The Micro-Determinants of Credit Spreads

ECO375: Empirical Project

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November 27, 2025

1 Introduction

The yield that investors require to purchase a firm's bond is the spread over the yield provided by a comparable government bond. Finding the micro-determinants for credit bonds is useful for finding what affects yields over time. Micro-determinants are variables that are related to the probability of default and the liquidity associated with a specific bond issue. This project seeks to assess the importance of firm specific factors in determining the spread for its bonds. The data used covered two points in time: 2022 and 2024. The model is a cross-sectional problem focusing on the changes in spread from 2022 to 2024. Fixed effects were not included as these were not vary across bonds.

Economic intuition indicates that Total Debt to Equity which represents leverage, Price to Book Value which measures how expensive a firm is relative to accounting measure, Current Ratio which indicates liquidiy, and Return on Average Total Equity which indicates firm efficiency are key determinants in finding a a bond's spread.

This paper is structured as follows: Section 2 is the literature review situating the research question, Section 3 contains the preliminary analyses, Section 4 contains the methodology, Section 6 contains the results, and Section 5 has the hypothesis testing.

1.1 Description of variables

There are 861 observations encompassing 34 categories. The variables are as follows

Variable	Description
Issuer	Name of the company that issued the bond
Spread	The difference between the bond's yield and the yield on a government bond of the same maturity. Measured in bps
Ticker Parent	Identifier for the parent company
Enterprise Value to Sales	Measures how expensive a company is relative to its revenue
Enterprise Value to PPE	Measures valuation relative to tangible assets
Price to Sales	How much investors pay for $1 of revenue
Price to Book Value	Measures how expensive the firm is relative to accounting equity
Dividend Yield	Return shareholders receive from dividends
Return on Average Total Equity	How efficient the firm is with investments
Operating Margin	Core profibility measure
Total Capital Expenses to Total Assets	How much firm invests in long-term assets
Book Value per Share	Accounting value per share

Variable	Description
Asset Turnover	Measures how well assets generate revenue
Current Ratio	Measures short-term liquidity
Cash Dividend Coverage Ratio	Measures if firm can pay dividends purely from operations
Total Debt to Equity	Measures financial leverage
Total Debt to Total Capital	Shows how much of capital is from debt
Amount Outstanding	Size of the bond
Years to Maturity	Number of years until the bond pays back its principal
Coupon	Annual payments made to bond holders

Enterprise value to sales measures how expensive a company is relative to its revenue. Thus, a high ratio means the market expects high growth (or the company is overvalued). Thus, a high enterprise value to sales means lower perceived risk and lower spreads.

PPE is tangible long-term assets. Thus, a high enterprise value to PPE means the firm is growth-oriented, but that also means has more risk and higher spreads.

A high Price to Sales signifies higher confidence in the firm by the general public which indicates lower spreads.

Price to Book Value is how the firm is valued by the general public. A lower ratio indicates undervaluation which produces financial distress and higher spreads.

Divident yield is how much bond holders are receiving from the dividents. A higher ration may indicate higher risk.

A higher Return on Average total equity indicates the firm is more efficient which means lower spreads.

The operating margin shows how much earnings are received before interest and taxes. A higher margin indicates the firm has a lower risk of going default which means lower spreads.

A high total capital expenses to total assets could indicate either lower spreads or a lack of liquidy.

A low book value per share may indicate the firm is close to going default and thus have a higher spread. A high asset turnover indicates the efficiency which implies lower spreads

A low current ratio indicates liquidity risk which implies higher spreads.

A low cash dividend coverage ratio indicates weak cash flow which implies higher spreads

A high total debt to equity means the firm has a high reliance on debt which implies higher spreads

1.2 Statement of hypothesis/research question

The research question this paper will seek to answer is what are the micro-determinants of credit spread. We propose that total debt to equity, price to book value, return on average total equity, and current ratioare the micro-determinants affect the change in bond spreads over time.

2 Literature Review

In "Credit Default Swap Spreads", Fu et. al employed a multi-factor analysis from both a firm-specific and market-specific perspective to examine the determinants of credit spreads in the USA, the UK, and Japan between 2005 and 2012. Their results indicated that the degree of firm leverage has a siginificant influence on spreads. They mention re-testing the influence of leverage on spreads as done in Collin-Dufresne et al. in 2001 Collin-Dufresn, Goldstein, and Martin (2001) and Aunon-Nerin et al. in 2002 Aunon-Nerin et al. (2002). From the data used, leverage is seen in Total Debt to Equity.

