7,001)	(6,813)	(7,464)	(10,612)		(9,358)	(8,244)	(8,833)	(9,475)
ENE	-11,601***	-4,885*	-7,746*	-7,299*	-9,774	_	-12,253*	-12,093***	-8,734	-7,121
	(4,449)	(3,007)	(4,041)	(3,725)	(6,879)		(5,539)	(5,410)	(5,291)	(6,420)
ENGI	9,234	5,022		-6,022	-1,519	_		-33,206***	-9,448	-5,355
	(8,600)	(8,959)		(13,645)	(11,942)			(9,400)	(11,451)	(11,319)
FOOD	-9,168	-6,515	-4,962	-12,450**	-1,282	_	-6,889	-8,919	-6,300	-17,350
	(5,605)	(4,689)	(4,889)	(4,993)	(8,369)		(7,132)	(6,364)	(6,612)	(18,725)
INDU	-13,205**	-7,966	-6,082	-10,054*	-15,916	_	-14,005*	-15,302	-10,325	-6,557
	(6,409)	(5,747)	(5,632)	(5,671)	(9,829)		(8,117)	(7,799)	(7,511)	(9,268)
INSU	9,971	18,004***	5,635	16,01***	2,637	_	9,390	12,242	15,493	26,458**
	(7,299)	(6,744)	(6,786)	(5,940)	(12,299)		(9,290)	(8,288)	(9,381)	(10,919)
MANU	-17,603*	-16,922*	-8,494	14,269	-24,667*	_	-27,231**	-10,450	-29,512**	-59,962***
	(10,176)	(10,047)	(9,216)	(14,113)	(13,004)		(12,592)	(10,610)	(13,825)	(13,664)
MEDIA	-24,358***	-25,087***	27,987***	5,801	-26,623**	_	-17,179*	-54,165***	-23,508***	-57,885***
	(8,607)	(8,263)	(8,155)	(13,690)	(10,831)		(10,595)	(11,785)	(9,663)	(13,320)
OIL	-17,810***	-10,465**	-14,590***	-13,448***	-15,302*	_	-18,432***	-20,181***	-13,050**	-9,644
	(5,400)	(4,434)	(5,159)	(4,504)	(8,591)		(6,699)	(6,363)	(6,328)	(7,373)

