FIRM INTERNATIONALIZATION AND THE DEBT COST OF CAPITAL

EVIDENCE FROM PUBLICLY TRADED DEBT IN THE US

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Abstract:

This paper examines the association between the firm internationalization and the cost of debt using bond credit ratings and bond credit spreads. Replicating the paper by Reeb, Mansi and Allee (2001) and then extending the study with more recent data from the period 2002-2019, we confirm their findings that higher levels of firm international activity are associated with a lower debt cost of capital. However, we also show that the method used does not hold when adding firm fixed effects to the model. Unlike Reeb, Mansi and Allee (2001), we do not observe a further association between international activity and the cost of debt, beyond that already captured in credit ratings.

Keywords:

Internationalization, Cost of Debt, Multi-nationality, MNCs

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Introduction

Research has, for many years, tried to explain multinational corporations (MNCs) and how they differ from purely domestic corporations (DCs). While numerous studies have investigated differences in firm performance, there has been less focus on the financing side of companies. Understanding how MNCs and DCs differ in debt financing can give an insight into how firm multi-nationality impact the overall risk of the company. Measuring the cost of debt capital provides a simple and accessible way of determining a firm's ultimate risk of default, as a higher cost of debt is associated with a higher risk of financial distress. This raises the question if MNCs face a lower uncertainty in continuing their operations in comparison with DCs. Do MNCs hold a lower default risk due to the benefits of income diversification between different economies, or is the default risk higher due to country risks such as differences in politics, culture and currency exchange rates? Or are there perhaps no significant default risk differences between the two different types of firms?

The above matter has been discussed extensively proposing arguments for both higher and lower cost of debt for MNCs and DCs. Reeb, Mansi and Allee (2001) provided the first empirical evidence suggesting that the debt cost of capital is lower for MNCs than for DCs. The discussion of the matter has been nearly quiet after their publication. To the best of our knowledge, there have only been a limited number of studies looking into the topic. We aim to clarify the issue using the following approach:

Firstly, in Part I, we replicate the study conducted by Reeb, Mansi and Allee (2001) *(Hereafter referred to as RMA).* RMA suggested a lower debt cost of capital for MNCs using a sample from the years 1993-1997. This part includes a dataset description, our methodology, followed by our results and a discussion.

Secondly, in Part II, we conduct a similar study with the use of all available data, examining RMA's findings over a longer period (2002-2019). Thereby, we intend to shed further light on the relationship between the cost of debt financing and firm international activity. Further, we extend the study by adding firm fixed effects to the model. This investigates the impact of internationalization on the cost of debt over time as each firm's level of international activity changes. As in Part I, we first describe the dataset and our method, followed by our results and a discussion.

Previous insights

Arguments that firm internationalization is associated with a lower cost of debt

A lower cost of debt capital with increased firm international activity can be motivated by the possibility for MNCs to spread their income streams across nations. Shapiro (1978) proposes this argument based on firms' possibility to diversify their default risk. These diversification benefits arise from the multiple cash flow streams coming from imperfectly correlated markets, leading to lower earnings volatility (Hughes, Logue and Sweeney, 1975). Another argument proposes that international capital flows can be slowed down by a variety of barriers including transaction costs, information costs and legal restrictions (Alexander, Eun and Janakiramanan, 1987). These barriers prevent the flow of capital from the national market to a foreign one, making it costly for firms to operate over borders. Errunza and Senbet (1981), also argue that the benefits of international activity arise from imperfections in product markets, financial markets and different taxation environments. Cristea and Nguyen (2016) find evidence for that MNCs exploit profit shifting for tax purposes, illustrating one advantage of MNCs.

Shaked (1986) presents empirical evidence of a significantly lower risk of bankruptcy in MNCs than in DCs. The evidence should indicate that MNCs have a lower debt cost of capital.

Further, RMA provides evidence supporting the theory that international activity is associated with lower debt cost of capital. Using a sample of US-based firms, they note that the level of firm international activity correlates negatively to the firm's outstanding tradable debt yields. They also find firms' multinational activity to be associated with higher credit ratings.

Arguments that firm internationalization is associated with a higher cost of debt

The main arguments for a higher cost of debt capital with increased firm international activity suggest that the activity imposes exchange rate risks, agency costs and uncertainty factors related to operating in a foreign setting.

