Milan, May 12th 2003

Subject: a comment to the Consultative Package 3 concerning the risk buckets of the Standard Approach

Dear Sirs,

the Consultative Package released on April 29th confirms the risk weights originally proposed in January 2001 to assess the relative riskiness of corporate loans within the Standard Approach.

As you know, previous empirical studies have suggested that this risk-weight curve should be made steeper to account for the differences in risk among borrowers belonging to different rating classes. This is the case, for example, of the study produced by Professors Altman and Saunders and published on Volume XXV of the Journal of Banking & Finance, which was based on historical loss rates per rating class.

We wish to further support this view through a new piece of evidence. In the enclosed study, we conduct an empirical analysis of corporate bond spreads through two separate exercises. First, "typical" credit spreads per rating class are estimated through a multivariate regression based on a sample of eurobond issues completed by almost 600 major corporations from 15 developed countries between 1991 and 2001 (an eleven-year period that includes at least one full economic and credit cycle). Second, the estimated credit spreads are used to capture the amount of risk capital associated with different rating grades; this is done by estimating the implied economic capital allocation from a risk-adjusted loan pricing formula like those adopted by most internationally-active banks using a credit value-at-risk (CreditVaR) model.

Our empirical analysis confirms that the risk-weight/rating relationship should be made steeper than the one proposed by the CP3. Further, to better incorporate market evaluations into the Standard Approach, six rating buckets should be considered (rather than the four currently proposed): 30 (for exposures rated AAA to AA-, that is Aaa to Aa3), 50 (A+ to A- / A1 to A3), 75 (BBB+ to BBB- / Baa1 to Baa3), 175 (BB+ to BB- / Ba1 to Ba3), 250 (B+ to B- / B1 to B3) and 300 (below B-/B3). This implies the third bucket including rating classes from BBB+ to BB- (from Baa1 to Ba3 in the Moody's' scale) should be split into two different levels; in addition to that, the current forth bucket (including all rating classes below BB-) should in turn be split into two different grades.

If the current system of only four weights has to be maintained, then at least BBB/Baa loans should be moved into the 50% bucket, since they appear more similar to other investment-grade investments than to BB loans.

Moreover, our results show that, while eurobonds issued by banks have a better average rating than those issued by non-financial companies, no significant difference emerges in the spread/rating relationship between banks and non-financial firms. In other words, the proposed distinction between banks and non-financial firms seems to have a poor economic justification once external ratings are accounted for. Accordingly, the distinction between banks and corporates should be retained only for unrated exposures.

We are aware that the ongoing process of refinement of the new capital adequacy regime has already come to a very advanced stage. However, knowing how much attention the Committee has always devoted to the debate with practitioners and academics, we hope that our study may contribute to your precious work.

Yours sincerely

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The Basel Committee proposal on risk-weights and external ratings: What do we learn from bond spreads?

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Abstract

The Basel Committee for Banking Supervision proposed a system of risk weights (the so called "standardised approach") to measure the riskiness of banks' loan portfolios. Its ability to adequately reflect risk is empirically investigated in this paper, through an analysis of the economic capital allocations implied in corporate bond spreads. This is based on a unique dataset of issuance spreads, ratings and other relevant bond variables (such as maturity, face value, time of issuance and currency of denomination) including 3,307 eurobonds issued by Canadian, European, Japanese and U.S. companies during 1991-2001. Three main results emerge. First, the spread/rating relationship is strongly significant with spreads increasing when ratings worsen. Second, the estimated spreads per rating class indicate a much steeper risk/rating relationship than the one proposed by the Basel Committee. Finally, no significant difference appears to exist in the spread/rating relation of banks and non-financial firms issuers. Following this empirical evidence, we propose some relevant changes in the standardised approach risk-weights.

JEL Classification Numbers: G15, G21, G28

Keywords: eurobonds, credit ratings, spreads, capital regulation, banks.

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1. INTRODUCTION

In January 2001, the Basel Committee for Banking Supervision released its proposals to reform the capital adequacy framework originally introduced with the 1988 Accord. These proposals are based on three mutually reinforcing pillars: (i) minimum capital requirements, (ii) supervisory review process, and (iii) market discipline. As far as the first pillar is concerned, the new Accord would be based on minimum capital requirements for credit, market and operational risks. Credit risk capital requirements, in turn, would be set according to a standardised approach or an internal ratings-based approach (IRB). In the standardised approach[1] the 1988 risk weights based on some broad borrower categories (sovereign, banks or non-financial corporations) are to be refined by reference to a rating provided by an external credit assessment institution, such as a rating agency. Column 2 of Table 1 reports the new risk weights for corporate loans (banks would be assigned a more favorable set of weights).

Altman and Saunders (2001) criticized the broad degree of granularity in the risk weights originally proposed by the Basel Committee in 1999, in that only three buckets for rated corporate loans were envisaged (see column 1 of Table 1). Using data on historical corporate bond defaults and losses per rating class to simulate expected and unexpected losses, they showed that the three weights of 20% (AAA to AA-), 100% (A+ to B-) and 150% (below B-) were too broad to reflect the relative risk of unexpected losses in each bucket. Based on their empirical findings, Altman and Saunders (2000) recommended a revised risk-weighting scheme that included splitting the A+ to B- bucket into two separate buckets (A+ to BBB- and BB+ to B-), reflecting the distinction between investment and non-investment grade borrowers (see column 3 of Table 1)[2].

Following this and other comments, in 2001 the Basel Committee proposed a new weighting structure based on splitting the second bucket into three: A+ to A-, with a 50% risk weight, BBB+ to BB-(100%), and below BB- (150%, see column 2 of Table 1).

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[1] Under the IRB approach banks would be allowed to use their own estimates of a borrower's probability of default produced by an internal rating system, conditional on specific criteria and on validation by national supervisors. The IRB approach also confers varying degrees of independence to banks in setting the parameters determining risk weights: the 'foundation' approach entails less independence than the 'advanced' one. Under both the standardised and the IRB approaches the original 8% minimum capital to risk-weighted assets is maintained.

[2] Note that Altman and Saunders themselves mention that their revised risk-buckets underestimate risk for grades BB, B and below B-.

In this paper, we further investigate the appropriateness of this choice. Rather than historical loss rates per rating class, corporate bond spreads[3] are used to estimate the risk/rating relationship. More precisely, eurobond issuance spreads are used to estimate the implied economic capital allocations of different rating buckets. This empirical analysis is based on two separate exercises. First, "typical" credit spreads per rating class are estimated through a multivariate regression based on a sample of eurobond issues completed by almost 600 major corporations from 15 developed countries between 1991 and 2001. Second, the estimated credit spreads are used to capture the amount of risk capital associated with different rating grades. This is done by estimating the implied economic capital allocation from a risk-adjusted loan pricing formula like those adopted by most internationally-active banks using a credit value-at-risk (CreditVaR) model.

The use of a wide sample of Eurobond issues has two main advantages. First, contrary to historical losses, bond spreads are forward looking and reflect the actual risk associated to different rating classes, as perceived by the investors. Second, while default and loss rates provided by rating agencies mostly come from US dollar-denominated bonds issued by US firms in their domestic capital market, our eurobonds are denominated in different currencies and internationally issued by companies from different countries. They therefore look as a more adequate empirical background for evaluating a regulation aimed at banks competing internationally on global markets.

This study uses issuance spreads rather secondary market ones: this, in turn, has two advantages. First, yields on new issues reflect actual transaction prices rather than brokers' "indicative prices", i.e., estimates derived from pricing matrices or dealers' quotes[4]. 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.

Using data from an eleven-year period (1991-2001) that includes at least one full economic and credit cycle allows us to get reliable estimates of the spread/rating relationship that are not biased by any particular state of the economy.

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[3] By "spread" we mean the difference between a corporate eurobond's yield to maturity and that of a Treasury security with similar maturity, denominated in the same currency.

[4] 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).

Three main results emerge from our empirical analysis. First, the spread/rating relation is strongly significant, with spreads increasing when ratings worsen. Second, the estimated spreads per rating bucket indicate a steeper risk/rating relationship than the one proposed by the Basel Committee. Finally, while eurobonds issued by banks have a better average rating than those issued by non-financial companies, no significant difference emerges in the spread/rating relationship between banks and non-financial firms. This indicates that the proposed distinction between banks and non-financial firms has no economic justification once external ratings are accounted for.

Following these empirical findings, we propose three main changes to the standardised approach. First, no distinction should be made between banks and non-financial companies, as far as the risk-weights already depend on ratings. Second, six rating buckets should be considered rather than the four (as currently proposed by the Basel Committee). Third, the risk weights should be adjusted in order to reflect a steeper relationship between risk and rating.

This paper proceeds as follows. Section 2 presents the model and variables used in our empirical analysis. Section 3 describes the data sources and summarizes sample characteristics. Section 4 presents the empirical results. Section 5 elaborates on the implications of our results for the system of risk weights proposed in the New Basel Capital Accord. Section 6 concludes.

2. MODEL AND VARIABLES

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[5], Japanese and U.S. companies between 1991 and 2001. Eurobonds were chosen for our empirical analysis is mainly for three reasons.

First, they are issued in relatively large amounts in a highly competitive market open to different kinds of investors (mostly institutional ones) from different countries[6]. This enhances liquidity and minimizes the risk of price anomalies.

Second, the eurobond market is relatively unregulated: issues are not subject to queuing or other costly procedures, listing only occurs for a minority of the issued amount in order to meet

[5] European issues include Austria, Belgium, Denmark, the Netherlands, France, Germany, Italy, Norway, Spain, Sweden, Switzerland and UK.

institutional investors' needs, investors are not subject to withholding tax, and bonds are mostly in bearer form. These factors significantly enhance the possibility to compare different bonds' spreads.

Finally, eurobonds are denominated in different currencies and issued by companies from different countries. This makes them a more adequate database for evaluating the effectiveness and fairness of the internationally-adopted Basel weights.

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. Our empirical analysis is largely consistent with these results, as it is based on cross-sectional regressions where maturity, coupon and face value all appear as independent variables. Note that, since time from issuance equals zero for all corporate bonds in our sample, only trading volumes are missing, since they are not available when issuance spreads are used. The use of secondary market spreads is avoided because of the relatively poor liquidity of the secondary market for some minor eurobond issues. Using primary market spreads also permits the use of "fresher" ratings because new issues are rated near the time of issuance.

Issuance spreads reflect the issuer's credit risk and the market conditions. As such, they are a function of eight main factors[7]: (1) the bond's default and recovery risk, (2) the time to maturity of the issue, as this affects its default risk premium (Merton, 1974), (3) the issue amount, as this in turn is believed to affect secondary market liquidity, (4) the expected tax treatment to which investors will be subject, (5) the currency of denomination[8], (6) the efficiency of the bond's primary market, (7) the bond market conditions at the time of the issue, and (8) the macroeconomic conditions of the country of the issuer.

The variables used to represent these eight factors are briefly outlined below.

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

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

[8] The latter 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 bond 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.

(1) Default and Recovery Risk

Our empirical analysis is based on the use of Moody's and Standard and Poor's *issue* ratings as proxies of the bonds' default and recovery risk:

RAT_01…RAT_21 Rating dummies. Each dummy variable is equal to 1 if the average Moody's and Standard and Poor's (S&P) rating[9] has the corresponding numeric grade (see Table 2 for rating scales) and zero otherwise[10]. These dummy variables should capture the difference in both issuers' creditworthiness and bonds' seniority and security structures[11].

In addition to that, the following variables are used:

SUBO A dummy variable that equals 1 if the issue is subordinated, zero if it is senior. 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[12].

BANK A dummy variable that equals 1 if the issuer is a bank and zero otherwise. This variable should control for differences between banks and non-financial firms that motivated the use of two separate sets of weights in the Basel proposal. Such differences might be due, e.g., to the presence of implicit government guarantees,

[9] 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.

[10] Empirical results are based on the average numerical value of the ratings assigned by S&P and Moody's (rating scales are presented in Table 2). 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.

[11] 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 spread changes and tend to focus on the limitations of ratings as leading indicators of credit quality. Since our attention is focused on the cross-sectional variability of issuance spreads, these limitations should be much less relevant.