TELE	10,633**	18,382***	5,0347	-10,779***	20,236***	_	6,943	12,096**	11,242**	15,557**
	(4,661)	(3,294)	(4,302)	(4,086)	(6,915)		(5,860)	(5,654)	(5,389)	(6,580)
AMOUNT	-1,055	-0,907	0,620	-2,111*	-2,536**	0,023	-3,310*	0,283	-1,133	2,0186*
	(0,933)	(0,944)	(0,829)	(1,090)	(1,280)	(0,813)	(1,930)	(0,989)	(1,084)	(1,061)
COUPON	9,694***	9,727***	7,502***	3,196***	17,615***	4,203***	15,539***	7,780***	10,617***	6,648***
	(0,535)	(0,540)	(0,559)	(0,449)	(1,089)	(0,492)	(1,000)	(0,605)	(0,631)	(0,676)
REG	38,823***	38,242***	29,095***	4,384	62,554***	12,919***	45,294***	20,925***	35,302***	19,961***
	(,276)	(4,311)	(4,374)	(3,863)	(7,359)	(4,815)	(6,892)	(5,402)	(4,783)	(5,785)
MANAGERS	0,120	0,132	0,070	-0,188***	0,445***	0,010	0,233	0,195	0,250**	0,299
	(0,083)	(0,084)	(0,074)	(0,067)	(0,153)	(0,072)	(0,177)	(0,092)	(0,104)	(0,114)
FEES	-0,140	-0,217	-2,033**	1,837*	0,600	-0,321	-0,209	0,070	0,072	1,385
	(0,909)	(0,928)	(0,819)	(0,952)	(1,352)	(0,874)	(1,667)	(1,010)	(1,075)	(1,127)
PRIVATE	-35,387***	-31,516***	-19,201	-9,829	-56,055***	-10,297	-49,708***	-45,331***	-23,464**	-18,818
	(,088)	(9,183)	(14,391)	(6,919)	(20,738)	(10,489)	(13,978)	(9,946)	(10,970)	(11,812)
FIXED	-3,976**	-3,846**	-3,694***	-5,151***	-5,057**	-5,098***	-3,688	-6,726***	-4,014**	-5,727***
	(1,543)	(1,556)	(1,383)	(1,629)	(2,195)	(1,593)	(2,607)	(1,700)	(1,789)	(1,847)
DEM	25,467***	24,326***	20,504***	16,391***	21,266***	7,275**	52,547***	21,070***	25,268***	16,174***
	(3,629)	(3,722)	(3,172)	(3,155)	(6,529)	(3,110)	(7,885)	(4,127)	(4,579)	(5,369)
DFL	21,055***	20,538***	15,151***	10,640***	16,258***	5,275*	47,958***	19,189***	24,935***	21,756***
	(3,782)	(3,813)	(3,308)	(3,121)	(8,020)	(3,040)	(9,601)	(4,282)	(4,871)	(5,707)
EUR	9,868***	9,432***	-1,547	6,724*	19,367***	-7,601***	33,901***	2,119	11,685***	-2,002
	(3,257)	(3,306)	(2,886)	(3,853)	(5,171)	(2,732)	(7,283)	(3,604)	(3,941)	(4,170)
FFR	9,769***	9,459***	3,594	5,463*	7,115	-0,296	31,439***	6,704*	10,891**	4,969
	(3,508)	(3,547)	(3,230)	(3,043)	(7,294)	(2,967)	(7,762)	(3,916)	(4,326)	(4,676)
STG	19,134***	19,525***	17,181***	11,906***	16,787***	11,652***	34,400***	18,199***	21,985***	22,592***
	(,260)	(3,296)	(2,852)	(3,055)	(5,305)	(2,815)	(7,199)	(3,607)	(4,020)	(4,295)
USD	23,763***	24,086***	17,730***	14,931***	18,646***	13,459***	43,011***	20,004***	27,003***	23,266***
	(,029)	(3,067)	(2,631)	(2,878)	(4,844)	(2,500)	(7,043)	(3,352)	(3,732)	(3,971)
CAN	8,725	7,823	3,501	6,763	6,852	20,000***	2,763	11,852*	7,928	4,400
	(5,565)	(5,600)	(5,569)	(4,907)	(10,490)	(6,270)	(8,695)	(6,083)	(6,733)	(6,872)
USA	2,651	2,671	0,916	-1,329	-0,068	14,232***	-2,456	-0,041	-1,600	-3,041
	(4,722)	(4,883)	(4,501)	(4,521)	(7,457)	(5,383)	(7,343)	(4,910)	(5,851)	(5,759)
DISCORDANCE	_	_	_	_	_	_	_	_	_	3,417**
										(1,744)
CROSS	_	_	-2,058*	_	_	_	_	_	_	_
			(1,222)							
PLEDGE	_	_	2,690*	_	_	_	_	_	_	_
			(1,462)							
FORCE	_	_	-31,067***	_	_	_	_	_	_	_
			(8,331)							
Constant	-9,241	31,039***	-7,759	74,251***	-90,460***	-17,992	-28,184	-31,028	-49,442**	-77,169
	(20,028)	(19,625)	(18,780)	(22,194)	(27,000)	(17,548)	(40,361)	(20,770)	(22,606)	(22,948)
N	3,403	3,403	2,735	1,525	1,878	1,851	1,552	2,457	2,527	1,581
R^2	0.896	0.887	0.813	0.728	0.905	0.703	0.922	0.889	0.903	0.911
Adjusted R^2	0.893	0.882	0.806	0.712	0.902	0.689	0.916	0.884	0.899	0.904
Adjusted R^2 b	0.790	0.790	0.790	0.430	0.824	0.242	0.838	0.747	0.808	0.769
F	263.803***	187.996***	107.370***	56.329***	255.128***	50.424***	171.348***	195.594***	229.264***	130.867***
Fb	694.885***	694.885***	213.781***	95.591***	499.406***	65.838***	429.043***	473.607***	572.954***	365.172***

