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RATING AND OTHER FACTORS EXPLAINING THE CORPORATE CREDIT SPREAD: EMPIRICAL EVIDENCE FROM TUNISIAN BOND MARKET

Chebbi **TAREK**
FSEGN, Université 7 Novembre à Carthage, **Tunisie**
chebbitarek78@yahoo.fr,

Abstract:

This is an examination of the determinants of corporate bond credit spreads using both primary and secondary market spreads for Tunisian corporate bonds. The factors which I use as explanatory variables in our estimations can be divided into three categories: market variables, issue and issuer characteristics. To some extent, these three categories correspond to the different types of risk, namely interest rate risk, liquidity risk and credit risk. Using OLS regressions, our empirical results indicate that primary market spreads are sensible to issue characteristics such as rating. Also, spreads observed in secondary market are sensible to market variables namely Exchange Index and Slope, characteristics issuers and issues (Rating and Time to maturity). This is the first study to indicate that the explanatory power of factors depends of spreads modelled. Hence, corporate credit spreads are driven by both default and interest rate risk for the secondary market and only by default risk for the primary market.

Keywords: credit spread, interest rate risk, liquidity risk, rating.

JEL Classification: G12, G24, G33

1. Introduction

In recent literature, a great deal of attention has been devoted to understanding the stochastic nature and determinants of credit spread. This issue plays a central role in the fixed income literature, primarily because of its importance in the pricing of risky debt and credit derivatives [Duffee, (1998), Longstaff, and Schwartz, (1995); Jarrow and Turnbull, (1995)].

The credit spread is defined to be the additional amount of interest prayed by a risky asset over the yield of a risk–free investment. In this context the term risky represents the credit risk, to which the asset is exposed through the probability of the issuer not being able to meet his obligations. This inability of meeting the obligation can be caused by insolvency, bankruptcy and further reasons leading to a delay or loss of promised payments and is referred to as the defaults of the obligor.

In the literature, there are two theoretical approaches to the pricing of risky debt. Both approaches take into account credit spreads as a central component in their pricing models.

In the structural approach [Merton, (1974), Longstaff and Schwartz, (1995)], Bevan and Garzarelli, (2000), Colin–Dufresne, *et al*., (2001), and Huang and Huang, (2003)], one makes explicit assumptions about the dynamics of a firm's assets, its capital structure, as well as its debt and share holders. It is then supposed that the firm defaults if its assets are not sufficient to pay off the due debt.

The factors affecting the price of a default–risky bond in a structural model differ for the various variants and extensions of Merton's basic model. They are determined by the respective specification of the firm value process, the definition of the threshold for the default event and other modelling issues like consideration of bankruptcy costs or stochastic interest rates. However, the set of factors which determine the price of a default–risky bond according to Merton's basic specification is common to all of its variants. In Merton's model the price of the put option on the firm's value is given by the well known Black Scholes formula and hence the factors are the ratio of debt to the value of the firm, i.e., the leverage ratio, the volatility of the firm value and the risk–free interest rate. We can see additional factors which are motivated by extensions of the basic framework, like the structural model of default risk with stochastic interest rates by Longstaff and Schwartz (1995), as well as variables motivated by empirical evidence such as measures for liquidity risk.

In the reduced form approach [Fons (1994); Jarrow and Turnbull (1995); Jarrow, *et al*., (1997); Elton, *et al*., (2001)] the default is not causally modelled in terms of firm's assets and liabilities, but is typically given exogenously i.e., the default occurs completely unexpectedly, by surprise so to speak. The stochastic structure of default is directly prescribed by an intensity or compensators process. Due to the unpredictability of default time, the implied credit spread properties are empirically quite plausible.

Recently, the yield spread is regarded as a measure of a comprehensive risk premium to compensate investors for a number of risks associated with corporate bonds. As described in Huang and Kong (2003), this credit spread on corporate bonds is the extra yield offered to compensate investors for a variety of risks, such as expected default loss, credit risk premium due to the uncertainty of default losses and liquidity and tax premiums. For investment–grade corporate bonds, Elton *et al*., (2001), using a reduced form model, estimate a state tax premium on the order of 40 basic points and Houweling *et al*., (2003) estimate a liquidity premium on the order of 20 basic points. Delianedis and Geske (2001) study the proportion of the credit spread that is explained by default risk, using a structural model. They conclude that it only explains a small fraction of the credit spreads; the rest is attributable to taxes, jumps, liquidity and market risk factors. The paper of Collin–Dufresne *et al*., (2001) studies which factors determine the first differences of credit spreads of individual industrial bonds on US market. Their main finding is that the spreads are mostly determined by a single common factor, which is not related to pricing theory.

The main focus of the present paper is not the pricing of assets subject to credit risk, but I examine theoretical implications and empirical evidence of credit spreads. The purpose of this study is to examine the determinants of credit spreads observed in primary and secondary Tunisian market. I do this in four ways. First, published empirical work has concentrated though almost uniquely on the secondary market, especially on the US bond market. This is the first study to indicate that the explanatory power of factors depends of spreads modelled. Second, previous research focuses on the determinants of either default risk [Duffee (1998)], systematic risk [Elton, *et al*., (2001)] or liquidity risk [Ericsson and Renault, (2006)]. In this paper, I use several explanatory variables that correspond to the different types of risk. Third, the factors used in this paper present qualitative and quantitative characters. Fourth, I include an analysis of investment and no investment grade bonds to better understand how these risk factors change across risk classes.