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

such as the too-big-to fail effect, that are not already incorporated into the issue rating.

BUILD, CHEM, COMP, ELE, ENE, ENGI, FIN, FOOD, HEALTH, HOTEL, INDU, INSU, MANU, MEDIA, OIL, RAIL, RETAIL, TELE, TRANS, OTHERINDU[13] – 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' 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.

(2) Maturity

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

(3) Secondary Market Liquidity

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 is therefore expected for this variable[14].

(4) Tax Treatment

The following two variables are used to proxy for the different expected tax treatment of different eurobond issues:

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 on capital gains and interest income. In some countries these two rates are different; however, given the wide range of nationalities of eurobond investors, the a priori effect of COUPON on the bond after

[13] Each industry's complete name is reported in Table 9. 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.

[14] 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.

tax value is uncertain. In addition to that, as most eurobonds are in bearer form, avoiding tax is relatively easy for investors. Nevertheless, 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 investor decides 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 is expected as eurobond investors would find it easier to avoid tax payments in the case of bearer bonds[15].

(5) Primary Market Efficiency

The following four variables are used to proxy for the different primary market efficiency of different eurobond issues:

MANAGERS - The number of financial institutions participating in the bond issuance management group (book runners, lead manager, any co-lead manager, and co-managers). A negative coefficient is expected as this would indicate that a larger syndicate is able to achieve, ceteris paribus, a larger number of potential investors. This would in turn result in a higher demand for the issuing bonds and in a lower spread[16].

PRIVATE A dummy variable that equals 1 if the bond issue is a private placement and zero if it is public[17]. Other things equal, private placements represent a less efficient issuance process as a smaller number of potential investors is directly reached. A negative coefficient is expected as investment banks are generally able to exploit a stronger placing/selling power in a private placement than in a public issue.

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[15] Only 3.33% of the sample eurobond issues (159 over 3,307) are registered (see Table 4).

[16] Note that an increase in costs associated to a larger number of syndicate members would already be captured by the FEES variable. Quite surprisingly, these two variables are not significantly correlated: their Pearson correlation coefficient is indeed low (0.306) and statistically not significant. Moreover, MANAGERS is not significantly correlated with AMOUNT: indeed, the correlation coefficient is negative (-0.114), indicating that larger issues are not associated with a higher number of managers.

[17] Only 12 of the 3,307 eurobonds in our sample were issued through a private placement (see Table 4).

FEES The amount of gross fees charged by the bond issuance syndicate to the issuer. These include underwriting fees, management fees and selling concession[18]. No clear theoretical *a priori* conclusion can be reached on the expected sign of this variable. A negative sign would indicate that issuers can translate the higher fees to the final investors through a lower spread. This would also indicate that a sort of performance-related incentive scheme is in place, whereby the fees paid by the issuing firm to the syndicate members are negatively related to the funding cost for the issuer.

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 for the bonds, in an open-priced one the final investors play a role in determining the actual 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 is achieved in this kind of issues. This should in turn results in a lower spread. A negative coefficient is therefore expected.

(6) Currency

DEM, DFL, EURO, FFR, STG, USD, CAN, OTHERCUR – Currency dummies. Each dummy variable is equal to 1 if the issue is denominated in the corresponding currency and zero otherwise. These variables should capture both the different credit standing and liquidity of the national Treasury securities and eurobonds investors' currency preferences[19].

(7) Bond market conditions at time of issuance

QI-91, QII-91, QIII-91, QIV-91, QI-92, …, QIV-01 – Quarterly dummies. Each dummy variable is equal to 1 if issue *i* has been completed during the corresponding quarter and zero otherwise[20].

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[18] 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.

[19] The OTHERCU dummy was dropped to avoid perfect collinearity

[20] The QI-91 dummy variable has been dropped to avoid perfect collinearity

RF_10Y – Risk free rate offered on 10-year Treasury bonds in the quarter when each eurobond in our sample was issued. Note the rate actually used depends on the currency in which each eurobond is denominated[21]. As we shall see, this 10-year rate can capture the variations in bond market conditions when the bonds were issued, and in a more parsimonious way than quarterly dummies.

(8) Country

AUS, BEL, GER, FRA, JPN, ITA, NET, SPA, SWI, UK, USA, OTHERCOU – Country dummies[22]. These should capture cross-country differences in macroeconomic conditions[23].

3. DATA SOURCES AND SAMPLE CHARACTERISTICS

Our data come from two main sources: Capital Data BondWare and Moody's Corporate Default[24]. Capital Data reports information on the major debt and equity issues worldwide. As far as eurobonds are concerned, it provides information on both issuers (nationality, industry, etc.) and issues (Moody's and Standard and Poor's 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). Moody's Corporate Default Database 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.

All bonds with special features (e.g. callable bonds, perpetual bonds, floating rate bonds) that would affect their price have not been included in our empirical sample. Spreads at issuance for all issues of fixed rate, non-convertible, non-perpetual and non-callable eurobonds during the 1991-2001

[21] We used the actual 10-year T-bond rates for DEM, DFL, EURO, FFR, STG, USD, CAN and YEN. As a filler for issues denominated in other currencies, we used the 10-year rate on USD-denominated treasuries.

[22] Eurobond issues are often carried out by wholly owned subsidiaries located in fiscal havens such as the Cayman Islands or the Bahamas. In such cases, the parent company's country (as indicated by Capital Data BondWare and/or Moody's Corporate Default) was used.

[23] The OTHERCOU dummy variable has been dropped to avoid perfect collinearity.

period were collected. This amounts to 5,482 bonds, of which 476 were issued by companies of LDC or minor countries (such as Chile, Bulgaria, Malta, Mexico and Russia) and 1,602 were issued by central banks, supranational institutions, central or local governments. These were not considered; moreover, 96 more observations were left out, as they carried no information on the FEES variable. This left us with 3,307 issues, completed by 690 corporations from 15 different countries (see Tables 3 and 4).

This sample suffers from two potential selection biases. First, a relatively larger number of issues has been completed during the second part of the Nineties. This is partly due to a general increase in the average number of eurobond issues, and partly the consequence of the availability of Moody's and Standard and Poor's ratings. Second, as companies tend to issue eurobonds when the market is more receptive, the number of issues is particularly low in the third and fourth quarter of 1998, when the Russian crisis occurred, and particularly high during 1999, during a low interest rate environment. However, neither of these biases should make our empirical sample unfit to answer the key question of our study. In other words, 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 possible biases.

Moody's and Standard and Poor's (S&P) ratings at issuance for these 3,307 issues are either from Capital Data BondWare or from the January, 2001 release of Moody's Corporate Default Database. Both Moody's 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), is different by one notch only in 24.9% of the cases (394 issues) and by two notches in 4% of the cases (64 issues)[25].

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[24] Moreover, risk-free rates on 10-year T-bonds, used to create the RF_10Y variable, are taken from the Datastream database.

[25] A difference of more than two notches is present in only 6 of the 1,822 issues for which both ratings are available (0.3% of the issues). We checked for these differences for the banks' issuers subsample too, in order to test whether a higher degree of uncertainty is present. Results appear similar to those of the whole sample. Indeed, of the total 1,827 bank issues, both ratings were available for 846 only. When both ratings are available, the corresponding numerical value is the same in 75.4% of the cases (638 issues), is different by one notch in 20.6% of the cases (174 issues), and is different by two notches in just 4.0% of the cases (34 issues).

More information on sample characteristics is provided in Tables 5 through 9. As shown by Table 5, most of the sample issues have been completed by German, US, UK, Dutch and French companies. Together, they account for about 80% of the number of issues and of the total amounts. The average spread is significantly higher than the sample average for Italian, Spanish, UK and US issuers. However, these countries also show the worst average rating. This seems to indicate that the higher spread is simply a consequence of the higher default risk perceived by eurobond investors. This phenomenon is also graphically shown in Figure 1.

Table 6 describes the sample by year of issuance. The total amount issued per year has grown from less than 40 billion USD in 1991 to almost USD 170 billion in 2001, with the average issue growing from just over 200 million USD to more than 500 million USD. The average spread has significantly risen during the last five years, from 23.3 basis points in 1996 to 107.8 b.p. in 2001, while the average rating has significantly worsened, from 2.52 (equivalent to AA+/AA in the S&P scale) in 1991 to 4.26 in 2001 (approximately equivalent to A+).[26]

Table 7 reports the main features of the sample issues by rating category. Most of the issues fall into the first six notches (from AAA to A in the S&P scale and from Aaa to A2 in the Moody's' one). Indeed, these rating classes account for 90.7% of the number of issues and for over 87% of the total amount[27]. Average spreads per rating category increase monotonically with rating values, except for classes 9, 10, 12, and 14, for which a limited number of issues is available. Note that banks are mostly concentrated in the top four rating classes (from AAA/Aaa to A+/A1).

Table 8 splits the sample by currency of denomination. Three currencies (Euro, British pound sterling and U.S. dollar) account for 64.2% of the issues and 76.3% of the amounts. Euro-denominated issues have a higher spread (88.5 bps compared to a sample average of 61.3 bps), a higher rating (4.24 versus 3.10) and a higher issue amount (U.S. dollar 483.3 million versus 311.2 million). These differences are mostly due to the fact that most Euro-denominated issues have been

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[26] Note that such averages were computed based on the numeric scale reported in Table 2, where the distance between two adjacent grades is supposed to be constant (that is, the difference between AAA and AA+ is supposed to be equivalent to that between a BBB- and BB+). This does not apply to our regression results, where each rating class is represented by means of a separate dummy.

[27] However, the remaining 10% still amounts to more than 300 issues. Therefore, we feel confident that the conclusions reached by our analyses still are reliable also for below-A borrowers.

completed in the last four years (1998 to 2001), when the bond market conditions were worse and average issues were larger than in the previous years (see Table 6).

Finally, Table 9 provides information on the industry distribution of the sample issuers. Almost two thirds of the sample issues have been completed by banks (55.2%) and financial corporates (19.4%). Significant differences emerge among industries' average spreads. These differences basically reflect differences in the industries' average ratings.

4. EMPIRICAL RESULTS

4.1. Regression analysis

Table 10 reports various estimates of our model coefficients and standard errors. Adjusted R^2s are shown at the bottom of the table, together with F-statistics.

Column (1) shows our basic regression: an adjusted R^2 of 0.89 indicates that ratings and other control variables explain a significant portion of the spreads' cross-sectional variability.

All rating dummies are statistically significant at the 1% level (the first grade is omitted to avoid perfect collinearity, and can be thought to have a zero coefficient). The monotonic pattern of most coefficients indicates that spreads rise when ratings worsen (see Figure 2)

MATU and REG both have significant coefficients with the expected signs. The same happens for SUBO, indicating that investors require a higher risk premium on subordinated bonds than the one implicit in the agency ratings. Quite surprisingly, AMOUNT is not statistically significant. This result is consistent with previous empirical evidence[28] and could be attributed to two main factors: (i) the liquidity of the eurobonds' secondary market is not affected by the size of the issues, (ii) eurobond investors tend to hold these securities to maturity and are therefore indifferent to their secondary market liquidity.

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[28] Analyzing yield differences between corporate bonds and medium-term notes (MTNs), Crabbe and Turner (1995) find no relationship 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 contrasts with the idea that large issues have larger liquidity and suggests that large and small securities issued by the same borrower are close substitutes.

COUPON has a positive, significant coefficient as expected, indicating that investors require a higher return on higher-coupon issues due to their relatively worst tax treatment[29]. All reported currency dummies have significant positive coefficients, indicating that those currencies command higher spreads than other ones[30]. This result flows from the higher credit standing and liquidity of their Treasury issues[31]: because spreads are computed by subtracting such Treasury yields from eurobond yields, they tend to be higher for Euro, U.S. dollar and pound Sterling.