***, **, and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

Table 9 – Linear Regressions of SPREAD on Country Dummy Variables

Reported are regression coefficients and standard errors (in parenthesis) of the rating dummy variables only. The dependent variable is the spread between the yield on the eurobond and a Treasury security of comparable maturity denominated in the same currency. Equations are estimated by OLS. F denotes the standard F-statistic. Fb denotes the calculated F-statistic for the null hypothesis that the coefficients on the subset of rating dummies jointly equal zero. Adjusted R^2 b indicates the Adjusted R^2 obtained when rating dummy variables are used as the only independent variables in the regression specification. Explanatory variables used in the regression specification include the following:

RATING Rating dummies equal to 1 if the issue Moodys and S&P average rating is equal to the corresponding numerical value, 0 if not. The RATING = 1 dummy variable has been dropped.

MATU the time to maturity (in years) of the issue.

AMOUNT the natural log of the U.S. dollar-equivalent amount of the issue.

COUPON the annual coupon paid by the bond (percent)

DEM, DFL, EUR, FFR, STG, USD, OTHERCUR – Currency dummies equal to 1 if the eurobond is denominated in the corresponding currency, 0 if not. The OTHERCUR variable has been dropped.

SUBO a dummy variable that equals 1 if the eurobond is a subordinated one and zero if it is a senior one.

REG a dummy variable that equals 1 if the eurobond is a registered one and zero if it is a bearer one.

QI-91, QII-91, …, QIV-01 – Quarter and year dummies. The QI-91 dummy variable has been dropped.

MANAGERS The number of managers in the issuing syndicate.

FEES the total gross fees earned by the issuing syndicate (percent).

PRIVATE a dummy variable that equals 1 if the issue is a private placement one and zero if it is a public one.

FIXED a dummy variable that equals 1 if the issue is fixed priced and zero if it is open priced.

	FRANCE	GERMANY	JAPAN	UK	USA
RATING = 2	17,213***	5,822***	9,313**	9,269	7,895
	(4,302)	(2,133)	(3,652)	(7,873)	(11,329)
RATING = 3	24,839***	11,892***	11,084***	19,834***	8,776
	(4,273)	(2,562)	(3,900)	(7,144)	(6,155)
RATING = 4	22,843***	15,629***	14,695**	25,618***	14,437**
	(4,126)	(2,682)	(6,773)	(7,587)	(6,664)
RATING = 5	36,816***	18,095***	56,365***	34,237***	31,533***
	(5,364)	(3,563)	(9,615)	(7,785)	(5,988)
RATING = 6	36,099***	28,112***	_	44,190***	40,837***
	(6,487)	(9,376)		(7,970)	(5,078)
RATING = 7	67,468***	65,926***	54,753***	61,491***	34,794***
	(8,219)	(6,428)	(13,491)	(9,023)	(8,176)
RATING = 8	93,136***	50,424***	151,244***	65,737***	63,536***
	(10,354)	(9,339)	(12,845)	(9,607)	(12,847)
RATING = 9	51,952***	116,4104	_	77,983***	92,086***
	(7,970)	(10,924)		(17,240)	(18,983)
RATING = 11	_	_	_	62,352*	176,672***
				(32,376)	(23,680)
RATING = 12	_	_	_	28,471	127,177***
				(23,843)	(40,787)
RATING = 13	_	564,268***	_	_	412,402***
		(19,414)			(39,670)
RATING = 14	487,279***	343,475***	_	345,768***	327,552***
	(28,901)	(18,620)		(24,664)	(22,489)
RATING = 15	510,131***	551,603***	_	407,648***	378,542***
	(26,177)	(22,214)		(19,104)	(18,384)
RATING = 16	513,934***	848,954***	_	451,993***	333,229***
	(28,951)	(17,119)		(17,221)	(19,081)
RATING = 20	_	_	_	_	274,244***
					(39,677)
RATING = 21	_	_	_	_	360,769***
					(26,699)
Constant	-106,074**	-37,438	-93,855**	-5833,199*	-23,645
	(46,529)	(25,475)	(39,716)	(73162,962)	(64,020)
N	420	739	168	518	571
R^2	0.892	0.950	0.900	0.920	0.947
Adjusted R^2	0.869	0.945	0.844	0.906	0.937
Adjusted R^2 b	0.798	0.854	0.294	0.762	0.894
F	39.424***	179.645***	14.970***	2.727**	108.652***
Fb	128.930***	353.352***	12.576***	65.238***	523.238***