Notice that this paper is one of very few to document the determinants of credit spread in the emerging market, namely Tunisian market of corporate bonds.

The factors which I use as explanatory variables in this study can be divided into three categories: market variables, issue and issuer characteristics. To some extent, these three categories correspond to the different types of risk which account for the spreads between the yield of corporate bonds and the yield on government bonds, namely interest rate risk, liquidity risk and credit risk.

The analysis confirms that credit spread for new issues are closely related to issuer characteristics, namely rating. Notice that the coefficient of rating is consistent with intuition (Investment Grade is usually associated with a low credit spreads). We can see that spreads observed in secondary market are sensible to market variables namely Exchange Index and Slope, issuer and issue characteristics (Rating and Time to maturity). To summarize, the Tunisian credit spreads are driven by both default and interest rate risk for the secondary market and only by default risk for the primary market and also provides evidence in favour of incorporating macroeconomic indicators into credit risk models.

The paper is organised in the following manner. First, I examine previous empirical and theoretical research suggesting a number of explanatory variables, which could affect the credit spreads. Second, I describe the main empirical results. Finally, I conclude the paper.

2. Explanatory Variables

The theoretical approach and empirical evidence show that the corporate credit spreads are affected by three factor types: market variables, issue and issuer characteristics. The most commonly mentioned factors are the default risk, liquidity effects, the term–structure of the risk free interest rate, macroeconomic indicators and the term to maturity.

2.1. Issuer characteristics

2.1.1 Rating

The theoretical central component of the credit spreads is the default risk. It refers to the probability that the issuer of a bond may default on its obligations and to the associated capital loss.

Previous studies found a strong relation between a yield spreads and rating. In fact, rating provides important information in the issuer ability to meet his obligations. A declining in credit quality of issuer can leads to inability of meeting the obligation and to a delay or loss of promised payments.

Empirical studies, like Duffee (1998) and Alessandrini (1999), have proven a tight relationship between rating and default experience and thus the credit spread. Fons (1994), Alessandrini (1999), Delianedis and Geske (2001) and Zhang (2002) observed a stronger reaction of low–graded corporate bonds spreads to systematic business cycle–related risk than high–grade bonds else equal. Alessandrini (1999) and Düllmann, *et al*., (2000) detected a higher volatility for lower–grade bonds.

Notice that Merli and Roger (1999) and Merli (2000) illustrate a negative relationship between rating and risk premiums observed in the French market of corporate bonds.

2.2 Market variables

2.2.1 Interest Rate Variables

In order to study the relationship between credit spreads and the term–structure, empirical studies implement two variables, which summarize most of the variation of the term–structure, the level and the slope of the term structure.

2.2.1.1 Level

We can see several theoretical arguments concerning the relation between credit spreads and the risk–free interest rate. While structural approach illustrates a negative relationship between the risk free rate and the default risk and thus the credit spread [Longstaff and Schwartz, (1995)], reduced form models usually postulate for empirical implementation the independence of risk–free interest rates and default risk.

Mixed empirical evidence has been found on the relationship between the credit spread and the term–structure of the risk–free interest rate.

Empirical studies like Duffee (1998) and Alessandrini (1999) for the US market, Annaert and DeCeuster (19999 for the European market by, Frino *et al*., (2006) for Australian market by and for the German market by Düllmann, *et al*. (2000) confirm a negative relation for longer maturities as well as for lower–grade bonds.

Bevan and Garzarelli (2000) support the negative relationship over the short term, over the long run, however, they document a theoretically inconsistent positive relationship.

Joutz, *et al*., (2000) suggest that Treasury yields are positively related to credit spreads in the long run, but negatively related in the short run. This has implications in the contingent claims and the reduced form approaches for valuing risky debt. In the contingent claims approach framework, an increase in Treasury yields is a negative signal to the market over the long run about the firm's future cash flows. In the short run, however, an increase in the Treasury yield indicates an increase in the value of the call option.

Huang and Kong (2003) shows that relation between interest rate level and credit spreads depend of rating. Notice that this factor can account for only a small portion of the credit spread changes for the investment–grade indexes. The signs of the coefficients on the interest rate are consistent with intuition. High interest rates and steep yield curves are usually associated with an expanding economy and low credit spreads. This variable performs much better for the high–yield credit spread series.

2.2.1.2 Slope

The interpretation of the slope of the riskless yield curve is twofold: first, in the context of the Longstaff and Schwartz (1995) structural model with stochastic interest rate, in the long run the short rate is expected to converge to the long interest rate. Hence an increase in the slope of the term structure should lead to an increase in the expected future spot rate. This in turn will decrease the credit spread, as has been pointed out above. Second, from a more general perspective, a decreasing slope of the term structure may imply a weakening economy, which in turn may lower the expected growth rate of the firm value and hence lead to higher credit spreads. Thus both arguments predict an inverse effect of changes in the slope of the yield curve on changes in the credit spread.