While MANAGERS and FEES are not statistically meaningful, FIXED has a significant negative coefficient, indicating that fixed-priced issues raise funds at a lower spread. This result is likely to follow from the higher risk of unsold bonds in fixed-priced issues, rather than from eurobond investors requiring higher returns on open-priced ones. The same is true for PRIVATE: a strongly negative coefficient indicates that the investment banks managing a private placement are generally able to fund their corporate clients at a lower rate. This can be explained in two different ways: first, given the lower disclosure and competition on private placements, investors have to rely more heavily on the information and advice provided by the bond issuance syndicate. Second, public issues are generally subject to higher regulatory costs which increase the total yield.

The BANK dummy lacks statistical significance. This means that, while eurobonds issued by banks do have a better average rating than those issued by non-financial companies, no significant difference emerges in the spread/rating relationship between banks and non-financial firms. This has some clear policy implications for the Basel Committee's "standardised approach" (in which banks actually enjoy a more favorable weighting scheme), and we shall return to this result in our final remarks.

Finally, while country dummies[32] are not significant (as suggested by a joint F-statistic of 1.61), most quarter dummies are (the joint F-statistic of 27.1 is significant at the 1% level). However, while quarter dummies help us achieve a better fit of *the past behavior* of the eurobond market, they become useless for simulation purposes. In other words, when one wants to use the model in Table

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[29] This empirical result is consistent with Elton et al. (2000).

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

[31] 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.

10 to infer what spreads the market would expect from differently-rated bonds, it is impossible to specify a value for the dummies associated with *future quarters*.

We then scrutinized our set of quarterly dummies more carefully (see Figure 3), and found out that they were strongly correlated with 10-year rates, both on dollar- and ecu/euro-denominated Treasury bonds (the correlation coefficients being -63.2% and -66.2%, respectively).

Therefore we substituted all quarterly dummies with just one variable, RF_10Y, expressing the rate offered on 10-year Treasury bonds in the quarter when each eurobond issue in our sample was completed (the rate actually used depends on the currency in which each eurobond is denominated). This makes our model (see column 2 in Table 10) much more parsimonious and transparent (it can now be used also to run simulations, provided that a value for long-term, risk-free rates is specified), while reducing the adjusted R-square only slightly.

The 10-year rate has a negative coefficient, that is, higher rates imply lower spreads. One possible explanation for this behavior relates to the economic cycle: when the cycle is booming (and perceived default risks are lower), long term rates tend to increase as the demand for funds exceeds the supply of savings. Moreover, if higher consumption and employment rates prompt a rise in inflation, nominal rates must rise even more. The opposite is true when an economic slowdown comes: savings tend to exceed investments and real rates decrease; as deflationary pressures arise, nominal rates may fall even more sharply. In the meantime, credit risk estimates are revised upwards, and spreads go up. A negative link between risk-free, long term yields and credit spreads therefore looks quite consistent with market behavior.

Another explanation for the significance of the 10-year rate concerns its link with the COUPON variable. We have seen that a higher coupon causes spreads to increase, since it implies a less favorable tax treatment. However, if the increase in coupons reflects a rise in risk-free rates (that is, a market-wide phenomenon), then spreads tend to stay unchanged and the COUPON effect has to be corrected downwards[33].

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[32] To save room, the individual values of the country and quarter dummies were not reported in Table 10. However, F-statistics for their joint significance were reported in the bottom part of the Table.

[33] COUPON and RF_10Y show a positive correlation of about 70%, a value that might signal some multicollinearity risks. Note that, however, an alternative version of the model in column (3) was estimated using only *the difference between COUPON and RF_10Y*, and the coefficients/significance of all other variables remained virtually unchanged.

The results for this alternative specification (Table 10, column 2) are very similar to our base model. However, two dummies that used to be significant (SUBO and FIXED) look now weaker. As we shall see in the next section, those variables tended to be significant for the eurobond market only in the first years of our sample: therefore, their effect becomes less strong once quarterly effects are removed. In addition to that, both MANAGERS and FEES become statistically significant with the expected negative coefficient.

The model was further refined in column (3), where all variables that were not statistically significant were sequentially removed. This model will be used as a basis for the simulations reported in § 5 of this paper.

4.2. Robustness checks

Alternative specifications of our model (see columns 4a-6b of Table 10) were estimated in order to assess its robustness[34].

Early vs. late Nineties - First, separate regressions were run for bonds issued between 1991 and 1996 (1,503 observations) and bonds issued between 1997 and 2001 (1,804 observations)[35], to test for any temporal evolution in the relevant factors. Results are reported in columns (4a) and (4b). The adjusted R^2 increased from 0.65 in the first sub-period to 0.91 in the second one, indicating that the independent variables improved their explanatory power over the Nineties.

Most rating dummies are statistically significant and the spread/rating statistical relationship is very similar for the two sub-samples (Figure 4, panel a). However, at least four differences emerge between the two sub-samples: first, SUBO is statistically significant in the 1991-1996 sub-sample only. This result could be the consequence of the rating agencies' evaluation of subordinated bonds improving over time or, alternatively, of a decrease over time in the recovery rate gap between senior and subordinated bonds as perceived by investors (this in turn could imply a more accurate

[34] Our base model (column 1) was also estimated including fixed effects (i.e., a dummy variable for each company or economic group issuing at least 5 bonds in our sample). This was meant to ascertain whether the variation in the independent variables *within* an issuer affects the spreads differently than *between* issuers. Results (not reported, for sake of brevity) did not show any significant difference from standard OLS estimates, therefore confirming the main conclusions reached in the text.

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

judgment, based on more information[36]). Second, while FIXED is not significant in the late Nineties, it has a strongly negative coefficient in the 1991-1996 sub-sample. Third, while REG is not statistically significant in the 1991-1996 sub-sample, it has a strong positive effect in the second period. Finally, while PRIVATE is not significant in the first period, it has a strongly negative sign in the second one. The last two 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 privately placed issues were completed during the first half of the Nineties[37].

Banks vs. corporates - The second check regards the relevance of the issuer type ("BANK") dummy. This check has been performed by running separate regressions for eurobonds issued by banks and other financial institutions and for those issued by non-financial firms. In fact, using a common sample could produce misleading results if investors evaluate these two type of issuers differently (e.g., if they attribute a different relevance to the exogenous variables used in our model). Results are reported in columns (5a) and (5b) of Table 10.

Once again, most rating dummies are statistically significant (with the expected sign) for both sub-samples, and explain a significant portion of the spread. Moreover, statistically significant dummies have very similar coefficients for the two sub-samples (see Figure 4, panel b). This means that financial and non-financial firms, when equally rated, are perceived by investors to have similar default risk. It is therefore our opinion that a common, unique scale of risk-weights per rating bucket should be adopted for both banks and non-financial firms. A differential treatment would still be reasonable (as it was in the 1988 Accord) only for unrated exposures.

Only few significant differences emerge between the two sub-samples. First, the adjusted R^2 of 0.904 for the corporate sub-sample (compared to 0.570 for banks) indicates that ratings and other independent variables explain a higher portion of the spread variability for non-financial firms than for banks. This suggests that other unidentified factors may be relevant in explaining banks' bonds issuance spreads.

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[36] Most empirical studies on bonds' recovery rates appeared in the mid and late Nineties. See Altman and Kishore (1996), Hamilton et al. (2002) and Van de Castle et al. (2000).

Second, SUBO is strongly significant, with a positive coefficient, only for banks. As mentioned before, rating agencies tend to downgrade subordinated issues by one notch: seemingly, investors view this practice as fair (given the expected recovery rates) only for corporate bonds: as concerns banks, subscribers are relatively more pessimistic than rating agencies. This result can be explained in two alternative ways. First, investors find it more difficult to evaluate the expected recovery rate in the case of bank-issued subordinated bonds because of a lower degree of disclosure and of the financial nature of most banks' assets: the higher degree of uncertainty gets then translated into 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, leading to an increase in expected losses. This adverse phenomenon would obviously be particularly exacerbated for subordinated bonds.

Other minor differences between the two models, such as the statistical insignificance of PRIVATE in the banks' specification[38], and that of FIXED in the corporate specification, are most likely the consequence of the different composition of the two sub-samples.

Moody's vs. S&P's - Third, separate regressions using Moody's' ratings only (2,317 observations) and S&P's ratings only (2,449 observations) were estimated, to check for biases due to use of "average" ratings (using the average value of ratings coming from two different sources could produce misleading results if the agencies adopt significantly different criteria). Results are reported in columns (6a) and (6b) of Table 10: 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 scales (Figure 3, panel c). Third, as shown by the adjusted R^2 and by the "F-rating" test, in both cases ratings explain a significant portion of the spreads' cross-sectional variability. Fourth, SUBO is not statistically for both Moody's' and S&P's. Some minor differences, such as the significant, positive coefficient of DFL and FFR in the S&P sub-sample, are most likely the consequence of the different composition of the two datasets.

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[37] Only 25% of the registered bond issues have been completed during the 1991-1996 period (28 over 110), with 60% of them (66 over 110) having been issued during the last three sample years (1998-2001). Most of the few private placement issues (9 over 12) have been completed during the 1991-1994 period.

National models – A robustness check of the model in column (2) has been performed by running separate regressions for each G5 country. The results, reported in Table 11, show that the spread/rating relationship is very similar (and always statistically significant) for bonds issued by corporations of different countries. In addition to that, most rating dummy coefficients show a monotonic pattern, indicating that spreads increase when ratings worsen.

Industry dummies – The BANK dummy had to be dropped from the models in columns (1) and (2) because of its lack of statistical significance. However, one might object that it would turn out to be relevant when considered *inside a whole set of industry dummies* (covering all non-bank sectors on a one-by-one basis, instead of melting them into one undiversified pool). This was done by including into model (2) a set of 23 dummy variables (see Table 9 for details), dropping the constant term to avoid perfect collinearity. The results (not reported) were the following: 1) the coefficients and statistical significance of the non-industry regressors remain approximately unchanged; 2) as concerns the industry dummies, only two out of 23 (insurance and telecoms) turn out to be significant at the 5% level; 3) however, a joint LM test for the whole set of dummies leads to a F-statistic of 4.05, with a p-value close to zero; 4) as concerns the banking sector, the value of the coefficient associated with its dummy (22.3) is not statistically different from the weighted average value for non-bank sectors (23.7): a Wald test of the null hypothesis that the two values are the same leads to a F statistic of 1.74 and a p-value of 22.5%. We conclude that although some industries (such as insurance and telecoms) show a difference in the spread requested by the market (all other variables being equal), this is not the case for banks; therefore, the investors' assessment of a bank's riskiness seems to be fully captured by their comparatively better ratings, even when a whole set of industry dummies is considered[39].

Granularity of the rating scale – Although most rating dummies in our models get a coefficient that is significantly different from zero, the coefficients assigned to adjacent rating grades are not always statistically different from each other at the 5% level: a set of Wald tests (not reported) shows no difference for 4 out of 17 adjacent couples. One way to circumvent this problem is to reduce the granularity of our rating scale, e.g. reverting to the more "compact" set of six buckets shown in Table 1. When moving from the original 21 rating dummies to this more compact set of 6

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[38] Only 4 of the 1,827 banks' eurobond issues sub-sample are private placements.

[39] Including industry dummies into model (1) leads to similar results.

buckets, however, the results of model (3) do not show any dramatic change[40]. All "compact" dummies are largely significant (and all other variables in the model still are, with no relevant changes in their coefficients); however, the adjusted R-square drops from 86.7% to 84.7%. Most interestingly, as shown in next Section (see Table 12 and footnote 41), the "typical" spreads associated with each bucket remain the same, regardless of the fact that they are derived from the regression based on the "compact" scale, or computed as a simple average of the spreads derived from model (3), where all rating dummies are included (e.g., for the "A+ to A-" bucket, averaging the spreads obtained through the coefficients of RAT_5, RAT_6 and RAT_7).

5. IMPLICATIONS FOR THE ADEQUACY OF THE BASEL COMMITTEE'S PROPOSED RISK WEIGHTS

5.1. Simulated spreads

Once the credit spreads required by the eurobond market have been decomposed into their main drivers, we can use our estimated equations to capture the degree of credit risk associated with different rating grades. To do so, we use our reduced model (see Table 10, column 3) to simulate the spreads paid by a "standard" eurobond. This "simulated" bond has the following characteristics:

- it is issued by a group of 14 managers (including co-managers, book-runners etc.) for a fee of 139 basis points (these values are close to the sample averages shown in Table 3);
- it is denominated in US dollars, has a 7-year maturity, pays a 6,5% coupon rate and is issued at a time when risk-free T-bonds pay a 6,2% yield (again, this mimics our sample averages; note, however that sensitivity analyses will be performed on this second array of parameters);
- like most issues in our sample, it is publicly placed and unregistered.