According to Solnik (1974), all firms operating in floating exchange rate environments are exposed to exchange rate risks. On a similar note, firms with international activity also experience greater variance in the return of their domestic currency due to exchange rate fluctuations (Adler and Dumas (1975); He and Ng (1998); Reeb, Kwok and Baek (1998)). These researchers also state that the international firm faces a higher risk than the domestic firm due to the increased political risk exposure for the international firm. The risks related to the political environment in terms of corruption, economic nationalism and exchange rates would, therefore, imply a higher cost of debt.

Furthermore, other factors that MNCs suffer from are greater stakeholder diversity and information asymmetry (Armstrong and Riddick, 1998). The various creditors to MNCs receive different amounts of information. This creates information gaps, which, in combination with a variety of legal settings that MNCs operate in, imply higher financial distress costs. Additionally, MNCs face higher agency costs and bankruptcy costs. Fatemi (1984) notes that US-based MNCs have target leverage ratios significantly below the ones of DCs due to higher agency costs and bankruptcy costs related to their international activity. Lee and Kwok (1988) also suggest that MNCs have higher agency costs than DCs as it is more difficult for MNCs to monitor managers in international markets. Burgman (1996) further concludes that monitoring costs increase with international activity due to geographical constraints, cultural misunderstandings as well as language and legal system differences.

Structure

Our paper aims to investigate if there is a difference between the debt cost of capital for MNCs and DCs. We examine the relationship between firm internationalization and credit ratings as well as yield spreads for firms' outstanding publicly traded debt. The paper is divided into two parts:

Part I A replication of the study *"Firm Internationalization and the Cost of Debt Financing: Evidence from Non-Provisional Publicly Traded Debt"* conducted by Reeb, Mansi and Allee (2001), which will be referred to as RMA in this paper.

Part II Extension of the study instead using data from 2002-2019. In addition to the methodology used in Part I, a firm fixed effects model is added to measure the impact of internationalization on the cost of debt over time with respect to the variation of international activity in each firm.

In both parts, we will examine two main research questions:

1. Is there an association between the level of a firm's international activity and its credit rating? If so, do MNCs generally enjoy higher or lower credit ratings than DCs?
2. Is there an association between the level of a firm's international activity and the cost of public debt financing beyond the potential effect captured in the credit ratings?

Part I, Replication of the study by Reeb, Mansi and Allee (2001)

Data and Methodology

Databases

Thomson Reuters Worldscope Database	Lehman Brothers Fixed Income Database	Mergent Fixed Income Database
The Thomson Reuters Worldscope Database (WorldScope) contains detailed financial statement data and profile data on public companies globally. The database offers fundamental data including annual and quarterly data, financial statement content, per share data etc. Comprehensive annual history dates back to 1980 and is statistically significant from January 1985 and onwards (Wharton, n.d.).	The Lehman Brothers Fixed Income Database (Lehman Brothers Database) provides corporate bond time sales data on the bonds' maturity, market value, coupon, yield-to-maturity, credit spread and credit ratings from both S&P and Moody's.	The Mergent Fixed Income Database (Mergent FISD) is a comprehensive database containing over 140 000 publicly offered US bonds. Mergent FISD is the successor to the Lehman Brothers Fixed Income Database (Wharton, n.d.).

For the replication, we use the databases described above. As the Lehman Brothers Database was unobtainable, we instead use an excerpt of the database. The excerpt included faulty data-points regarding certain issue information (i.e. incorrect offering amounts). Therefore, we complement this data by linking the bond issues with bond issue data from Mergent FISD using the instrument's 8-digit unique cusip identifiers. The merging between the equity and debt databases are performed by first linking observations on 6-digit cusips, then matching further observations using name variables from the Lehman Brothers and WorldScope databases. All matches are confirmed manually. For a firm-year observation to be included in our final dataset, data must be available for the following variables:

WorldScope: *Foreign Sales, Total sales, Foreign assets, Total assets, Total debt, Number of geographic segments, Stock volatility, Current ratio and Coverage ratio.*

Lehman Brothers Database: *Price, Yield-to-maturity and bond credit rating from S&P and Moody's.*

Mergent FISD: *Issue and maturity dates, flags for convertible, redeemable and puttable debt securities, offering prices, yields and amounts.*

To minimize survivorship bias, we only drop observations that have missing values on variables that are used in all regressions. As RMA does, we also drop bonds that are provisional, meaning that they can be converted into common stock or have a call or put option.

The final sample comprises 297 firms and 1045 year observations from the years 1993-1997.

Variable Measurements

As done in the study by RMA, we measure the Degree of Internationalization (DOI) using a primary factor from a principal-component factor analysis of the following three variables:

i) Foreign sales to total sales.
ii) Foreign assets to total assets.
iii) The number of geographical segments that the firm operates in.