Boss and Scheicher (2006) show that the slope of the yield curve has a statistically significant influence on credit spreads, with coefficient around –0.28. The sign is in accordance with bond pricing theory.

Brown and Zarnic (2003) indicate that the sign of the coefficient for the term–structure slope is negative, which is in accordance with intuition, but the coefficient is statistically insignificant.

Joutz, *et al*., (2000) indicate that relation between credit spreads and the slope is complex. For intermediate investment grade bonds, there is a positive relation in both the short and long run, but for long–term bonds the predominant relation in the long run is negative and there is no statistically significant relation in the short run.

Frino *et al*., (2006) find that changes in the slope of the yield curve possess a significant amount of explanatory power for changes in AAA, AA and A spreads.

Batten and Hogan (2003) and Collin–Dufresne *et al*., (2001) find that the coefficients on the changes of the slope of the yield curve are not significant explanators of changes in the credit spread.

2.2.2 Macroeconomic Indicators

Empirical evidence indicates that credit spreads behave cyclically over time [Van Horne, (2001)]. During periods of economic downturn, credit spreads are expected to widen as investors become more risk–averse and firms have lower asset returns. Fridson and Jonsson (1995) find that an index of lagging economic indicators has significant impact on credit spread changes for high yield bond indexes. Helwege and Kleiman (1997) find that the GDP growth rate and recession indicators are important in explaining the aggregate default rates of high–yield bonds.

Jarrow and Turnbull (2000) also suggest that incorporating macroeconomic variables may improve a reduced–form model.

Huang and Kong (2003) use the month–to–month percentage changes in the three indexes of leading, coincident, and lagging indicators as gauges of the state of the US economy. The leading indicator index indicates the future direction of aggregate economic activity. The coincident indicator index measures the current health of the economy. And the lagging indicator index usually reaches its cyclical peaks in the middle of a recession.

As expected, increases in the leading index lead to narrowing credit spreads. But surprisingly, the coincident index, which measures the current health of the economy, has positive coefficients that are significant at the 5% level for four of nine credit spread series. The sign on the lagged index is mixed, and is insignificant in all cases.

Bedendo *et al*., (2004) found that a phase of economic downturn which affected the US economy in 2000–2001 had a significant impact on corporate credit spreads.

2.3 Issue characteristics

2.3.1 Term to maturity

Theoretical studies illustrate a strong relationship between term to maturity of a corporate bond and its credit spread, which is referred to as the term structure of credit spreads or credit spread curve. This relation is regarded as complex and depends on the risk of the issuing firm.

While the probability of a downgrade of high–rated companies increases with increasing term to maturity, resulting into an upward–sloping credit spread curve, low–grade companies experience an increasing probability of being upgraded the longer the term to maturity and thus a decreasing spread. This functional dependence of the credit spread on the maturity has been empirically supported by Fons (1994) and Sarig and Warga (1989).

Helwege and Turner (1999) found similar results for investment grade bonds, but argue that the downward–slope might result from a sample selection bias related to the use of ratings–related aggregate spreads.

Using the Helwege and Turner approach, He, *et al.*, (2002) confirm the findings of Fons (1994) and Sarig and Warga (1989) i.e., an upward–sloping credit spread curve for investment grade bonds and a downward–slope for speculative grade bonds.

Empirical studies like Truck *et al*. (2004) find only upward–sloping credit spread curves. These empirical results, which contradict theory, are explained by dependence on parameter values or no directly applicapability of theories for individual firms to aggregate credit spreads. The issue is still quite controversial.

2.3.2. Liquidity measuring variables

Liquidity is usually referred to as the ease with which a financial asset can be sold at or near its value. There are competing models, which examine different markets and use different measures to capture its effect on bond yields. Mostly it is not clear how much liquidity risk contributes to the spread credit. The great majority of the academic literature defines liquidity within market microstructure models in terms of transaction costs. This approach is mainly concerned about inventory risk, which will be priced by market participants in the form of higher bid–ask spreads.

In literature different measures for liquidity were used. For corporate bonds, where most transactions occur on the over the counter market, direct liquidity measures based on transaction data are often not reliable and difficult to obtain.

Fisher (1959) was among the first academics that proposed the issued amount as a proxy variable. He claimed that large issues trade more often, so that the issued amount is actually a proxy for the direct liquidity measure trading volume. Recent studies' results suggest that larger issues are more liquid than smaller issues and should have a higher price and lower yield in order to account for the liquidity premium. Although all studies found the positive price effect of the issued size on government bond yields, the empirical research on corporate bonds is inconclusive; both positive and negative effects are observed.

The age of the bond is a popular measure of its liquidity [Yu, (2005)]. Sarig and Warga (1989) observed that while a bond gets older, an increasing percentage of its issued amount is absorbed in investors' buy–and–hold portfolios. Thus, the older the bond gets, the less trading takes place, and the less liquid it becomes. Moreover, once a bond becomes illiquid, it stays illiquid until it matures.