Table 12 (panel "a") shows the simulated spreads required on different "rating buckets[41]". The standard eurobond described above is compared to some alternative cases, considering:

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[40] To save room, the results are not reported in the paper, although they are available from the authors upon request.

[41] Spreads for the buckets were obtained as simple averages of the spreads required on each single rating class falling into each bucket. We prefer to stick to simple averages since a weighted average would strongly depend on the specific composition of our sample which (especially for less numerous buckets) would probably not coincide with the rating mix of the universe of loans and bonds subjected to the new Basel Accord. However, spreads derived from a "compact"

- shorter (3 years) and longer (10 years) maturities;
- a change in the currency in which the bond is denominated (euro vs. US dollar);
- different scenarios for risk-free, long-term rates (ranging from 4% to 8%) and coupon rates (4,3% to 8,3)[42].

As can bee seen, spreads tend to remain unchanged regardless of the working hypotheses used in our simulations. While maturity exerts a limited effect, risk-free rates and the currency of denomination have almost none.

In the second part of the Table (panel "b"), simulated spreads are turned into risk-weights by imposing that:

(i) the ratio between the risk-weights of different rating buckets be identical to the one between the estimated spreads;

(ii) the resulting weighted average risk-weight - computed using the distribution of banks' credit portfolios by rating buckets estimated by the Basel Committee[43] - be similar to the current 100%[44] level.

The resulting curves are much steeper than those proposed by the Committee and by some previous studies (panel "d"); this means that the degree of risk-sensitivity of the new requirements, although it marks an undoubted improvement over the "uniform" 100% risk weight currently assigned to all corporate loans, still lags behind the indications coming from the market.

In other words, the new risk weights, although they differentiate among borrowers of different credit standing, still seem to imply a relevant degree of "cross subsidization" among loans, with the

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model where only six large rating buckets are considered (see Section 4.2) would lead to results very similar to those reported in Table 12.

[42] Note that, when simulating changes in risk-free rates, the bonds' coupon rates are changed accordingly.

[43] See Table 12, panel c). The assumed distribution of banks' portfolios is based on the results of a quantitative impact study (simulating the effect that the new Basel Accord proposals would have for a sample of banks), published by the Basel Committee in November 2001. The study includes weighted average information on the quality distributions of corporate, interbank and sovereign portfolios held by those banks. The results have been weighted inside countries by the capital of the banks and between countries by the relative importance of the international banking sector.

[44] This criterion is consistent with the objective of the New Capital Accord, as explicitly stated by the Basel Committee, not to alter the overall capital levels of the banking industry. Note that the risk-weights proposed by the Committee itself and by professors Altman and Saunders would result into a net decrease of the average risk-weight (of about 20% and 40%, respectively).

best borrowers paying for a share of the risks originated by the worst ones (and, again, a lot of scope for regulatory arbitrage and opportunistic behavior…).

5.2. Expected and unexpected losses

The analysis above was based on the assumption that a linear relationship exists between the spreads, required by private investors on different ratings, and the amount of capital that a bank should hold to cover its risks.

However, such an approach lends itself to be refined, and more accurate ways can be worked out, to turn bond spreads into an estimate of capital requirements on different rating buckets.

A risk-adjusted loan pricing formula can be used, like those adopted by most internationally-active banks using a credit value-at-risk (CreditVaR) model[45]. Namely, one can impose that the spread s_i on a loan to the i-th borrower be set in such a way that the expected proceedings from the loan (allowing for its expected losses) cover all expected financial costs (including the cost of that portion of the loan, say k, that has to be funded with capital to cover unexpected losses, thereby incurring an extra cost of s_k).

For a one-year loan, this amounts to imposing that[46]

$$(1+r_f+s_i)(1-p_{1i})+R\cdot p_{1i}=(1+r_f)(1-k)+(1+r_f+s_k)k \tag{2}$$

where: r_f is the risk-free rate, p_{1i} is the probability that the i-th borrower will default within one year, R is the recovery rate on defaulted exposures[47], k is the loan's implied capital ratio, s_k is the risk-premium the lender/investor has to pay on its shareholders' capital.

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[45] See Ong (1999) and Saunders (1999).

[46] Equation (2) basically states that the interest rate charged to a borrower should be a function of four main factors: (i) the risk-free interest rate, as a proxy for the bank's cost of funds, (ii) the borrower probability of default, (iii) the loan's expected recovery rate, (iv) the loan credit VaR, i.e. a measure of the amount of economic capital that the bank has to allocate to the loan, and (v) the equity premium s_k, as a measure of the excess return required by the bank's shareholders on economic capital.

[47] This is the nominal amount the bank will be able to recover for each dollar originally lent. We impose that the recovery takes place at the end of the year, so we need not multiply R by a capitalization factor.

For two-year loans, equation (2) above becomes

$$\begin{aligned}&(1+r_f+s_i)^2(1-p_{2i})+R(1+r_f)p_{1i}+R(p_{2i}-p_{1i})=\\&=(1+r_f)^2(1-k)+(1+r_f+s_k)^2k=(1+r_f)^2+k\left[(1+r_f+s_k)^2-(1+r_f)^2\right]\end{aligned} \tag{3}$$

where p_{2i} is the (cumulated) probability that the i-th borrower will default within two years[48].

The more general case of a n-year loan requires that

$$R\sum_{j=1}^{n}\left(p_{j,i}-p_{j-1,i}\right)\left(1+r_f\right)^{n-j}+\left(1+r_f+s_i\right)^n\left(1-p_{n,i}\right)=\left(1+r_f\right)^n+k\left[\left(1+r_f+s_k\right)^n-\left(1+r_f\right)^n\right] \tag{4}$$

where $p_{j,i}$ is the (cumulated) probability that the i-th borrower will default within j years.

Finally, equation (4) can be reformulated, to estimate k when the spread s_i is known:

$$k=\frac{R\sum_{j=1}^{n}\left(p_{j,i}-p_{j-1,i}\right)\left(1+r_f\right)^{n-j}+\left(1+r_f+s_i\right)^n\left(1-p_{n,i}\right)-\left(1+r_f\right)^n}{\left(1+r_f+s_k\right)^n-\left(1+r_f\right)^n} \tag{5}$$

Through equation (5) we can estimate the capital ratios[49] implied by "typical" market spreads like those reported in Table 12. To do so, however, we must specify values for the other parameters in the equation. We proceed as follows:

- spreads s_i will be taken from Table 12;
- n (maturity) and r_f (risk-free rate) will be consistent with the values used to simulate spreads in Table 12; this means that n will vary from 3 to 10 years (around a central value of 7), while r_f will fluctuate between 4% and 8% (6.2% being the base value);
- the matrix $\mathbf{P} = [p_{j,i}]$ of default probabilities (for different time horizons and rating buckets) will be based on the historical default rates recorded by Standard and Poor's[50] (see Table

[48] To keep things simple, we are implicitly using a flat risk-free yield curve. The model could be easily generalized to non-flat rate structures. However, since our focus is not on risk-free rates, but rather on credit spreads, we feel that this extra complexity would not be compensated by any significant improvement in the accuracy of our conclusions.

[49] Note that since spreads also cover screening and monitoring costs on risky borrowers (which were not included in our formulae), the capital ratios generated by equation (5) might be somewhat biased upwards.

[50] Our last rating bucket is based on the default rates for the CCC+/Caa1 rating class (RAT_17 in our model) because no data is available from S&P's for other rating classes in the bucket.

13); note that using data by Moody's (taken, e.g., from Hamilton, 2002) would not affect our findings;

- R and s_k will be set according to the results of some recent research works. Therefore, R will vary between 45% and 55%[51] (see Table 14), while s_k will take a value of 4% (see Table 15, based on Maccario, Sironi and Zazzara, 2002). As regards the latter, however, to incorporate the fact that investors operating in the junk-bond market are perceived as riskier by their own shareholders, institutions underwriting non-investment grade bonds will have to pay a higher risk premium: s_k will gradually rise to 8%[52].

Table 16 reports the estimated values of k for different rating buckets, and the resulting risk-weights (as in Table 12, the latter were computed by imposing that the resulting weighted average risk-weight be similar to the current 100% level). Several findings appear noteworthy:

- the capital levels implied by the eurobond spreads look higher than 8%, even for high quality bonds; this could follow from the fact that primary financial institutions (like those underwriting bonds on the Euromarket) tend to hold capital in excess of the minimum regulatory levels.
- low quality investments tend to be financed with a surprisingly high volume of capital. It must be remembered, however, that our formulae are likely to overstate capital because they do not account for operating costs. This means that the portion of credit spread required by an institutional investor to cover its own operating expenses is here attributed to the cost of capital, thereby inflating the estimated capital levels.
- the capital levels decrease - and the risk-weight curve becomes less steep[53] - for shorter-term investments; the same happens when recovery rates are reduced, since this implies that a higher portion of the spread is meant to cover expected losses (while, conversely, the implied unexpected losses have to shrink); again, the curve grows flatter when risk-free rates

[51] This is a relatively prudent assumption. Recovery rates are generally lower in the bond market than for corporate loans (see Table 14).

[52] A sensitivity check is reported in Table 16, considering an alternative value of 10% for the maximum risk-premium required to banks investing in low-quality bonds.

[53] This can follow from the fact that our sample is made up mainly by long-term bonds, and that long-term spreads may not be suitable to estimate capital requirements on shorter-term investments, especially for the riskiest rating classes.

increase, as the differences in spread between bonds of different quality become less significant in relative terms.

- the risk-weights derived from these capital ratios (see panel b) confirm the results of Table 12: their profile is much steeper than suggested by the Basel Committee's buckets, while the third (BBB+ to BBB-) and fourth class (BB+ to BB-) reveal deeply different risk levels.

One might argue that the capital levels proposed by the Basel Committee are supposed to cover *both expected and unexpected losses* arising from credit risks, so that the results in Table 16 (based on credit VaR, that is, unexpected losses) do not account for the whole capital buffer that banks are supposed to hold in the "Basel approach".

While we believe that such a framework is excessively prudent, and that a bank's economic capital should only cover unexpected losses (expected ones being covered by loan loss reserves), it is not difficult to adjust our findings to this perspective. We simply adjust the capital ratios in Table 16 (unexpected losses) by adding up a measure of expected losses (given by the *n*-year average PD times the expected severity rate[54]), and we normalize the result so that, as usual, the risk weight on a bank's average loan portfolio equals 100%: the results are shown in panel (c) of Table 16. The new set of weights broadly confirms our previous findings.

6. CONCLUSIONS

This study has examined the ability of the Basel Committee's proposed risk-weights to adequately reflect the risk-rating relationship. Issuance spreads on eurobonds issued by more than 600 major corporations from 15 economically developed countries during 1991-2001 have been used in order to estimate the average spread per rating bucket and evaluate the risk-rating relationship.

Three main results emerged from the empirical analysis.

First, the spread/rating relation is strongly significant, with spreads increasing when ratings worsen. Second, the estimated spreads per rating bucket indicate a much steeper risk/rating relation than the

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[54] The *n*-year expected PD for a borrower of class *i* is based on the cumulative default probabilities (p_{ni}) taken from S&P transition matrices, and was computed as $1-(1-p_{ni})^{1/n}$.

one implied in the risk-weights proposed by the Basel Committee. Finally, while eurobonds issued by banks have a better average rating than those issued by non-financial companies, no statistically significant difference emerges in the spread/rating relationship of banks and non-financial firms. This indicates that the proposed distinction between bank and corporate loans has no economic justification once external ratings are accounted for[55].

Following these empirical findings, we propose three main changes to the standardised approach risk-weights per rating bucket.