***, **, and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

Table 10 – Adjusted R squares for different regression specifications

Independent Variables	Adjusted R^2	F - test
Control variables (country + currency + quarter and year dummies) only	0.197	13.685***
Control variables + rating dummies	0.862	253.213***
Control + rating dummies + other default and recovery risk variables	0.874	274.535***
Control + default and recovery risk variables + industry dummies	0.878	244.036***
Control + default and recovery risk + industry dummies + liquidity variables	0.878	271.770***
Control + default and recovery risk + industry dummies + liquidity + tax variables	0.892	271.317***
All variables	0.893	263.803***
Control variables + industry dummies	0.352	24.722***
Control + liquidity variables	0.197	14.243***
Control + tax variables	0.737	150.105***
Control + primary market efficiency variables	0.262	18.770***

Table 11 – Ratings Availability and Concordance

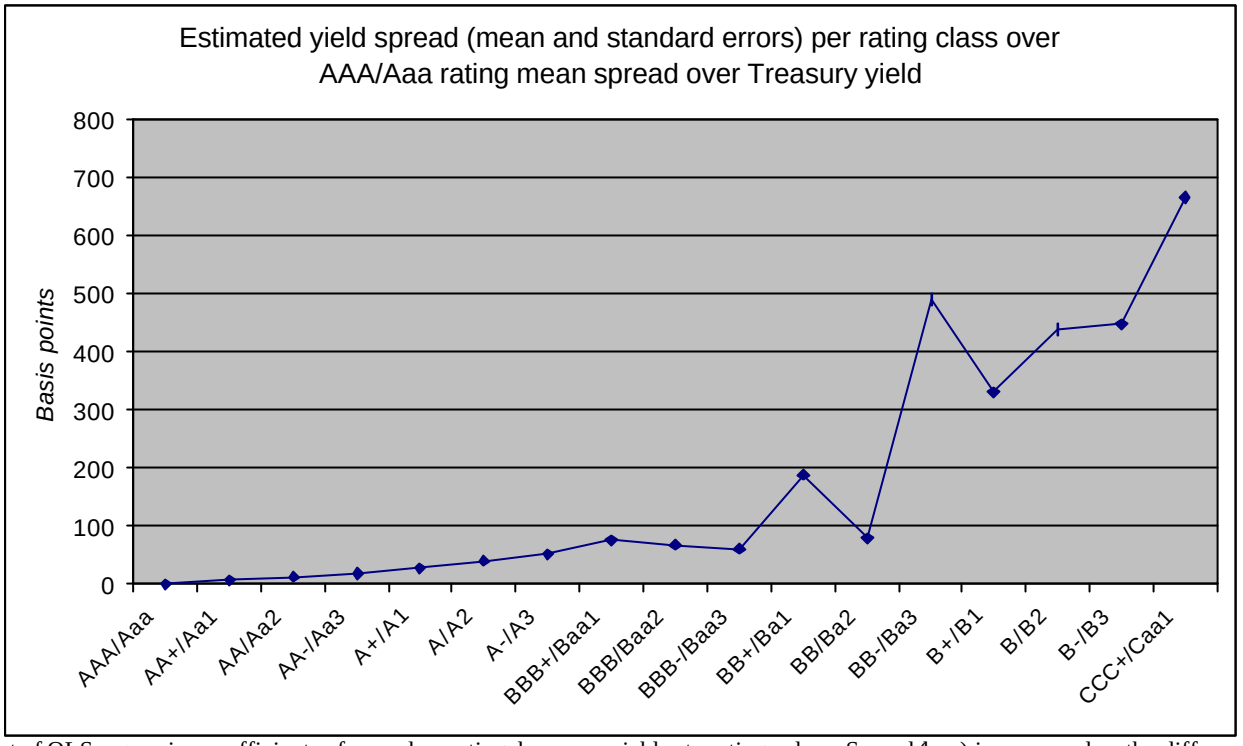
	Total Number	%
Issues	3,403	100.0%
Moodys	2,457	72.2%
Standard & Poors	2,527	74.3%
Only 1 rating available	1,822	53.5%
Both available	1,581	46.5%
of which:		
- same rating	1,117	70.7%
- difference = 1 notch	394	24.9%
- difference = 2 notches	64	4.0%
- difference = 3 notches	5	0.3%
- difference = 4 notches	1	0.1%
Total	1,581	100.0%