Houwelling, *et al*., (2003) suggest that yield dispersion, which reflects the extent to which market participants agree on the value of a bond, may be used as a good proxy for liquidity. The first argument is, that if investors have more heterogeneous perceptions, the liquidity premium is larger. Secondly, in spirit of the inventory costs argument, dealers face more uncertainty if prices show a larger diffusion among contributors. Either way, the positive relation between yield dispersion and bond yields can be assumed.

Huang and Kong (2003) calculate the ratio of net new cash flow to total net assets and the ratio of liquid assets to total net assets for all corporate bond mutual funds and all high yield mutual funds. The estimation results indicate that, as expected, the coefficient on the liquid asset ratio is positive for all the credit spread series, and the coefficient on the net cash flow ratio is negative.

Bedendo *et al*., (2004) use the difference between the yield on the Refcorp bonds and the yield on the treasury zero–coupon bonds for the corresponding maturity as a measure of liquidity premium. Refcorp bonds are virtually risk–free therefore the calculated risk premium measures the flight–to–liquidity on the risk–free bond market and its potential impact on credit spreads. They find that high liquidity premium are reflected in the corporate bond market, and lead to a significant increase in credit spreads.

Boss and Scheicher (2006) use two measures, namely the liquidity spread of 30–year government benchmark bonds, i.e., the difference between the on–the–run and the off–the–run 30–year benchmark bund, and the liquidity spread of the government bond market, which is the average absolute deviation from the mean yield error derived from a term structure estimation according to Svensson's (1994) model. The regression results show that the second measure has a strong impact on the changes of credit spreads.

Fridson and Jonsson (1995) found increased fund flow into high–yield mutual funds, as a percentage, to be associated with a narrowing of the yield spread and an increase in the price of no investment grade securities. Further, an increase in the amount of assets held as liquid securities, a percentage of high–yield assets, was associated with an increase in yield spread and a decrease in the price on no investment grade securities.

3. Modelling the Tunisian credit spread

This study models the determinants of the credit spread. Our focus lies on the detection of relevant variables that affecting credit premiums observed in primary and secondary market. To do this I formulate original testable hypotheses. The main hypotheses considered in this paper are:

H1: Credit spreads observed in primary market are more sensible to issue and issuer characteristics.

H2: Credit spreads observed in secondary market are more sensible to market variables.

I first describe our corporate bonds data. I then discuss the integration of explanatory variables used in our empirical analysis and provide some basic summary statistics on credit spread. Finally, I present and discuss the results of our estimations and provide some interpretation.

3.1 Data

I use new issues (primary market bonds) and bond of secondary market. In fact, the impacts of factors on spreads are not similar for the different market. Hence, the primary market spreads are well affected by factors characterising the issue and issuers. In the other hand, the secondary market spreads are more sensible to variations of market variables.

I consider two samples. The first (S1) is composed by the new issues for the period 1998–2007. Thus, for 133 bonds issued by the Tunisian firm corporate we have 133 observations. The second (S2) is composed by the secondary market bonds spanning the period 02/01/2004 to 22/12/2006. For 67 bonds presents in this market, we chose a bi–monthly frequency. Thus, we have 70 observations by data series.

I note that this database contains two rating categories: investment grade (rating A) and speculative grade (rating BBB). Also, I consider two sector categories: financial sector (leasing, bank and factoring) and no financial sector (trade, tourism and industry).

Table 1. Bond Repartition by Sector and Rating

Sector and Rating	Financial Sector		No Financial Sector		Rating A		Rating BBB	
	S 1	S 2	S 1	S 2	S 1	S 2	S 1	S 2
Number	80	41	23	26	45	23	36	20
%	64.10	61.19	35.9	38.81	43.69	34.33	34.95	29.85

This table shows the reparation of bonds used in our study by sectors and categories of rating, namely, investment grade (rating A) and speculative grade (rating BBB).

3.2 Integration of variables

3.2.1 Qualitative variables

The qualitative information can not be measured by a continuous manner and can take tow or several modalities. Hence, it is necessary to definer (p–1) auxiliary variables that taken, respectively, the value 0 or 1.

Rating

The *rating* is modelled as follow: for three modalities of this factor, I have the following values for two auxiliary variables. The table 1 provides a manner of integration of this variable in our regression models.

Table 2. Integration of Rating in our Regression Model

Modalities	R 1	R 2
A	1	0
BBB	0	1
No Rated	0	0

Descriptive statistics of primary and secondary market spreads for the entire samples of corporate bonds and for investment, and speculative groups are reported in appendix. Credit spreads differ substantially among the credit–risk groups. As descriptive statistics show, we can see a negative relation between rating and credit spread. This finding is subject to our empirical evidence.

Table 3: Basic summary statistics on corporate bond yield spreads observed on primary market

This table presents the mean, median, standard deviation, min and max of the credit spreads and the number of bonds analysed in this study. The spreads are partitioned according to North Africa Fitch Rating. The period of analysis is 1998 to 2007.