First, no distinction should be present in the risk-weights for rated banks and non-financial companies; a more favorable weight for banks should be kept only for unrated entities. Second, the risk-weights per rating bucket should be adjusted in order to reflect the steeper relationship between risk and rating. Third, six rating buckets should be considered rather than the four currently proposed by the Basel Committee. Our proposal for the corresponding risk-weights are the following: 30 (for bonds rated AAA to AA-, that is Aaa to Aa3), 50 (A+ to A- / A1 to A3), 75 (BBB+ to BBB- / Baa1 to Baa3), 175 (BB+ to BB- / Ba1 to Ba3), 250 (B+ to B- / B1 to B3) and 300 (below B-/B3).

This implies that the third bucket including rating classes from BBB+ to BB- (from Baa1 to Ba3 in the Moody's' scale) should be split into two different levels; in addition to that, the current forth bucket (including all rating classes below BB-) should in turn be split into two different grades.

If the current system of only four weights has to be maintained, then at least BBB/Baa loans should be moved into the 50% bucket, since they appear more similar to other investment-grade investments than to BB loans.

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[55] Actually, one might argue that, for a given rating class, banks tend to show *higher* default frequencies than non-financial corporations, at least in the U.S. This was shown by Ammer e Packer (2000), by means of a probit model based on Moody's data, in which rating and vintage effects are separately accounted for: their results (see Table 4 in the paper) quantify in 2.14% the expected default frequency for banks, as opposed to 1.37% for non-financial corporations. This result was recalled by the Basel Committee itself, in its 2000 survey on rating sources (Basel Committee on Banking Supervision, 2000); however, Cantor and Falkenstein (2001), working on data for speculative-grade issuers, have shown that the gap between banks' and non-banks' historical default rates appears significant only if one assumes that default probabilities stay constant over time. When a more sophisticated framework is adopted (where default probabilities fluctuate over time because of short-term shocks, like the Savings & Loans crisis), no clear proof emerges that banks are to be considered more risky than non-financial firms in the same rating class. However, none of the above-mentioned studies ever hinted that banks should be considered *less* risky, as in the Committee's standardised approach.

Such changes – although they may seem hard to implement at the very advanced stage reached by the Basel reform process – would make the standardised approach much closer to the markets' sentiment, thereby bridging a potentially dangerous gap between the first and the third "pillar" of the new regulatory architecture.

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Table 1

Proposed Risk-Weights per Rating Bucket – Standardised Approach

	(1) *Basel 1999 proposed risk weight (%)*	*(2)* *Basel 2001 proposed risk weight (%)*	*(3)* *Altman-Saunders proposals (%)*
AAA to AA- / Aaa to Aa3	20	20	10
A+ to A- / A1 to A3	100	50	30
BBB+ to BBB- / Baa1 to Baa3	100	100	30
BB+ to BB- / Ba1 to Ba3	100	100	100
B+ to B- / B1 to B3	100	150	100
Below B-/B3	150	150	150

Source: Altman and Saunders (2001), Basel (2001).

Table 2

Rating Scales

Moody's	Aaa	Aa1	Aa2	Aa3	A1	A2	A3	Baa1	Baa2	Baa3	
S& P's	AAA	AA+	AA	AA-	A+	A	A-	BBB+	BBB	BBB-	
Our value	1	2	3	4	5	6	7	8	9	10	
Moody's	Ba1	Ba2	Ba3	B1	B2	B3	Caa1	Caa2	Caa3	-	-
S&P's	BB+	BB	BB-	B+	B	B-	CCC+	CCC	CCC-	CC	D
Our value	11	12	13	14	15	16	17	18	19	20	21

Table 3

Sample Descriptive Statistics (continuous variables)

	Spread	*Rating*	*Amount*	*Maturity*	*Coupon*	*Managers*	*Fees*
N	3,307	3,307	3,307	3,307	3,307	3,307	3,307
Mean	61.33	3.10	311.22	7.16	6.47	13.58	1.35
Median	40.00	2.00	242.99	5.00	6.25	12.00	1.63
Mode	20.00	1.00	200.00	5.00	6.00	1.00	1.88
Min.	-13.00	1.00	0.10	1.00	0.00	1.00	0.02
Max.	1,014.00	21.00	4,597.94	50.00	15.00	54.00	3.50
Std. Dev.	91.11	2.83	302.28	5.03	1.86	9.77	0.75

Notes: SPREAD: the difference, measured in basis points, between the Eurobond 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 equivalent value (see Table 2) of the average Moody's and Standard and Poor's issue rating. COUPON: the annual coupon (percent). MANAGERS: the number of financial institutions participating in the issuing syndicate. FEES: the total gross fees (%) earmed by the eurobond issuing syndicate (underwriting fees, management fees and selling concession).

Table 4

Sample Descriptive Statistics (dummy variables)

	Subo	*Reg*	*Cross*	*Pledge*	*Force*	*Private*	*Fixed*	*Bank*
N. of available issues for which data is available	3,307	3,307	2,782	2,801	2,751	3,307	3,307	3,307
N. of issues for which dummy = 1	180	110	1702	1711	2740	12	2450	1827
% of Total available data	5.44%	3.33%	61.18%	61.09%	99.60%	0.36%	74.09%	55.25%

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

Table 5

Sample Descriptive Statistics - Corporate eurobond Issues by Issuer's Country

Country	*Total # of issues*	*% Tot. # of Issues*	*# of Issuers*	*Avg. # of Issues per Issuer*	*N. of Bank Issues*	*% Bank Issues*	*Avg. Spread (b.p.)*	*Avg. Rating*	*Total Amount (US$ m)*	*% Tot. Amount Issued*	*Average Amount (US$ m)*	*Average Maturity (years)*
Austria	80	2.4%	17	4.71	70	87.5%	49.9	2.05	19,831	1.9%	247.9	7.33
Belgium	78	2.4%	16	4.88	59	75.6%	35.6	3.15	12,424	1.2%	159.3	6.06
Canada	102	3.1%	24	4.25	36	35.3%	61.6	3.41	16,536	1.6%	162.1	5.48
Denmark	23	0.7%	8	2.88	15	65.2%	44.6	2.96	3,460	0.3%	150.4	6.84
France	410	12.4%	65	6.31	217	52.9%	51.2	2.92	140,195	13.6%	341.9	7.93
Germany	724	21.9%	88	8.23	581	80.2%	41.3	2.06	224,384	21.8%	309.9	6.27
Italy	31	0.9%	18	1.72	9	29.0%	108.6	6.35	27,433	2.7%	884.9	8.03
Japan	168	5.1%	33	5.09	81	48.2%	38.8	1.54	61,442	6.0%	365.7	6.61
Netherlands	461	13.9%	51	9.04	364	79.0%	42.0	2.09	147,937	14.4%	320.9	6.62
Norway	24	0.7%	7	3.43	3	12.5%	43.2	1.58	5,496	0.5%	229.0	6.67
Spain	45	1.4%	20	2.25	7	15.6%	90.4	4.80	19,568	1.9%	434.8	7.63
Sweden	78	2.4%	24	3.25	31	39.7%	74.9	4.29	23,054	2.2%	295.6	6.21
Switzerland	46	1.4%	16	2.88	28	60.9%	58.2	3.15	11,319	1.1%	246.1	5.62
U.K.	487	14.7%	176	2.77	150	30.8%	94.2	4.70	161,937	15.7%	332.5	10.27
United States	550	16.6%	127	4.33	176	32.0%	89.3	4.18	154,184	15.0%	280.3	6.28
Total	3307	100.0%	690	4.79	1827	55.2%	61.3	3.10	1,029,199	100.0%	311.2	7.16

Table 6

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 Issues*	*Average Spread (b.p.)*	*Average Rating*	*Total Amount (US$ m)*	*% Tot. Amount Issued*	*Average Amount (US$ m)*	*Average Maturity (years)*
1991	188	5.7%	84	44.7%	61.3	2.52	39,072	3.8%	207.8	6.66
1992	193	5.8%	92	47.7%	52.5	2.51	47,953	4.7%	248.5	7.00
1993	249	7.5%	127	51.0%	45.8	2.55	73,976	7.2%	297.1	7.64
1994	217	6.6%	132	60.8%	29.3	2.51	50,916	4.9%	234.6	6.36
1995	218	6.6%	127	58.3%	24.5	2.30	54,054	5.3%	248.0	6.02
1996	438	13.2%	308	70.3%	23.3	2.51	105,903	10.3%	241.8	5.99
1997	347	10.5%	233	67.1%	27.4	2.69	91,776	8.9%	264.5	6.36
1998	305	9.2%	178	58.4%	69.0	3.33	94,083	9.1%	308.5	8.17
1999	479	14.5%	231	48.2%	93.4	3.80	186,942	18.2%	390.3	7.95
2000	342	10.3%	170	49.7%	107.9	3.90	115,039	11.2%	336.4	7.47
2001	331	10.0%	145	43.8%	107.8	4.26	169,484	16.5%	512.0	8.45
Total	3307	100.0%	1827	55.2%	61.3	3.10	1,029,199	100.0%	311.2	7.16

Table 7

Sample Descriptive Statistics - Corporate Eurobond Issues by Average Rating Class

Rating Class	*Total # of issues*	*% Tot. Number of Issues*	*N. of Bank Issues*	*% 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	1418	42.9%	954	67.3%	31.3	26.48	419,513	40.8%	295.8	6.73
AA+/Aa1	365	11.0%	264	72.3%	34.8	27.20	94,251	9.2%	258.2	6.51
AA/Aa2	392	11.9%	241	61.5%	44.9	32.37	116,748	11.3%	297.8	6.72
AA-/Aa3	366	11.1%	180	49.2%	57.6	39.30	108,149	10.5%	295.5	8.15
A+/A1	235	7.1%	73	31.1%	72.3	40.95	76,942	7.5%	327.4	8.29
A/A2	224	6.8%	87	38.8%	91.2	40.55	76,276	7.4%	340.5	7.29
A-/A3	123	3.7%	20	16.3%	106.7	56.49	68,658	6.7%	558.2	7.79
BBB+/Baa1	69	2.1%	4	5.8%	137.8	63.02	34,532	3.4%	500.5	8.67
BBB/Baa2	32	1.0%	1	3.1%	118.2	71.14	10,895	1.1%	340.5	7.50
BBB-/Baa3	2	0.1%	0	0.0%	83.5	58.69	486	0.0%	243.0	7.50
BB+/Ba1	4	0.1%	0	0.0%	308.5	95.21	522	0.1%	130.5	11.73
BB/Ba2	4	0.1%	0	0.0%	133.0	64.84	1,759	0.2%	439.7	8.00
BB-/Ba3	3	0.1%	0	0.0%	613.3	42.39	370	0.0%	123.3	7.31
B+/B1	12	0.4%	3	25.0%	433.9	182.00	2,768	0.3%	230.6	7.79
B/B2	24	0.7%	0	0.0%	584.6	169.21	6,897	0.7%	287.4	9.29
B-/B3	29	0.9%	0	0.0%	588.0	167.57	8,889	0.9%	306.5	9.85
CCC+/Caa1	1	0.0%	0	0.0%	827.0	-	401	0.0%	400.5	10.00
CC	1	0.0%	0	0.0%	442.0	-	250	0.0%	250.0	10.00
D	3	0.1%	0	0.0%	611.0	150.00	894	0.1%	298.1	9.33
Total	3307	100.0%	1827	55.2%	61.3	91.11	1,029,199	100.0%	311.2	7.16