The factor analysis yields a high loading on a single factor, which explains approximately 85 % of the variance in the three variables.[1]

(1) $Size = \ln(Total\ Assets)$

To measure firm size, we use the natural log of total assets. This slightly differs from the measure used by RMA, as our dataset had missing values for the required variables.[2]

(2) $Leverage = \frac{Total\ Debt}{Total\ Assets}$

To be consistent with how we measure firm size, we measure leverage using the total debt to total assets ratio.[3]

(3) $Yield\ Spread = Bond\ YTM_m - Treasury\ YTM_m,$

where *m* represents the time to maturity. The *yield to maturity (YTM)* is a security's discount rate at which the sum of all future cash flows from the security is equal to the current price. This includes all coupon payments and the principal amount. The *yield spread* is the difference between the yield to maturity of the corporate bond and the yield to maturity on a Treasury security with a similar time to maturity. The yield spread is provided in our excerpt of the Lehman Brothers Database. This measure is weighted together on all of each firm's outstanding debt, creating one yield spread per firm-year observation. That is, we achieve a weighted average yield spread of each firm's outstanding bonds per year.

(4) $Age = \frac{Bond\ Observation\ Date - Bond\ Issue\ Date}{365}$

The Age is the time expressed in years that each bond has been outstanding. Like the measurement of yield spread, the age variable is weighted together into one observation per firm-year using the firm's total outstanding bond amount during the same year.

(5) $Ratings = Average\ (S\&P\ Credit\ Rating; Moody's\ Credit\ Rating)$

The variable measure Ratings consists of the average of Moody's and S&P bond credit ratings at the time of each bond observation. The ratings are transformed into numerical ratings where the number 1 represents a D-rated bond, 2 a C-rated bond, all the way to the numerical rating 23, which represents the highest credit rating AAA+.[4]

Further control variables include the accounting measures Current Ratio and Coverage Ratio as well as the Stock Volatility.

[1] Details of the factor analysis can be found in the appendix.

[2] As the total assets for firm size measurement is widely used in the finance literature (Dang et al., 2018) and RMA also found their results to be robust to using this measurement, we have no reason to suspect that this choice would alter the outcome of our study. Our results are robust to using the natural log of total sales and also the natural log of market capitalization as alternative measurements of firm size.

[3] Our findings are robust to using other commonly used measurements of leverage.

[4] The conversion table used can be found in the appendix.

Descriptive Statistics

TABLE 1
Descriptive Statistics and Industries

Exhibit 1, Descriptive Statistics

Variable	Mean	Median	Standard Deviation	Minimum	Maximum
DOI	1,17	1,11	1,00	0,00	3,76
Size	15,13	15,04	1,21	11,89	19,53
Leverage	0,31	0,29	0,15	0,00	0,94
Yield (%)	7,23	7,03	1,37	2,91	18,70
Spread (%)	1,02	0,67	1,24	0,02	13,06
Rating	15,47	15,00	3,20	6,00	22,00
Age	3,46	3,21	2,47	0,00	11,29
Volatility (%)	22,58	21,21	6,63	11,78	61,17
Current Ratio	1,54	1,39	0,72	0,24	6,07
Coverage Ratio	6,23	4,25	9,54	-26,54	189,59

Exhibit 2, Industries

SIC Code	Title of Industry	No, of Observations
0	Agriculture, Forestry and Fishing	0
1	Mining	79
2	Construction	332
3	Manufacturing	333
4	Transportation	116
5	Wholesale Trade	129
7	Retail Trade	48
8	Services	8

Exhibit 1 of Table 1 provides summary statistics of the sample used in our analysis for the replication of RMA. The dataset consists of 1045 firm-year observations during the years 1993-1997. Descriptive statistics are presented in exhibit 1 and include the degree of firm internationalization (DOI), weighted average yield (Yield), the yield spread (Spread), the average credit rating (Ratings), firm size (Size), weighted average bond age (Age) and firm leverage (Leverage).

Exhibit 2 of Table 1 includes the number of total firm-year observations in the sample for each industry group using single-digit Standard Industrial Classification codes (SIC-codes), where the SIC-code six is excluded as it belongs to the financial industry. The industries that are included are mining, construction, manufacturing, transportation, wholesale and retail trade as well as services.

A correlation matrix between all variables used in our analysis can be found in the appendix.