Table 12 - Ratings Scales

VALUE / RATING TYPE	1	2	3	4	5	6	7	8	9	10
Moody's	Aaa	Aa1	Aa2	Aa3	A1	A2	A3	Baa1	Baa2	Baa3
Standard & Poors	AAA	AA+	AA	AA-	A+	A	A-	BBB+	BBB	BBB-

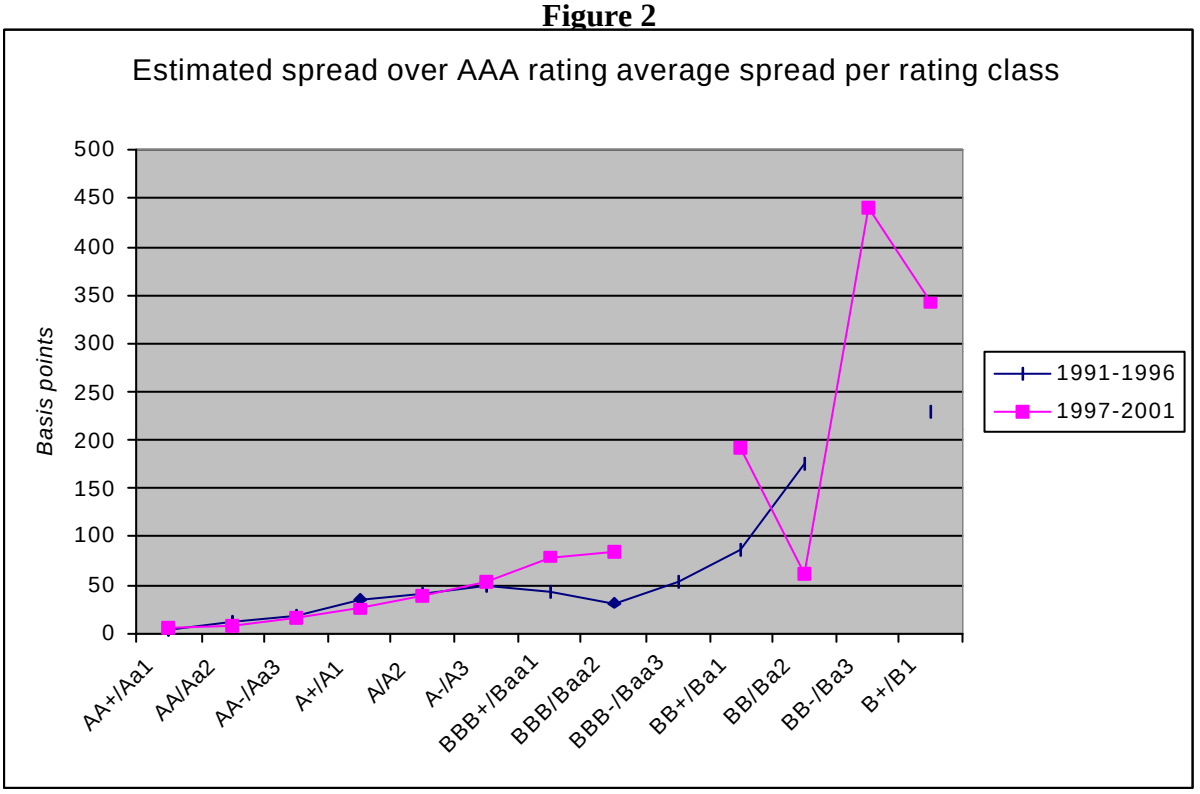
VALUE / RATING TYPE	11	12	13	14	15	16	17	18	19	20	21
Moody's	Ba1	Ba2	Ba3	B1	B2	B3	Caa1	Caa2	Caa3	-	-
Standard & Poors	BB+	BB	BB-	B+	B	B-	CCC+	CCC	CCC-	CC	D