Table 8

Sample Descriptive Statistics - Corporate Eurobond Issues by Currency

Currency	*Total # of issues*	*% Tot. # of Issues*	*# of Bank Issuers*	*% Bank Issuers*	*Average Spread (b.p.)*	*Average Rating*	*Total Amount (US$ m)*	*% Tot. Amount Issued*	*Average Amount (US$ m)*	*Average Maturity (years)*
AUS $	56	1.7%	42	75.0%	29.1	2.71	3,914	0.4%	69.9	4.64
CAN $	307	9.3%	210	68.4%	38.3	2.23	34,400	3.3%	112.1	5.49
DFL	162	4.9%	133	82.1%	20.6	2.00	35,392	3.4%	218.5	7.04
DKR	40	1.2%	35	87.5%	23.5	2.75	2,598	0.3%	64.9	6.08
DEM	230	7.0%	129	56.1%	34.9	2.60	67,602	6.6%	293.9	6.27
ECU	14	0.4%	9	64.3%	14.9	2.07	2,393	0.2%	171.0	4.15
EUR	726	22.0%	327	45.0%	88.5	4.24	350,880	34.1%	483.3	7.30
FFR	266	8.0%	157	59.0%	33.1	2.80	79,364	7.7%	298.4	8.31
NKR	17	0.5%	5	29.4%	43.9	3.65	986	0.1%	58.0	2.75
NZ$	29	0.9%	25	86.2%	51.0	2.41	1,777	0.2%	61.3	3.45
SKR	16	0.5%	14	87.5%	44.6	1.75	1,267	0.1%	79.2	4.90
STG	569	17.2%	227	39.9%	85.6	3.54	153,369	14.9%	269.5	11.64
US$	828	25.0%	483	58.3%	61.6	2.68	281,055	27.3%	339.4	5.08
YEN	38	1.1%	23	60.5%	22.1	2.79	13,505	1.3%	355.4	6.20
Others	9	0.3%	8	88.9%	45.1	3.11	697	0.1%	77.5	6.43
Total	3307	100.0%	1827	55.2%	61.3	3.10	1,029,199	100.0%	311.2	7.16

Table 9

Sample Descriptive Statistics - Corporate Eurobond Issues by Industry

	Total N. of issues	*% Tot. N. of Issues*	*Avg Spread (b.p.)*	*Avg Rating*	*Total Amount (USD m)*	*% Tot. Amount*	*Avg Amount (USD m)*	*Avg maturity (yrs)*
Automotive	28	0,8%	81,2	5,3	10.488	1,0%	375	4,8
Bank	1827	55,2%	39,8	2,2	509.154	49,5%	279	6,5
Building Society	38	1,1%	72,5	4,2	10.345	1,0%	272	9,6
Chemicals	28	0,8%	159,2	6,6	8.191	0,8%	293	8,0
Construction	16	0,5%	119,7	5,3	4.656	0,5%	291	9,0
Computers/Software	12	0,4%	309,5	10,8	6.104	0,6%	509	7,4
Electronics/Electrical	24	0,7%	122,9	7,1	11.096	1,1%	462	7,0
Engineering	13	0,4%	136,7	7,7	4.345	0,4%	334	7,9
Energy/Utility	151	4,6%	64,7	3,6	55.152	5,4%	365	10,3
Financial Corporate	640	19,4%	55,1	3,1	217.012	21,1%	339	6,6
Food & Drink	53	1,6%	64,5	4,1	12.788	1,2%	241	7,1
Healthcare & Pharma.	10	0,3%	90,2	4,2	3.940	0,4%	394	6,5
Hotel & Leisure	10	0,3%	197,3	8,1	2.168	0,2%	217	7,7
Industrials	33	1,0%	69,3	4,5	11.009	1,1%	334	6,7
Insurance	24	0,7%	108,7	4,7	8.472	0,8%	353	13,1
Manufacturing	11	0,3%	173,9	8,2	3.984	0,4%	362	8,4
Media & Publishing	16	0,5%	237,3	9,8	5.106	0,5%	319	8,3
Oil & Gas	59	1,8%	70,3	3,5	15.957	1,6%	270	8,4
Retailing & Consumer	49	1,5%	98,5	5,4	16.350	1,6%	334	9,1
Railways	55	1,7%	45,1	1,6	17.632	1,7%	321	11,7
Telecom	133	4,0%	206,3	6,7	74.254	7,2%	558	8,5
Transport	18	0,5%	162,6	4,7	5.127	0,5%	285	13,0
Other Industries	59	1,8%	107,4	5,2	15.821	1,5%	268	9,3
Total	3307	100,0%	61,3	3,1	1.029.199	100,0%	311	7,2

Table 10

Linear Regressions of SPREAD

Variable	*(1) Entire sample, quarterly dummies, full*	*(2) Entire sample, 10-yr rate, full*	*(3) Entire sample, 10-yr rate, reduced*	*(4a) 1991-96 issues*	*(4b) 1997-01 issues*	*(5a) Bank issuers*	*(5b) Corporate issuers*	*(6a) Moody's only*	*S&*
Constant	-47.893**	20.457	17.960***	-20.296	59.084**	51.723***	28.439	2.517	60
	(19.110)	(19.338)	(3.877)	(22.515)	(26.227)	(18.364)	(38.195)	(21.137)	(2
Ratings									
RAT_02	7.101***	4.468**	4.404**	4.182**	6.081*	2.166	4.047	4.742**	-
	(1.893)	(2.047)	(1.971)	(1.825)	(3.173)	(1.845)	(4.612)	(2.317)	(
RAT_03	12.546***	9.730***	9.450***	14.538***	5.264*	9.562***	9.091**	10.376***	5.
	(1.866)	(2.011)	(1.918)	(1.748)	(3.131)	(1.954)	(3.845)	(2.251)	(
RAT_04	18.251***	15.623***	15.461***	18.319***	13.457***	10.080***	17.979***	16.594***	11.
	(1.940)	(2.110)	(1.982)	(1.907)	(3.168)	(2.173)	(3.805)	(2.348)	(
RAT_05	28.109***	24.609***	24.937***	35.124***	21.885***	18.658***	25.508***	22.826***	14.
	(2.344)	(2.552)	(2.393)	(2.469)	(3.656)	(3.336)	(3.939)	(2.916)	(
RAT_06	38.603***	43.196***	42.711***	44.678***	39.068***	41.388***	43.423***	44.318***	29.
	(2.440)	(2.641)	(2.467)	(2.891)	(3.602)	(3.199)	(4.358)	(2.890)	(
RAT_07	51.962***	47.904***	48.966***	46.831***	49.599***	30.282***	44.962***	50.474***	37.
	(3.142)	(3.413)	(3.235)	(3.724)	(4.626)	(5.873)	(4.846)	(3.754)	(
RAT_08	75.500***	74.481***	74.666***	42.581***	77.093***	-3.913	73.271***	66.701***	47.
	(4.089)	(4.382)	(4.234)	(6.733)	(5.324)	(12.396)	(5.799)	(4.582)	(
RAT_09	68.198***	62.447***	64.555***	25.392***	78.112***	-30.711	59.830***	97.598***	37.
	(5.696)	(6.180)	(6.032)	(6.214)	(8.528)	(24.455)	(7.768)	(7.995)	(
RAT_10	59.868***	35.896	38.844*	56.227***			37.960	23.454**	193
	(21.770)	(23.630)	(23.527)	(14.857)			(28.203)	(10.961)	(2
RAT_11	190.495***	188.323***	187.768***	99.988***	182.652***		162.358***	66.424**	137
	(15.613)	(16.994)	(16.919)	(21.085)	(21.302)		(20.623)	(32.194)	(1
RAT_12	81.248***	60.094***	60.059***	169.978***	46.879**		52.651***	269.196***	2
	(15.400)	(16.769)	(16.706)	(21.529)	(20.592)		(20.138)	(23.627)	(2
RAT_13	496.152***	469.162***	469.083***		397.109***		419.150***	370.167***	215
	(18.010)	(19.683)	(19.610)		(21.438)		(24.104)	(19.301)	(2
RAT_14	333.324***	315.023***	313.584***	224.923***	305.423***	231.096***	313.976***	296.930***	338
	(9.455)	(10.371)	(10.291)	(11.821)	(14.346)	(14.606)	(15.181)	(11.420)	(1
RAT_15	442.652***	418.346***	417.798***		339.382***		373.338***	417.355***	323
	(7.968)	(8.795)	(8.704)		(11.264)		(12.238)	(12.562)	(
RAT_16	453.064***	422.434***	421.866***		342.265***		378.404***	486.590***	343
	(7.570)	(8.399)	(8.312)		(11.052)		(11.893)	(10.485)	(1
RAT_17	672.309***	632.219***	622.848***		518.430***		565.839***		581
	(31.351)	(34.307)	(33.893)		(37.292)		(41.752)		(3
RAT_20	345.637***	298.403***	297.348***		235.030***		265.262***		232
	(30.986)	(33.650)	(33.629)		(36.105)		(40.344)		(3
RAT_21	447.780***	442.027***	440.578***		352.639***		390.714***		311
	(18.513)	(20.137)	(20.069)		(22.411)		(24.854)		(2

(Table continued on next page)

Table 10 (second part)

Linear Regressions of SPREAD

	Variable	*(1) Entire sample, quarterly dummies, full*	*(2) Entire sample, 10-yr rate, full*	*(3) Entire sample, 10-yr rate, reduced*	*(4a) 1991-96 issues*	*(4b) 1997-01 issues*	*(5a) Bank issuers*	*(5b) Corporate issuers*	*(6a) Moody's only*	*S&*
Bond Features	SUBO	9.143***	4.238		12.420***	1.172	17.354***	-8.316	2.970	
		(2.641)	(2.861)		(3.538)	(3.657)	(2.752)	(6.238)	(3.197)	
	MATU	1.972***	1.821***	1.890***	1.494***	2.026***	1.572***	1.917***	1.913***	1
		(0.130)	(0.142)	(0.134)	(0.161)	(0.188)	(0.162)	(0.225)	(0.160)	
	BANK	0.702	-1.130		-3.223**	3.151			-0.843	
		(1.316)	(1.428)		(1.271)	(2.224)			(1.635)	
	AMOUNT	-0.460	0.101		-0.515	-1.240	-0.565	-1.272	1.349	
		(0.907)	(0.982)		(1.154)	(1.290)	(0.916)	(1.980)	(1.073)	
	COUPON	9.139***	15.071***	15.169***	4.104***	25.778***	8.612***	22.605***	14.040***	2
		(0.484)	(0.595)	(0.588)	(0.508)	(1.003)	(0.574)	(1.111)	(0.686)	
	REG	38.682***	40.293***	40.832***	2.949	57.971***	15.931***	49.251***	22.396***	7
		(4.279)	(4.649)	(4.625)	(4.260)	(7.090)	(5.627)	(7.177)	(6.014)	
	MANAGERS	0.092	-0.615***	-0.609***	-0.296***	-0.437***	-0.674***	-0.528***	-0.650***	-
		(0.083)	(0.083)	(0.080)	(0.072)	(0.142)	(0.076)	(0.175)	(0.094)	
	FEES	-0.284	-5.365***	-5.584***	-1.968*	-1.579	-3.770***	-7.886***	-5.230***	
		(0.908)	(0.951)	(0.925)	(1.011)	(1.379)	(0.996)	(1.647)	(1.096)	
	PRIVATE	-34.694***	-30.060***	-28.670***	-6.820	-59.184***	-3.134	-46.092***	-43.473***	-7.
		(9.092)	(9.846)	(9.800)	(7.601)	(20.792)	(12.322)	(14.609)	(11.089)	
	FIXED	-3.752**	-0.786		-4.409**	-0.692	-4.655**	1.942	-3.158*	
		(1.542)	(1.662)		(1.763)	(2.243)	(1.843)	(2.706)	(1.884)	
Currency	DEM	21.918***	18.361***	19.007***	10.822***	15.319***	6.022*	32.338***	12.259***	2
		(3.251)	(3.575)	(3.399)	(3.299)	(5.571)	(3.348)	(7.254)	(4.138)	
	DFL	17.701***	9.769**	9.525***	6.343*	6.481	-0.812	23.793**	5.933	1
		(3.480)	(3.793)	(3.616)	(3.276)	(7.244)	(3.277)	(9.412)	(4.384)	
	EUR	6.049**	19.586***	20.824***	0.351	20.803***	5.798**	33.015***	14.175***	2
		(2.785)	(3.070)	(2.786)	(4.266)	(4.046)	(2.832)	(6.372)	(3.442)	
	FFR	6.528**	9.040**	10.284***	1.715	-2.217	4.478	18.252**	2.260	2
		(3.183)	(3.551)	(3.326)	(3.245)	(6.424)	(3.278)	(7.290)	(4.060)	
	STG	16.338***	24.788***	23.961***	5.415	30.095***	17.544***	33.338***	21.308***	2
		(2.973)	(3.348)	(3.170)	(3.464)	(4.764)	(3.152)	(6.803)	(3.765)	
	USD	20.473***	22.019***	22.376***	12.221***	29.491***	16.170***	29.555***	18.804***	2
		(2.629)	(2.937)	(2.703)	(2.910)	(4.302)	(2.644)	(6.294)	(3.322)	
	CAN	6.023**	29.773***	30.152***	12.521***	17.675***	22.823***	35.740***	24.225***	3
		(2.846)	(3.224)	(3.187)	(3.018)	(5.361)	(2.810)	(7.323)	(3.711)	
RF_10Y		-	-15.304***	-15.238***	3.161***	-30.486***	-10.391***	-21.458***	-14.313***	-2
		-	(0.774)	(0.757)	(0.837)	(1.473)	(0.783)	(1.401)	(0.881)	
N. of obs.		3307	3307	3307	1503	1804	1827	1480	2317	
R-squared		0.892	0.869	0.869	0.650	0.910	0.570	0.904	0.847	
Adj. R-squared		0.890	0.867	0.867	0.640	0.907	0.561	0.901	0.844	
F-statistic		300.1***	460.9***	675.7***	66.1***	385.1***	64.0***	292.4***	296.7***	2
F-rating		319.5***	228.1***	237.4***	72.1***	85.2***	48.2***	81.8***	193.6***	1
F-quarter		27.1***	-	-	-	-	-	-	-	
F-country		1.61	1.44	-	4.68***	0.96	3.01***	2.07**	2.92***	