In "Liquidity of Corporate Bonds and Credit Spread", Wang examined corporate bond liquidity's impact on credit spreads for listed companies in China. He found that the better the liquidity of listed corporate bonds, the smaller the credit spread. He found that "the higher the ROE, the higher the current ratio, the better the ability to service debt…the smaller the credit spread" (Wang 2023). From the data used, return on net assets can be seen as Return on Average Total Equity, and Current ratio is directly used in the data.

In "Loan Spreads and Credit Cycles", Carvalho et. al find evidence that lender optimism can lead to excessive fluctuations in credit spreads. Carvalho means "Equity Volatility, Size, Firm Age, Profibility, Tangibility, M/B (market-to-book), Leverage…" as determinants for bond spreads (Carvalho, Gao, and Ma 2023). From the data used, Price to Book Value corresponds with Market-to-book

3 Descriptive

3.1 Plots
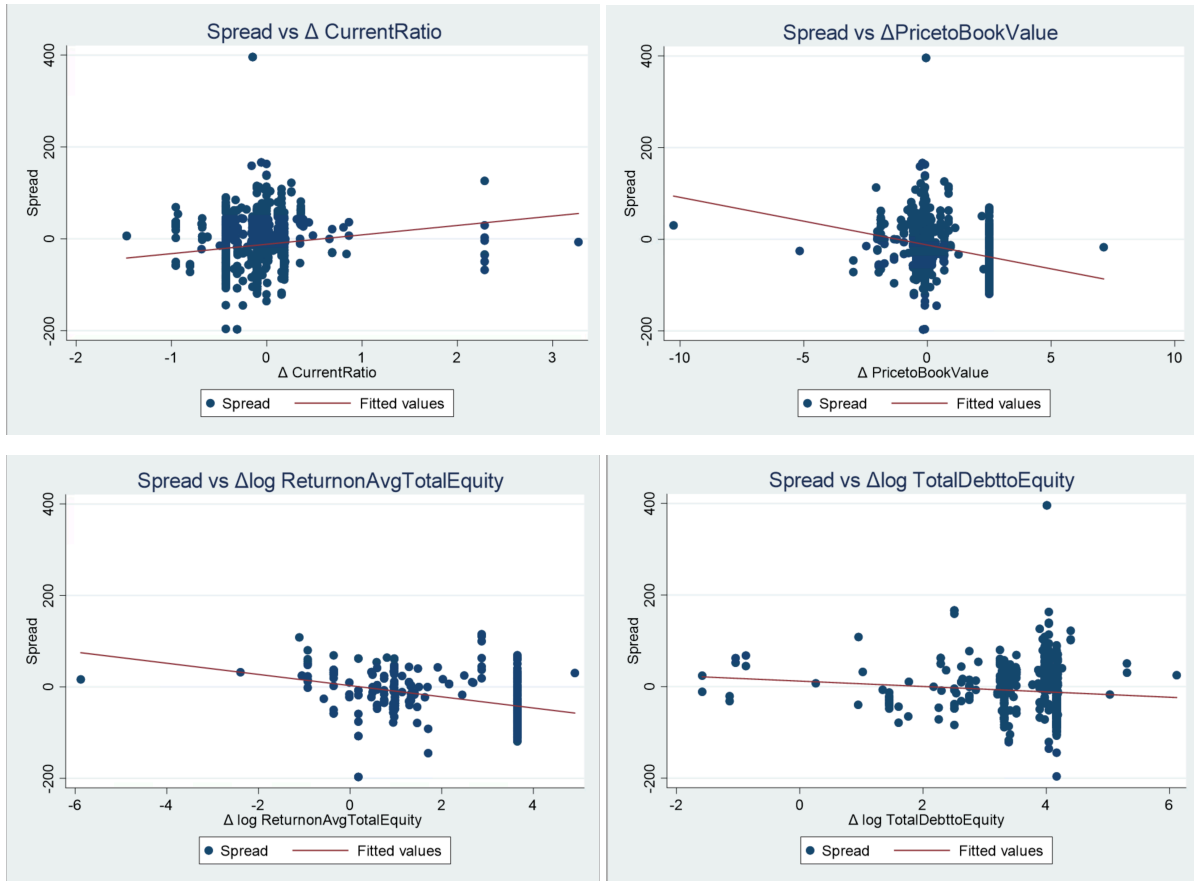
3.2 Summary of key variables

Spread is numeric with a range from [-196.8, 395.8]. It had a mean of -14.6 and a standard deviation of 57.6. It had skweness of 1.017