Figure 1



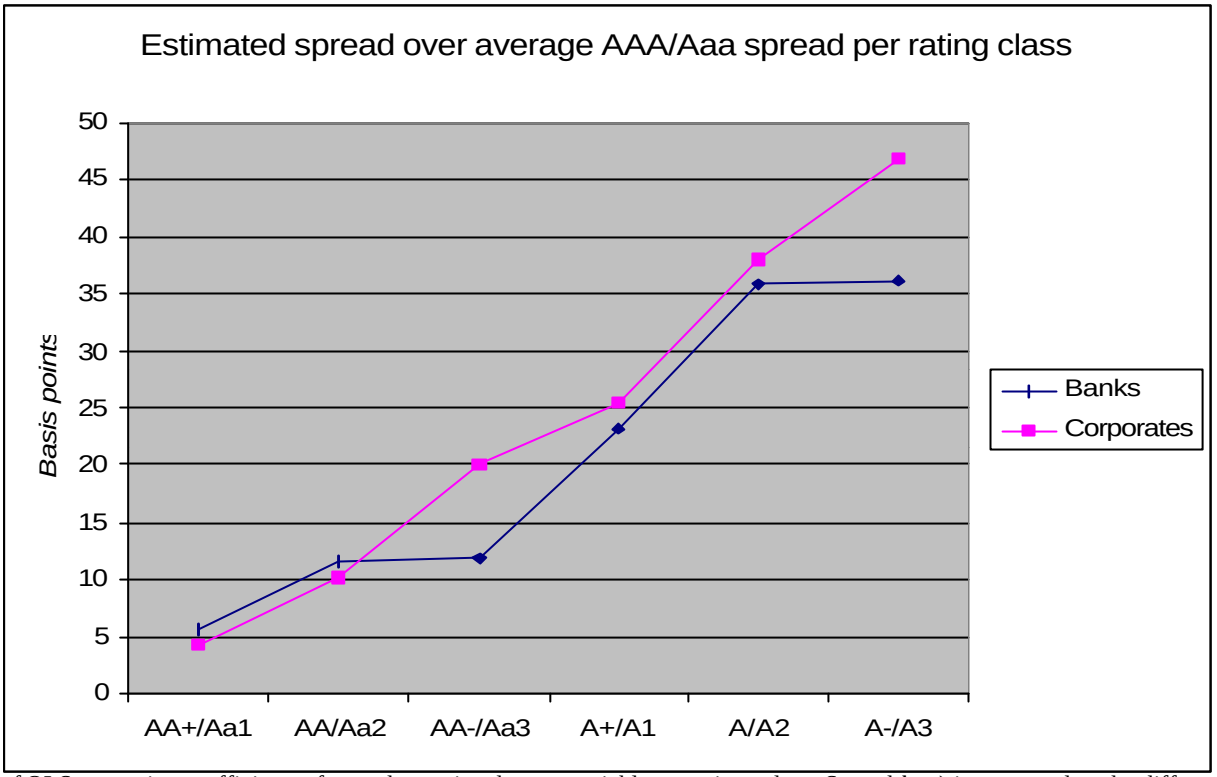
Plot of OLS regression coefficients of spread on rating dummy variables to rating values. Spread (b.p.) is measured as the difference between the eurobond yield to maturity and the yield of a Treasury bond of comparable maturity denominated in the same currency. Rating values are the numeric values of the ratings given by Moodys' and Standard & Poors as defined in Table 12. Includes 3,403 eurobonds issued between 1991 and 2001.