Sample	All bonds	A	BBB
Median	1.7825	1.2033	1.7518
Mean	1.9535	1.2433	1.8501

Min	0.9855	0.9855	1.2500
Max	3.0512	1.7480	3.0512
Number of bonds	133	28	61

Table 4: Basic summary statistics on corporate bond yield spreads observed on secondary market

This table presents the mean, median, standard deviation, min and max of the credit spreads and the number of bonds analysed in this study. The spreads are partitioned according to North Africa Fitch Rating. The period of analysis is 02/01/2004 to 22/12/2006.

Sample	All bonds	A	BBB
Median	2.4968	1.2687	2.4502
Mean	2.2144	1.2478	2.3647
Std dev	0.7511	0.2311	0.3851
Min	0.6258	0.6258	1.0968
Max	3.4622	1.6715	3.4622
Number of bonds	67	23	20

3.2.2 Quantitative variables

I include the maturity of a bond in order to describe the shape of the credit spread term structure. On average, the term structure of credit spreads is upward–sloping [see Helwege and Turner (1999)]. Therefore, longer maturity should be associated with higher yield spreads.

According to structural models of the credit risk the risk–free spot rate is a relevant factor for the pricing of risky debt. I use changes in the monetary market rate as a proxy for the risk–free spot rate. As has been pointed out above, in Merton's basic framework the price of the put option on the firm value, which determines the price of the risky debt, equals the well known Black–Scholes formula. The risk–free rate enters the Black–Scholes formula as the rate at which the expected payoff of the option at maturity is discounted to the present value.

The second variable in the category of interest rate related factors is the change in the slope of the term structure. I define the slope as the difference between the risk free rate of 3–years and short risk free rate observed.

As liquidity proxies, I use issue size. This factor has been shown to relate negatively to credit spreads [see Warga, (1992); Perraudin and Taylor, (2002)]. Generally speaking, a larger issue size is associated with more investor interest, more secondary market trading, and consequently, lower spreads. A larger issue size may also benefit from the economy of scale in underwriting costs.

I use the exchange index as a measure of general economic conditions. Although the yield curve slope is taken as measure of economic conditions, I believe that the exchange index should be a better barometer of future economic conditions.

I summarize explanatory variables taken in our studies and the expected sign of relation with credit spreads in table 5. Also, descriptive statistics for the independent variables are presented in tables 6 and 7.

Table 5: Explanatory variables and expected signs on the coefficients of the regression

Variable	Description	Expected Sign
SIZE	Size	–
MAT	Time to maturity	+
R	Rating	–
MMR	Free risk rate	–/+/0
INDBVM	Exchange index	–
SLOPE	The slope of the yield curve	–/+/0

Table 6: Descriptive statistics: independent variables**,** January 1998–July 2007
This table reports descriptive statistics of independent variables analysed in this study. The period of analysis is January 1998 through July 2007.

Variables	*SIZE*	*MAT*	*MMR*	*EI*	*SLOPE*
Median	10.0000	7.0000	5.0500	1001.220	0.5875
Mean	11.6875	6.5789	5.4843	1090.392	0.6042
Std dev	10.9919	2.5767	0.4901	310.1113	0.0740
Min	0.5	5.0000	6.8750	729.7300	0.7565
Max	70	25.0000	5.0000	1727.260	0.4796

Table 7: Descriptive statistics: independent variables, January 2004–december 2006
This table reports descriptive statistics of independent variables analysed in this study. The period of analysis is 02/01/2004 to 22/12/2006.

Variables	*SIZE*	*MAT*	*MMR*	*EI*	*SLOPE*
Median	9.8515	4.0809	5.0072	1102.180	0.28000
Mean	10.2575	4.0236	5.0092	1149.514	0.2990
Std dev	8.7714	1.7484	0.0088	180.2832	0.2511
Min	0.5	0.0073	4.9985	652.0000	–0.0387
Max	70	6.8514	5.0350	1612.590	0.7565

3.3 Empirical results
3.3.1 Explanatory factors of primary market spread

The general form of relation between dependant variable and explanatory variables is presented as follow:

$$SPREAD_i = \beta_0 + \beta_1 R1_i + \beta_2 R2_i + \beta_3 SIZE_i + \beta_4 MAT_i + \beta_5 MMR_i + \beta_6 EI_i + \beta_7 SLOPE_i + \varepsilon \quad (1)$$

Where:
i = 1, 2, …,133
$j = 0, 1, 2, ..., 7$
ε is the error term.

The estimation results using data from January 1998 through July 2007 are presented in appendix. To judge the overall fit of our set of proxies for interest rate risk, liquidity risk, rating and macroeconomics indicators the R^2 is of particular interest. The measure of determination is around 76 % (R^2 = 0.763607) and indicate that our variables have some information content.

This finding is confirmed by Fisher–Snedecor test (F–statistic = 29.063 > 2.08). In fact, at least one variable provide a significant contribution in explaining risk premium.

The Student–Fisher test of marginal contribution shows that only the factors characterising issuer such as rating have significant impact on credit spreads.

The estimation results, reported in table 8, indicate, as expected, that the signs of the coefficients on the Rating are consistent with intuition. Investment grade bonds are usually associated with a low credit spreads. Notice that the coefficients on the rating are also statistically significant at the 5 % level.