PricetoBook Value is numeric with a range from [-10.3, 7.1]. It had a mean of 0.214 and a standard deviation of 1.17. It had skewness of 0.106.

Return on Average total equity was numeric with a range [-90.96, 135.03]. It had a mean of -0.47 and a standard deviation of 19.466. It had a skweness of 1.236. We squared Return on Average Total equity in order to have only positive results

Current Ratio is numeric with a range from [-1.47, 3.27]. It had a mean of -0.14 and a standard deviation of 0.395. It had a skewness of 2.86.

Total Debt to Equity is numeric with range from [-80.36, 452.69]. It had a mean of 30.07 and a standard deviation of 39.65. It had a skewness of 39.65. We squared Total Debt to Equity in order to have only positive results.

4 Methodology

4.1 Clear statement of the model and its assumptions

$$\Delta y_i = \beta_0 + 2\beta_1 log(|x_{i1}|) + \beta_2 x_{i2} + 2\beta_3 log(|x_{i3}|) + \beta_4 x_{i4}^3$$

Where Δy is the difference in the spread of bonds from 2022 to 2024,

x_1 is the difference in Total Debt to Equity. x_2 is the difference in Price to Book Value. x_3 is the different in Return on Average Total Equity. x_4 is the difference in Current Ratio.

Linearity in Parameters

From the model above, it is clear that the model is linear in parameters.

Random Sampling

This is an assumption about the data given. It is randomly sampled.

No Perfect Collinearity

We ran correlation between all the variables and got the following table. Since none of the columns are a repeat, there is no perfect collinearity.

```
. pwcorr Spread EntrprValuetoSales PricetoBookValue AssetTurnover ///
>           DivYield CurrentRatio ReturnonAvgTotalEquity ///
>           CashDivCoveragRatio OperMargin TotalDebttoEquity ///
>           EntrprValuetoPPE TotalCapExptoTotalAssets ///
>           TotalDebttoTotalCapital PricetoSales  BookValuePerShare

             │  Spread Entrpr~s Pricet~e Asset~er DivYield Curren~o Return~y
─────────────┼──────────────────────────────────────────────────────────────
      Spread │  1.0000
  EntrprValu~s │ -0.0001   1.0000
  PricetoBoo~e │ -0.2129   0.5153   1.0000
  AssetTurn~er │ -0.0143   0.2364   0.1378   1.0000
     DivYield │  0.0807  -0.2190  -0.3081   0.0600   1.0000
  CurrentRatio │  0.1404   0.1441   0.0565   0.0057   0.0499   1.0000
  ReturnonAv~y │ -0.1537   0.5742   0.6466   0.1732  -0.4685   0.1143   1.0000
  CashDivCov~o │  0.2976   0.0654  -0.2499  -0.0928  -0.5760   0.2872   0.0793
    OperMargin │  0.0477   0.8210   0.3071   0.3258  -0.1963   0.2027   0.5919
  TotalDebtt~y │  0.0764  -0.6385  -0.2976  -0.2265   0.3430  -0.1456  -0.5005
  EntrprValu~E │ -0.1837   0.1563   0.0737   0.0295   0.0256  -0.2055   0.0551
  TotalCapEx~s │ -0.0022   0.2476   0.0351   0.2420  -0.1337  -0.0593   0.1256
  TotalDebtt~l │  0.3005  -0.2997  -0.1842  -0.2153   0.1537   0.1786  -0.3437
  PricetoSales │ -0.1857   0.8317   0.6506   0.1674  -0.2384  -0.0445   0.5133
  BookValueP~e │ -0.1209  -0.6254  -0.4051  -0.1731   0.1552  -0.6203  -0.5457


             │ CashDi~o OperMa~n TotalD~y Entrpr~E TotalC~s TotalD~l Pricet~s
─────────────┼──────────────────────────────────────────────────────────────
  CashDivCov~o │  1.0000
    OperMargin │  0.3003   1.0000
  TotalDebtt~y │ -0.2820  -0.7082   1.0000
  EntrprValu~E │ -0.2207   0.1279  -0.1126   1.0000
  TotalCapEx~s │  0.0814   0.2820  -0.1952   0.0161   1.0000
  TotalDebtt~l │  0.1256  -0.3333   0.6329  -0.1410  -0.1830   1.0000
  PricetoSales │ -0.2584   0.4924  -0.4399   0.0704   0.1862  -0.3839   1.0000
  BookValueP~e │ -0.3134  -0.6814   0.4254   0.0571  -0.0909  -0.1190  -0.3331

             │ BookVa~e
─────────────┼──────────
  BookValueP~e │  1.0000
```