*Note: Reported are regression coefficients and standard errors (in parenthesis). F-rating (-quarter, -country) denotes the F-statistic for the null hypothesis that the coefficients of all rating (quarter, country) dummies jointly equal zero. ***, **, and * indicate statistical significance at the 1%, 5% and 10% level, respectively.*

Table 11

Linear Regressions of SPREAD for G5 countries

	France	*Germany*	*Japan*	*UK*	*Usa*
Constant	-105.970**	73.390**	-20.922	234.712***	-56.745
	(48.944)	(29.608)	(59.895)	(67.813)	(60.912)
RAT_02	18.041***	0.956	7.826	9.279	5.097
	(4.583)	(2.545)	(5.172)	(8.777)	(10.721)
RAT_03	32.344***	7.214**	-1.115	8.722	6.277
	(4.461)	(3.084)	(5.619)	(7.656)	(5.851)
RAT_04	16.130***	19.023***	17.407*	16.785**	6.613
	(4.414)	(3.130)	(10.269)	(8.369)	(6.476)
RAT_05	38.518***	22.423***	40.422***	25.104***	17.788***
	(5.801)	(4.714)	(14.412)	(8.424)	(5.739)
RAT_06	33.438***	53.578***		42.853***	39.788***
	(6.949)	(11.032)		(8.780)	(4.976)
RAT_07	81.190***	76.580***	49.636**	46.351***	15.969**
	(8.559)	(8.077)	(20.685)	(9.968)	(7.751)
RAT_08	110.531***	50.354***	133.434***	50.188***	75.483***
	(9.446)	(11.626)	(19.834)	(10.752)	(10.901)
RAT_09	54.652***	118.800***		45.809**	86.228***
	(8.368)	(13.433)		(19.847)	(18.418)
RAT_10	31.396				
	(26.051)				
RAT_11				47.543	173.069***
				(37.156)	(22.991)
RAT_12				22.362	66.325*
				(26.706)	(39.038)
RAT_13		514.403***			376.831***
		(23.433)			(39.046)
RAT_14	497.183***	298.362***		320.932***	309.798***
	(30.721)	(22.727)		(28.623)	(21.909)
RAT_15	471.150***	533.286***		374.238***	352.485***
	(27.694)	(26.835)		(21.999)	(17.461)
RAT_16	523.416***	829.617***		382.731***	294.065***
	(30.790)	(20.899)		(19.163)	(18.238)
RAT_20					218.499***
					(37.807)
RAT_21					341.069***
					(25.701)
N. of obs.	410	724	168	487	550
R-squared	0.839	0.917	0.610	0.872	0.940
Adj. R-squared	0.826	0.914	0.554	0.864	0.936
F-statistic	65.79***	265.13***	10.86***	100.19***	237.06***
F-rating	60.65***	170.30***	9.98***	40.36***	32.98***

*Notes: Reported are regression coefficients and standard errors (in parenthesis) of the rating dummy variables only. F-rating denotes the calculated F-statistic for the null hypothesis that the coefficients on the subset of rating dummies jointly equal zero. ***, **, and * indicate statistical significance at the 1%, 5% and 10% level, respectively. Rows were left blank when no bonds fall into that rating class for a country.*

Table 12

Estimated Spreads and Proposed Risk Weights per Rating Bucket

	AAA to AA- / Aaa to Aa3	A+- to A- / A1 to A3	BBB+ to BBB- / Baa1 to Baa3	BB+ to BB- / Ba1 to Ba3	B+ to B- / B1 to B3	Below B- /B3
(a) Simulated spreads (basis points)						
Base case	48.3	79.9	100.3	280.0	425.4	494.6
3-yr maturity	41.0	72.6	93.1	272.7	418.1	487.3
10-yr maturity	54.3	85.8	106.3	285.9	431.4	500.5
Euro-denominated	47.0	78.6	99.1	278.7	424.1	493.3
T-bond rates: 4%	48.8	80.3	100.8	280.4	425.8	495.0
T-bond rates: 8%	48.5	80.0	100.5	280.1	425.6	494.7
(b) Our risk-weights (100 means that risk-weighted assets equal unweighted assets)						
Base case	30	50	63	176	267	310
3-yr maturità	27	48	61	179	274	319
10-yr maturità	33	52	64	172	260	302
Euro-denominated	30	50	62	176	267	311
T-bond rates: 4%	30	50	63	175	265	309
T-bond rates: 8%	30	50	63	175	266	309
(c)Portfolio structure by rating grade used to compute our risk -weights						
	9.2%	26.8%	30.0%	28.6%	4.0%	1.4%
(d) Other systems of risk-weights						
Basel Committee	20	50	100	100	150	150
Altman-Saunders	10	30	30	100	100	150

Table 13

Average Cumulative Default Rates by Rating Grade (based on Static Pools, 1981-99)

Year	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
AAA	0.00%	0.00%	0.03%	0.06%	0.10%	0.18%	0.26%	0.40%	0.45%	0.51%
AA+	0.00%	0.00%	0.00%	0.10%	0.21%	0.33%	0.47%	0.47%	0.47%	0.47%
AA	0.00%	0.00%	0.00%	0.03%	0.09%	0.16%	0.30%	0.42%	0.50%	0.60%
AA-	0.03%	0.09%	0.23%	0.35%	0.49%	0.69%	0.86%	0.99%	1.07%	1.16%
A+	0.02%	0.07%	0.15%	0.33%	0.46%	0.61%	0.79%	0.93%	1.15%	1.40%
A	0.05%	0.11%	0.17%	0.22%	0.37%	0.51%	0.62%	0.79%	0.99%	1.17%
A-	0.05%	0.17%	0.30%	0.48%	0.73%	0.96%	1.28%	1.53%	1.73%	1.89%
BBB+	0.12%	0.29%	0.56%	0.87%	1.18%	1.64%	1.98%	2.20%	2.29%	2.38%
BBB	0.22%	0.52%	0.74%	1.12%	1.50%	1.76%	2.00%	2.27%	2.56%	2.89%
BBB-	0.35%	0.71%	1.12%	2.09%	3.02%	3.93%	4.81%	5.53%	6.05%	6.53%
BB+	0.44%	1.21%	2.75%	4.08%	5.22%	6.51%	7.48%	7.89%	8.66%	9.51%
BB	0.94%	2.59%	4.62%	6.04%	7.34%	8.72%	9.57%	10.72%	11.45%	11.80%
BB-	1.33%	4.28%	7.42%	10.47%	13.00%	15.65%	17.18%	18.58%	19.77%	20.70%
B+	2.91%	7.74%	12.08%	15.44%	17.92%	19.66%	21.38%	22.80%	23.79%	24.75%
B	8.38%	16.01%	21.00%	23.73%	25.73%	27.59%	28.79%	29.79%	30.84%	31.85%
B-	10.32%	18.27%	23.32%	27.02%	29.40%	31.03%	32.79%	33.74%	34.51%	34.78%
CCC	21.94%	29.25%	34.37%	38.24%	42.13%	43.62%	44.40%	44.82%	45.74%	46.53%

Source: Standard & Poor's (2001. Note: this table represents the transposed of matrix **P** *in the paper)*

Table 14

Recovery rates (%) by seniority and asset type

Reference:	Bank loans	Asset type: Bonds			
		Senior Secured	Senior Unsecured	Senior Subordinated	Subordinated
Altman and Kishore (1996)	--	58	48	34	31
Fons (1994)	--	65	48	40	30
Carty and Lieberman (1996)	71	57	46	—	34
Hamilton (2002)	67	52	44	35	32
Van de Castle and Keisman (1999)	84	66	49	37	26
Hu and Perraudin (2002)	--	53	50	38	33

Table 15

Banks' cost of equity and risk premia
(long-term averages, 1993-2001*)

Country	*(a) Cost of equity, inflation-adjusted*	*(b) Expected Inflation*	*(c) Long-term rate*	*Risk premium (a + b - c)*
Belgium	8.90%	1.92%	6.17%	4.65%
Canada	12.03%	1.72%	6.81%	6.94%
Switzerland	8.16%	1.21%	3.94%	5.43%
Germany	6.98%	1.98%	5.65%	3.31%
Spain	7.90%	3.42%	7.68%	3.64%
France	7.67%	1.46%	5.98%	3.14%
Great Britain	8.88%	2.58%	6.62%	4.85%
Italy	7.64%	3.05%	8.14%	2.55%
Japan	2.79%	0.17%	2.78%	0.19%
The Netherlands	9.04%	2.52%	5.78%	5.78%
Sweden	9.65%	1.07%	5.92%	4.81%
USA	8.94%	2.60%	6.20%	5.34%
Cross-country average	8.22%	1.97%	5.97%	4.22%

* except Sweden: 1996-2001

Source: Maccario, Sironi and Zazzara, 2002.

Table 16

Estimated Capital Ratios and Proposed Risk Weights per Rating Bucket

	AAA to AA- / Aaa to Aa3	A+- to A- / A1 to A3	BBB+ to BBB- / Baa1 to Baa3	BB+ to BB- / Ba1 to Ba3	B+ to B- / B1 to B3	Below B- /B3
(a) Simulated capital (k) held against unexpected losses (recovery rate of 50%, unless otherwise specified)						
Base case	11%	18%	24%	57%	84%	99%
3-yr maturity	10%	17%	21%	42%	44%	52%
10-yr maturity	12%	19%	27%	62%	86%	95%
Euro-denominated	10%	18%	24%	56%	84%	99%
T-bond rates: 4%	11%	19%	26%	62%	98%	118%
T-bond rates: 8%	11%	18%	23%	53%	75%	86%
Recovery of 55% (base case)	11%	19%	25%	61%	94%	113%
Recovery of 45% (base case)	11%	18%	23%	53%	75%	86%
Risk-premium of 10% for banks buying worst-quality bonds (base case)	11%	18%	24%	51%	69%	76%
(b) Our risk-weights (100 means that risk-weighted assets equal unweighted assets)						
Base case	31	54	71	166	248	292
3-yr maturity	37	65	80	160	168	195
10-yr maturity	33	52	73	168	235	258
Euro-denominated	31	53	70	167	250	294
T-bond rates: 4%	30	50	69	168	263	318
T-bond rates: 8%	33	56	72	165	235	269
Recovery of 55% (base case)	30	51	70	168	259	312
Recovery of 45% (base case)	33	56	72	165	235	268
Risk-premium of 10% for banks buying worst-quality bonds (base case)	34	58	76	162	220	243
(c) Combined risk-weights against expected and unexpected losses						
Base case	30	53	70	167	249	293
3-yr maturity	35	64	79	161	174	202
10-yr maturity	31	52	73	168	236	260
Euro-denominated	30	53	70	168	251	295
T-bond rates: 4%	29	51	69	168	263	318
T-bond rates: 8%	32	56	71	166	237	271
Recovery of 55% (base case)	30	51	69	168	262	318
Recovery of 45% (base case)	33	55	71	165	239	278
Risk-premium of 10% for banks investing in worst-quality bonds (base case)	34	57	76	162	224	252