I find that both level of the risk–free interest rate, and the slope of the treasury yield curve, which are used as proxies for the interest–rate factor, have not a significant influence on credit spread. While the coefficient on risk free rate is statistically insignificant, the sign is in accordance with bond pricing theory. As has been pointed out, according to the Merton model the changes of yields affect spreads in a negative form, i.e., when the general level of interest rates rises, the spread falls.

Notice that the behaviour of market liquidity is not a potentially important determinant of the spreads between risky and risk–free debt. Also, it should be noted that the sign of coefficient illustrates an economic insignificance. The estimation results indicate that, the coefficient on the macroeconomic indicator is positive for the primary market credit spread series, which is counter–intuitive.

The hypothesis H1 is partially confirmed by empirical results. In fact, primary market credit spreads are only sensible to issuer characteristics, namely the rating. Hence, corporate credit spreads are driven default risk.

3.3.2 Explanatory factors of secondary market spread

I define the following regression for the credit spread:

$$SPREAD_i^t = \beta_0 + \beta_1 R1_i^t + \beta_2 R2_i^t + \beta_3 SIZE_i^t + \beta_4 MAT_i^t + \beta_5 MMR_i^t + \beta_6 EI_i^t + \beta_7 SLOPE_t^i + \varepsilon$$

(2)

Where:
i = 1, 2… 67
t = 1, 2… 70.
ε is the error term.

The variables taken in our regression model have an explanatory power important, R^2 = 0.954739. At the 5% level, the Fisher–Snedecor test shows that at least one variable provide a significant contribution in explaining credit spreads (F–statistic = 31.128 > 2.08). Notice that the regression results are presented in table 8.

More importantly, the empirical results show that rating, time to maturity, exchange index and slope of risk free term structure are statistically significant at the level of 5 %. Also, they illustrate that the risk–free interest rate and the factor used as proxy of liquidity risk are not a significant explanators of changes in the credit spread.

The signs of the coefficients on the rating variables are consistent with intuition. But surprisingly, the coefficient on exchange index, which measures the current health of the economy, is negative, which is counter–intuitive. Notice that this coefficient is statistically highly significant.

I also find that the term to maturity, has a significant explanatory power on credit spread, consistent with the empirical evidence. Specifically, we find that the credit spreads are negatively related to this factor.

Empirical results are not consistent with hypothesis H2. I can see that secondary market premiums are jointly sensible to variables that correspond to market variations (Exchange Index and Slope), issuer and issue characteristics (Rating and Time to maturity). Hence, corporate credit spreads are driven by both default and interest rate risk.

For further analysis, I divided our sample into four credit–risk groups (all financial bonds, financial bonds A rated, financial bonds BBB rated and no financial bonds) and reestimated the Equation (2) for each group separately. Notice that, unlike financial bonds, the number of no financial bonds rated is much reduced.

The results of the regression are presented in table 9, for each credit rating (A and BBB) and sector. I find that credit spreads observed in Tunisian secondary market are more closely related to market variables (except the risk free rate for all cases and slope of term structure for financial bonds rated BBB) and time to maturity. The coefficients are statistically significant at the level of 5 %. I obtain similar results about the signs of coefficients.

The slope of the yield curve has a statistically significant influence on spreads. The relation between credit spreads and the slope is complex. We can conclude that only for financial bonds (all bonds and bonds rated BBB), the negative sign of the parameter for the slope of the term structure is also in line with what we expected. From the theoretical point of view a decrease in the slope should lead to a higher expected future spot rate and hence a rising credit spread. The same is true, when the slope is interpreted as an indicator for future economic growth. The estimated coefficients are large enough for economic significance to be present. For the other samples (no financial bonds and financial investment grade bonds) there is a positive relation between credit spreads and this factor.

As a proxy for the cyclical component of the credit spread I use the exchange index. While in most estimations this measure appeared to be highly significant, the sign positive, is counter–intuitive. Contrary, for financial bonds rated BBB this factor is statistically insignificant, but the sign of the coefficient on the Exchange Index is consistent with intuition. As expected, increases in this measure lead to narrowing credit spreads.

I find that term to maturity is highly significant in all cases at the level of 5 %. The positive coefficients indicate that longer time to maturity is associated with more risk, but this effect is somewhat counter intuitive if we take A and BBB rated bonds (0.103881 for A and 0.185853 for BBB). Notice that Fons (1994); Sarig and Warga, (1989) indicate that while low–grade companies experience an increasing probability of being upgraded the longer the term to maturity and thus a decreasing spread, the probability of a downgrade of high–rated companies increases with increasing term to maturity, resulting into a upward–sloping credit spread curve.

Table 8: Estimation results

This table shows the results of regression of the credit spreads for primary and secondary market bonds on the selected variable. The values in parentheses are the t–values. I also report the p–value. The t–values in bold are statistically significant at 5% level.