Zero Conditional Mean

This is an assumption about the population.

Homoskedasticty

We performed robust on all our entries and did not assume homoskedasticity.

Thus, following all these assumptions, the model is consistent and unbiased

```
. reg Spread lTotalDebttoEquity PricetoBookValue ///
>        lReturnonAvgTotalEquity CurrentRatio ///
>        ///
>        , robust

Linear regression                               Number of obs   =        63
                                                F(4, 58)        =      5.74
                                                Prob > F        =    0.0006
                                                R-squared       =    0.2348
                                                Root MSE        =    34.404

                         |              Robust
                  Spread |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------------------+----------------------------------------------------------------
       lTotalDebttoEquity |   6.945233   3.578155    1.94   0.057    -.2172218    14.10769
         PricetoBookValue |  -4.968845   1.504929   -3.30   0.002    -7.981288   -1.956402
  lReturnonAvgTotalEquity | -12.45153   3.361894   -3.70   0.000    -19.18109   -5.721968
             CurrentRatio |    1.02294    8.24629    0.12   0.902     -15.4838    17.52968
                    _cons |  -5.586531   11.96125   -0.47   0.642    -29.52957    18.35651
```

4.2 Specification tests

Before Adjusting for non linearity: $F(12,809)$ value for estat ovtest, rhs (linearity test) $= 6.22$ with p value 0.0000

After adjusting for non linearity (the model with logs and nooooo cubes) : estat ovtest, rhs $F(12, 46)$ value is 1.46 with p-value 0.1749

The estat ovtest (test for omitted variable bias) only run after adjusting for non linearity gave $F(3,55)$ value 1.55 with p-value 0.2129

4.3 Robustness considerations

For robustness considerations, we used robust every time we used regression. Thus, we never assumed homoskedasticity.

5 Hypothesis Testing

```
. *JOINT F TEST FOR ALL VARIABLES IN THE REGRESSION
. test lTotalDebttoEquity PricetoBookValue ///
>          lReturnonAvgTotalEquity CurrentRatio

 ( 1)   lTotalDebttoEquity = 0
 ( 2)   PricetoBookValue = 0
 ( 3)   lReturnonAvgTotalEquity = 0
 ( 4)   CurrentRatio = 0

       F(  4,     58) =      5.74
            Prob > F =     0.0006
```

```
. * T TESTS
. test lTotalDebttoEquity = 0

 ( 1)   lTotalDebttoEquity = 0

       F(  1,     58) =      3.77
            Prob > F =     0.0571

. test PricetoBookValue = 0

 ( 1)   PricetoBookValue = 0

       F(  1,     58) =     10.90
            Prob > F =     0.0016
```

```
. test lReturnonAvgTotalEquity = 0

 ( 1)   lReturnonAvgTotalEquity = 0

        F(  1,     58) =    13.72
             Prob > F =     0.0005

. test CurrentRatio = 0

 ( 1)   CurrentRatio = 0

        F(  1,     58) =     0.02
             Prob > F =     0.9017
```

5.1 Choise of appropriate test

We chose to do a joint f test to see whether any of the parameters should be 0. We also
completed a t test to see individual significance against the yield.

6 Results

6.1 Correct interpretation of results

6.2 Economic intuition provided

References

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