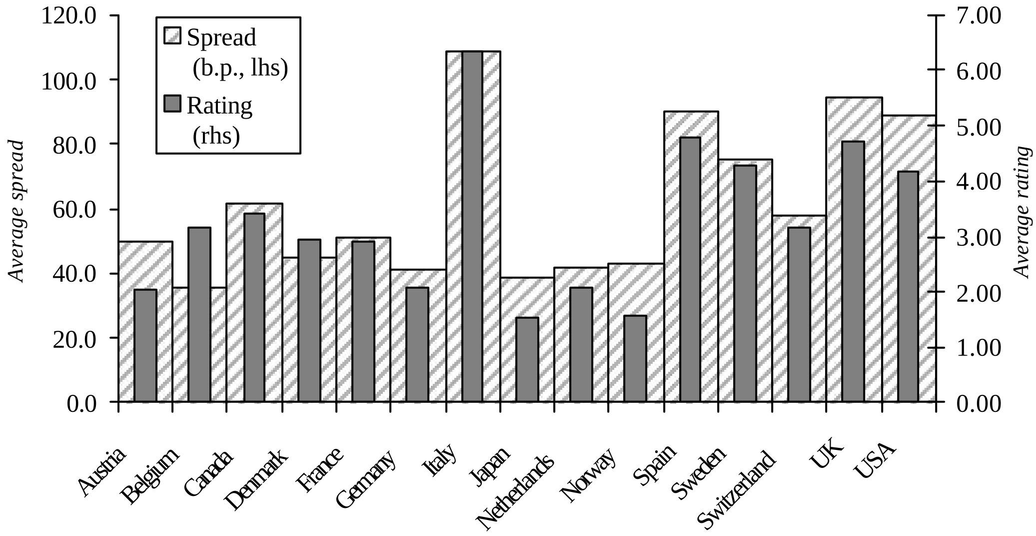


Figure1: Average spread and rating by issuer's country

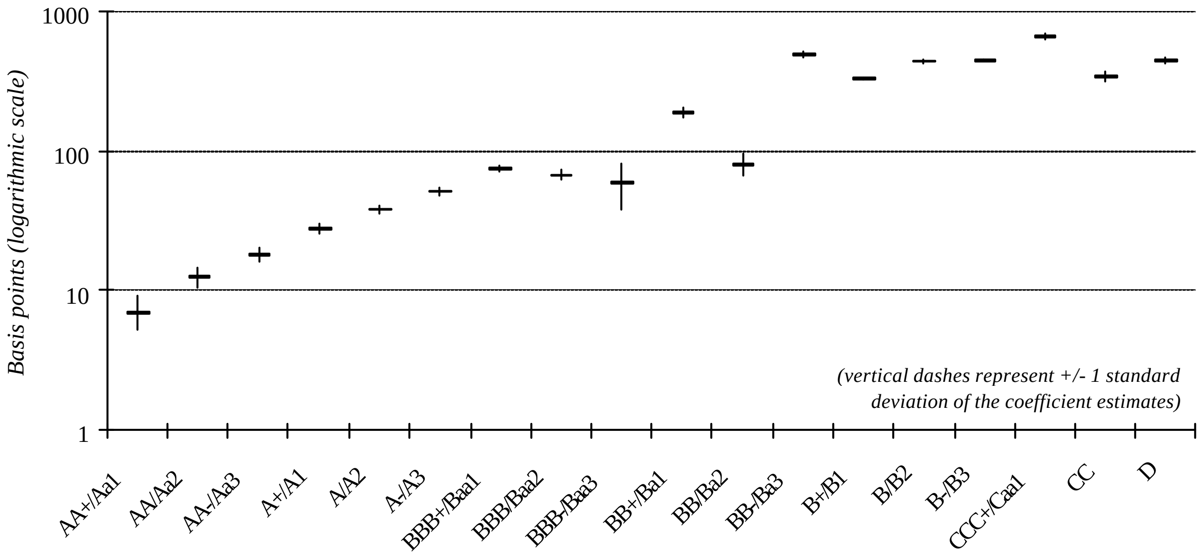


Figure2: Yield spreads over AAA-bonds by rating class (parameter estimates and standard deviations).

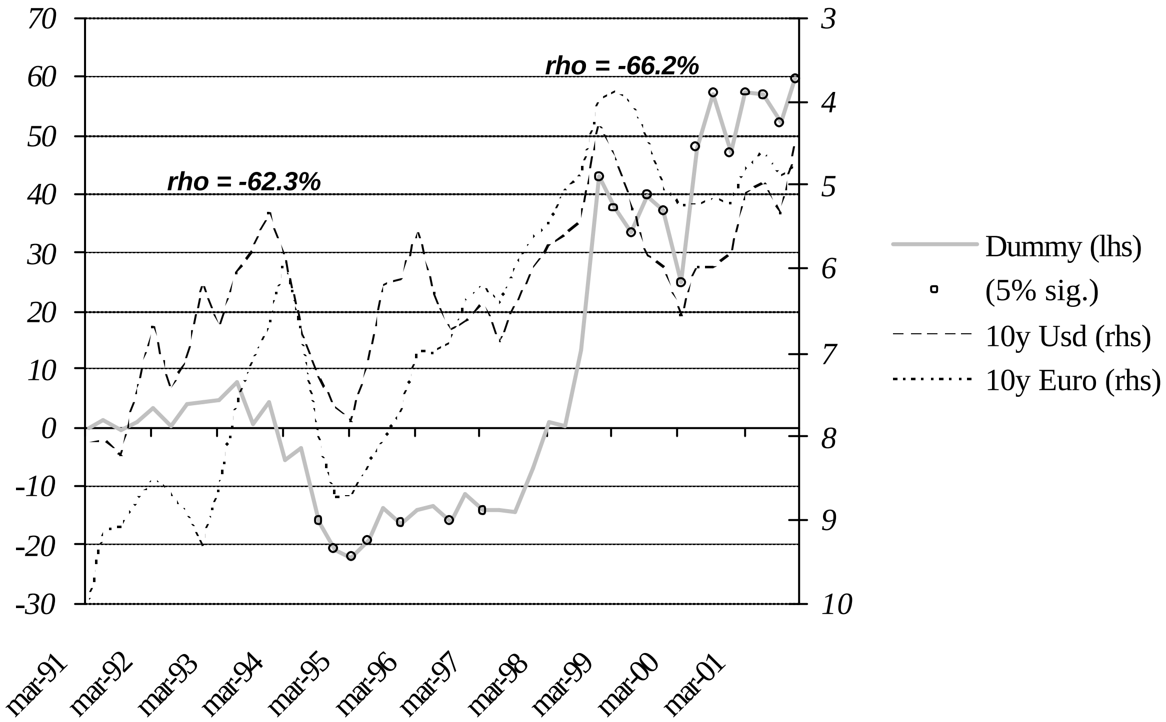
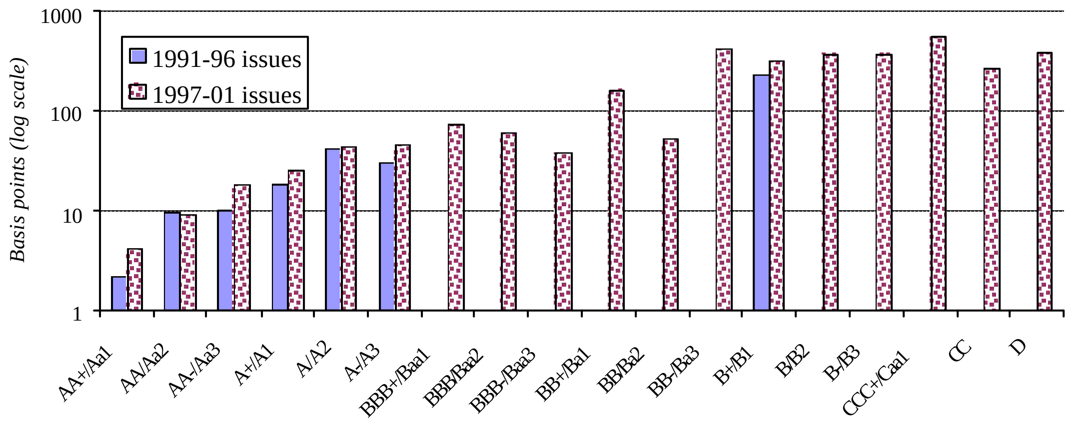
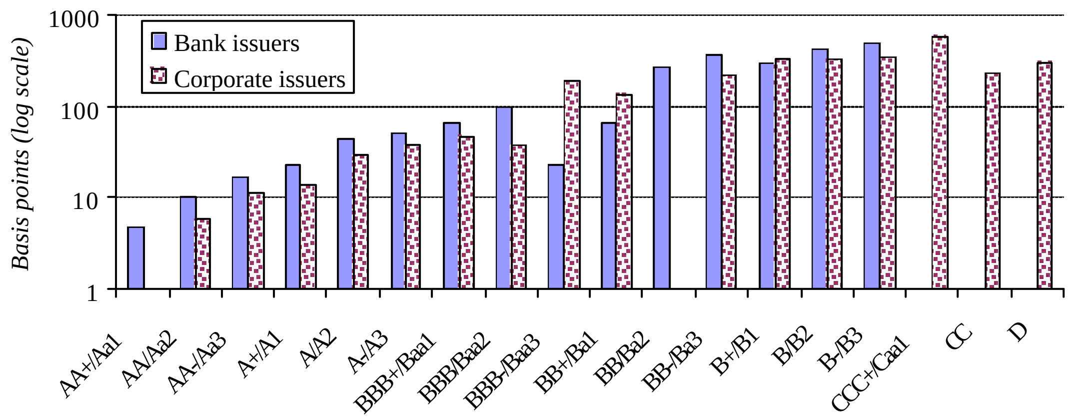


Figure3: Quarterly dummies and rates on 10-year T-bonds (dummy values that are at least 5% significant are highlighted by small circles)

(a)1991-96 versus 1997-2001issues



(b) bank versus corporate issuers



©Moody's versus S&P's ratings

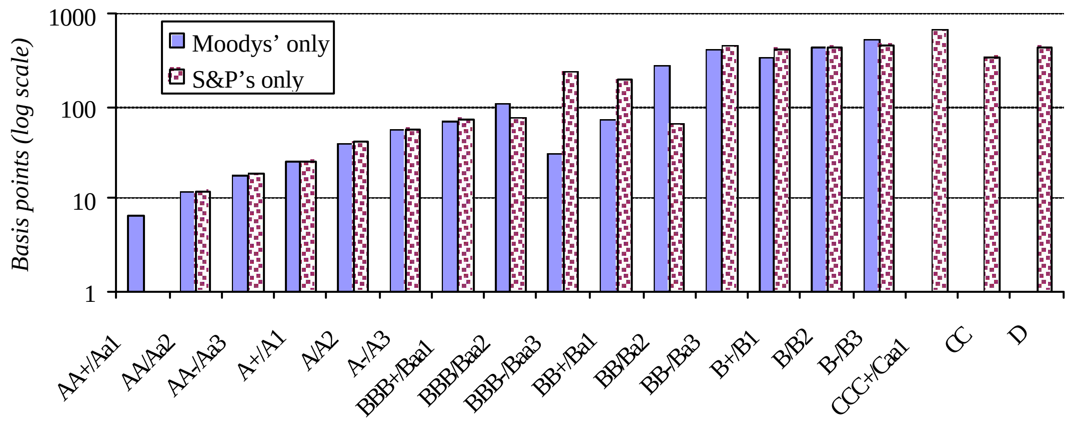


Figure4: Robustness-checks on the estimated yield spreads over AAA bonds
(only 5%-significant coefficients are reported)