Variable	Model 1 Estimate	p–Val	Model 2 Estimate	p–Val
Intercept	0.8857 (**3.02**)	0.0003	4.029121 (1.64)	0.1001
A	–1.05138 (**–12.91**)	0.0000	–1.4756 (**–245.53**)	0.0000
BBB	–0.13755 (**–2.73**)	0.00861	–0.4885 (**–83.64**)	0.0000
SIZE	0.000163 (0.38)	0.7032	–0.4152 (–0.88)	0.8825
MAT	–0.03042 (–1.12)	0.2632	0.12745 (**78.72**)	0.0000
MMR	–0.00025 (0.06)	0.3678	–0.3843 (–0.77)	0.4376
EI	0.004789 (0.06)	0.9502	0.00012 (**3.32**)	0.0009
SLOPE	0.00253 (0.35)	0.6253	0.2283 (**11.70**)	0.0000

Table 9: Regression results

This table shows the results of regression of the credit spreads for financial bonds (all samples, A–rated bonds and BBB–rated bonds) and no financial bonds on the selected variables. The values in parentheses are the t–values. The t–values in bold are statistically significant at 5% level.

Variable	Financial Sector	No Financial Sector

	All Bonds	A rated Bonds	BBB rated Bonds	
Intercept	–1.226348 (–0.13)	2.512714 (1.26)	3.579532 (0.53)	5.679735 (**2.37**)
SIZE	0.002536 (0.26)	0.01527 (0.27)	–0.2156 (–0.52)	0.08527 (0.35)
MAT	0.278907 (**48.50**)	0.103881 (**96.79**)	0.185853 (**44.58**)	0.109377 (**45.78**)
MMR	0.421753 (0.22)	–0.29812 (–0.74)	–0.45044 (–0.33)	–0.74595 (–1.54)
EI	0.000234 (1.70)	–0.000119 (**–4.02**)	0.000221 (**2.24**)	0.000264 (**7.38**)
SLOPE	–0.20737 (**–2.83**)	0.095712 (**6.12**)	–0.01761 (–0.33)	0.492193 (**24.78**)

4. Conclusion

This paper has examined which factors influence the credit spreads in the Tunisian corporate bonds. I evaluate two series, namely the primary and secondary corporate spreads. By means of linear regressions, I examine the significance of various factors proxying for interest rate, credit and liquidity risk. I examine statistical as well economic significance to quantify the overall effects of the various factors.

I proxy the term–structure of the risk–free interest rate by the level and the slope and expect a negative influence on the spread. The level is defined as the monetary market rate and the slope as the difference of the 3 –years risk free rate and the monthly rate. As a proxy for the cyclical component of the credit spread I use exchange index. To capture the liquidity risk I use size of issue. This factor has been shown to relate negatively to credit spreads.

Our principal results indicate that the hypothesis H1 is partially confirmed by our empirical results. In fact, primary market credit spreads are only sensible to issuer characteristics, namely rating. Notice that the coefficient of rating is consistent with intuition (Investment Grade is usually associated with a low credit spreads). The coefficient on the rating is also statistically significant at the 5 % level. Notice that empirical results are not consistent with hypothesis H2. We can see that spreads observed in secondary market are sensible to market variables namely Exchange Index and Slope, issuer and issue characteristics (Rating and Time to maturity). To summarize, the Tunisian credit spreads are sensible only to interest rate risk and credit risk.

In order to extend the results in this paper, I intend to analyse the regression for each credit rating (A and BBB) and sector. The results show that credit spreads observed in Tunisian secondary market are sensible to market variables (except the risk free rate for all samples and slope of term structure for financial bonds rated BBB) and time to maturity. The coefficients are statistically significant at the level of 5 %.

Generally, I confirm for the Tunisian market results of previous studies and our findings support the view that the credit spread is not an adequate measure for default risk. I provide proof that time to maturity, slope and macroeconomic indicators play a significant role in determining the credit spread on corporate bonds.

5. References:

[1] Alessandrini, F., (1999), *Credit risk, interest rate risk, and the business cycle*, in: *Journal of Fixed Income*, Vol. 9, pp. 42–53.

[2] Annaert, J., and De Ceuster, M., (1999), *Modelling European credit spreads*, in: *UFSIA research report*.

[3] Batten, J.A., Hogan, W., (2003), *Time variation in the credit spreads on Australian Eurobonds*, in: *Pacific–Basin Finance Journal*, Vol. 11, pp. 81–99.

[4] Bedendo, M., Cathcart, L., and El–Jahel, L., (2004), *The shape of the term structure of credit spreads: an empirical investigation*, working paper, Tanaka Business School, Imperial College London, South Kensington Campus.

[5] Bevan, A., and Garzarelli, F., (2000), *Corporate bonds spreads and the financial environment: introducing GS–spread*, in: *Journal of Fixed Income*, Vol. 9–18.

[6] Boss, M., Scheicher, M., (2006), *The determinants of credit spread changes in the Euro area*, in: *BIS Papers* 12.

[7] Brown, J.G., Zarnić, Z., (2003), *Explaining the increased German credit spread: the rol of supply factors*, ASP working paper, Kiel Institute for World Economics.