Figure 2



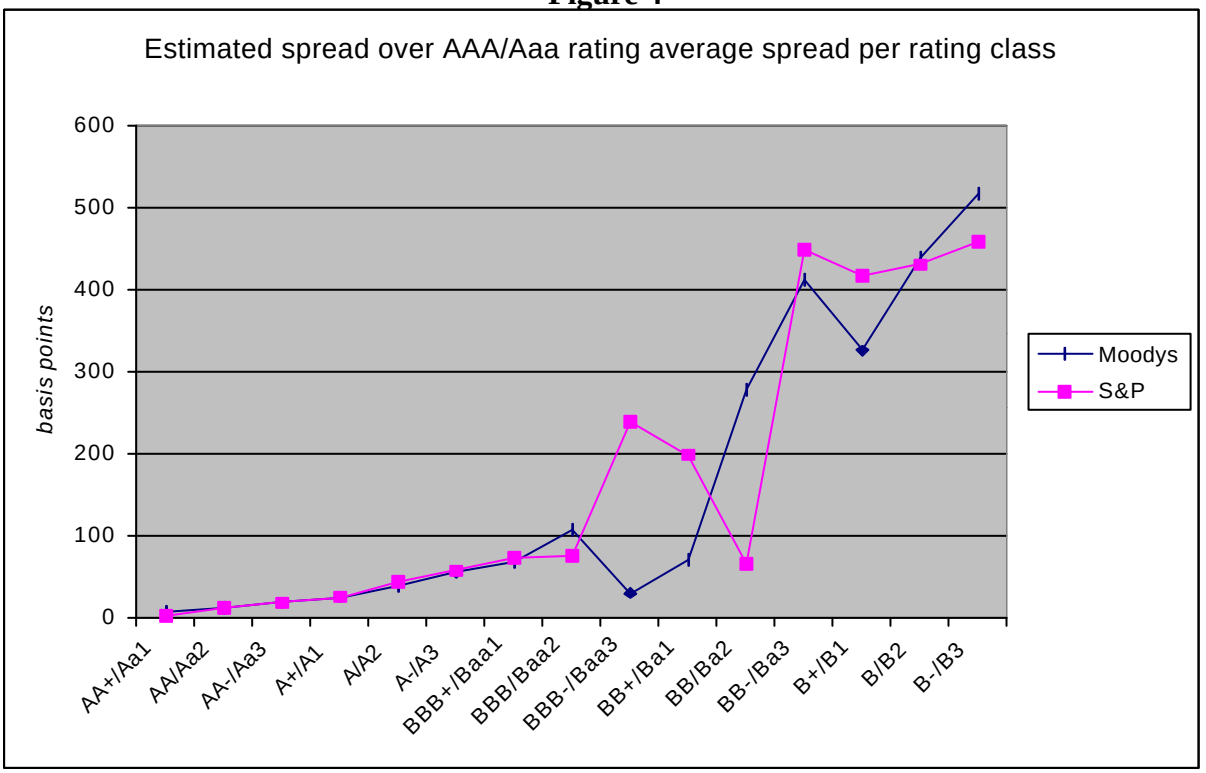
Plot of OLS regression coefficients of spread on rating dummy variables to rating values. Spread (b.p.) is measured as the difference between the eurobond yield to maturity and the yield of a Treasury bond of comparable maturity denominated in the same currency. Rating values are the numeric values of the ratings given by Moodys' and Standard & Poors as defined in Table 12. Includes 1,851 and 1,552 observations for the sub-sample of banks and corporates eurobond issues (issued between 1991 and 2001) respectively.

Figure 3



Plot of OLS regression coefficients of spread on rating dummy variables to rating values. Spread (b.p.) is measured as the difference between the eurobond yield to maturity and the yield of a Treasury bond of comparable maturity denominated in the same currency. Rating values are the numeric values of the ratings given by Moodys' and Standard & Poors as defined in Table 12. Includes 1,525 and 1,878 eurobond issues for the sub-sample of 1991-1996 and 1997-2001 respectively.

Figure 4



Plot of OLS regression coefficients of spread on rating dummy variables to rating values. Spread (b.p.) is measured as the difference between the eurobond yield to maturity and the yield of a Treasury bond of comparable maturity denominated in the same currency. Rating values are the numeric values of the ratings given by Moodys' and Standard & Poors as defined in Table 12. . Includes 2,457 and 2,527 observations for the sub-sample of Moodys' and S&P rated eurobond issues (issued between 1991 and 2001) respectively.