[8] Collin–Dufresne, P., Goldstein, R.S., Martin, J.S., (2001), *The determinants of credit spread changes*, in: *The Journal of Finance*, Vol. 6, pp. 2177–2207.

[9] Delianedis, G., Geske, R., (2001), *The components of corporate credit spreads: default, recovery, tax, jumps, liquidity, and markets factors*, working paper, UCLA.

[10] Duffee, G., (1998), *The relation between treasury yields and corporate bond yield spreads*, in: *Journal of Finance*, Vol. 53, pp. 2225–2241.

[11] Duellmann, K., Uhrig–Homburg, M., and Windfuhr, M., (2000), *Risk structure of interest rates: an empirical analysis for deutschemark denominated bonds*, in: *European Financial Management*, Vol. 6, pp. 367–388.

[12] Elton, E., Gruber, M., Agrawal, D,. and Mann, C., (2001), *Explaining the rate spread on corporate bonds*, in: *Journal of Finance*, Vol. 56, pp. 247–277.

[13] Ericsson, J., Renault, O., (2006), *Liquidity and credit risk*, in: *Journal of Finance*, Vol. 61, pp. 2219–2250.

[14] Fisher, L., (1959), *Determinants of risk premiums on corporate bonds*, in: *The Journal of Political Economy*, Vol. 67, pp. 217–237.

[15] Fons, J.S., (1994), *Using default rates to model the term structure of credit risk*, in: *Financial Analysts Journal*, Vol. 5, pp. 25–32.

[16] Fridson, M., and Jonsson, J., (1995), *Spread versus treasuries and the riskiness of high–yield bonds*, in: *The Journal of Fixed Income*, Vol. 5, pp. 79–88.

[17] Frino, A., Lepone, A. and Wong, B,. (2006), *Determinants of credit spread changes: evidence from the Australian bond market*, working paper, University of Sydney.

[18] Helwege, J. and Kleiman, P., (1997), *Understanding high–yield bond default rates*, in: *The Journal of Fixed Income*, Vol. 5, pp. 79–88.

[19] Helwege, J. and Turner, C., (1999), *The slope of the credit yield curve for speculative–grade issuers*, in: *Journal of Finance*, Vol. 54, pp.1869–1884.

[20] Houweling, P., Mentnik, A. and Vorst, T., (2003), *How to measure corporate bond liquidity?*, in: *Tinbergen Institute Discussion Paper*, Vol. 03, pp. 1–34.

[21] Huang, J. and Kong, W., (2003), *Explaining credit spread changes: new evidence from option– adjusted bond indexes*, working paper, Penn State University.

[22] Huang, J.Z. and Huang, M., (2003), *How much of the corporate treasury yield spread is due to credit risk?*, working paper, Penn State and Stanford Universities.

[23] Jarrow, R., Lando, D. and Turnbull, S., (1997), *A Markov model of the term structure of credit risk spreads*, in: *Review of Financial Studies*, Vol.10, pp. 481–523.

[24] Jarrow, R. and Turnbull, S., (1995), *Pricing derivatives on financial securities subject to default risk*, in: *Journal of Finance*, Vol. 50, pp. 53–86.

[25] Joutz, F., Mansi, S.A. and Maxwell, W.F., (2000), *The dynamics of corporate credit spreads*, working paper, George Washington University and Texas Tech University.

[26] Longstaff, F. and Schwartz, E., (1995), *A simple approach to valuing risky, fixed and floating rate debt*, in: *Journal of Finance*, Vol. 50, pp.789–821.

[27] Merli, M., and Roger, P., (1999), *Probabilité de défaut et spread de taux : étude empirique du marché français*, in: *Finance*, Vol. 20, pp. 61–89.

[28] Merli, M., (2000), *Etude comparée des spreads sur les marchés de l'Euro–Franc et de l'Euro– Mark*, *Banque et Marchés*, Vol.46.

[29] Merton, R., (1974), *On the pricing of corporate debt: the risk structure of interest rates*, *Journal of Finance*, Vol. 29, pp. 449–470.

[30] Perraudin, W. and Taylor, A., (2002), *Liquidity and bond market spreads*, working paper, Birbeck College.

[31] Sarig, O. and Warga, A., (1989), *Bond price data and bond market liquidity*, in: *The Journal of Financial and Quantitative Analysis*, Vol. 24, pp. 367–378.

[32] Truck, S., Laub, M. and Rachev, T.S., (2004), *The term structure of credit spreads and credit default swaps–an empirical investigation*, working paper, University of Karlsruhe.

[33] Van Horne, J., (2001), *Financial Market Rates and Flows,* 6th ed. Englewood Cliffs, NJ: Prentice – Hall.

[34] Warga, A., (1992), *Bond returns, liquidity, and missing data*, in: *The Journal of Financial and Quantitative Analysis*, Vol. 27, pp. 605–617.

[35] Yu, F., (2005), *Accounting transparency and the term structure of credit spreads*, in: *The Journal of Financial Economics*, Vol. 75, pp. 53–84.

[36] Zhang, Z., (2002), *Corporate bond spreads and the business cycle*, working paper, Bank of Canada, Vol. 15, pp. 1–28.