Multivariate Models

For the replication, we recreate all the specifications used by RMA to test for the effect internationalization has on the debt cost of capital.

Model 1

$$Ratings_{i,t} = A_0 + A_1(DOI_{i,t}) + A_2(Leverage_{i,t}) + A_3(Coverage_{i,t}) + A_4(Current_{i,t}) + A_5(Volatility_{i,t}) + A_6(Size_{i,t}) + A_7(DumYr_{i,t}) + A_8(DumInd_{i,t}) + e_{i,t}$$

where i represents firm i at time t for the variables above. The dependent variable is the firm credit rating (Ratings), and the independent variables are:

- *the Degree of Internationalization (DOI),*
- *firm leverage (Leverage),*
- *coverage ratio (Coverage),*
- *current ratio (Current),*
- *firm volatility (Volatility),*
- *firm size (Size),*
- *dummy variables for both year and industry.*

Model 1 estimates how the independent variables relate to credit ratings. Our primary interest is the association of DOI to credit ratings. A positive A_1-coefficient would imply that firms with higher international activity on average enjoy better credit ratings. This would support the arguments for a lower debt cost of capital with increased internationalization. A negative A_1 would provide support for the arguments that firm internationalization is associated with a higher debt cost of capital. As RMA suggests, Size is expected to be positively correlated with credit ratings as larger firms on average have lower default rates. Leverage and Volatility are predicted to be negatively correlated to ratings, as they both are associated with higher default risk. The Current and Coverage Ratios are expected to be positively associated with credit ratings as they are liquidity measures of the firm. Higher ratios imply that firms have a higher capability to serve their debt costs. The dummy variables control for differences between industries and years of measurement.

Model 2

$$Spread_{i,t} = B_0 + B_1(DOI_{i,t}) + B_2(Ratings_{i,t}) + B_3(Size_{i,t}) + B_4(Age_{i,t}) + B_5(Leverage_{i,t}) + B_6(DumYr_{i,t}) + B_7(DumInd_{i,t}) + e_{i,t}$$

where i represents firm i at time t for the variables above. The dependent variable is the yield spread (Spread), and independent variables are:

- *the Degree of Internationalization (DOI),*
- *predicted firm credit ratings from Model 1 (Ratings),*
- *firm size (Size),*
- *average bond age (Age),*
- *firm leverage (Leverage),*
- *dummy variables for both year and industry.*

For testing beyond the effect captured in Model 1, the yield spread is observed while including the predicted variable Ratings from Model 1 as a control variable. This allows us to test for further associations between the independent variables and the cost of debt beyond the relationships already explained by Model 1. Again, our primary interest is the relationship between the independent DOI-variable and the dependent variable Spread. A negative value of B_1 would suggest that firms with higher international activity on average have lower yield spreads, supporting the arguments for a lower debt cost associated with internationalization. A positive B_1-coefficient would indicate a higher yield spread being related to greater firm international activity, providing support for the higher cost of debt arguments. However, as predicted ratings are included as a control variable, the interpretation is slightly different. In the presence of a significant firm internationalization effect, the B_1-coefficient may be insignificant, as the information may already be incorporated in the Ratings-variable. Like RMA notes, Ratings are expected to be negatively correlated with Spread as firms with lower credit ratings suffer from a higher cost of debt. Size should also be negatively associated with Spread as larger firms are expected to have a lower cost of debt financing since they on average have lower default rates. It may be the case that the impact of size on the Spread-variable is already included in the Ratings-variable. Age is included to control for differences in the liquidity of the bonds, as newer bonds are usually more liquid and, therefore, have higher prices (Sarig and Warga (1989); Elton and Green (2002)). Leverage is expected to be positively associated with Spread, as higher leverage increases the risk of default. However, the effect of leverage may be captured already by the Ratings-variable. Dummy variables are included to control for differences between year and industry.

Multivariate testing results

In the following section, the results from regression models 1 and 2 are presented.

Results from Model 1

TABLE 2
Model 1, dependent variable: Credit Ratings

Variables	Predicted Signs	Regression Results	Non-Linear Volatility	Non-Linear Leverage	Ordered Logit
		1	2	3	4
Degree of Internationalization	Research Focus	0,35*** (4,20)	0,36*** (4,30)	0,35*** (4,13)	0,29*** (3,59)
Firm Leverage	–	-4,70*** (-5,57)	-4,72*** (-5,60)	-5,80** (-2,24)	-4,50*** (-6,47)
Coverage Ratio	+	0,07** (2,40)	0,07** (2,39)	0,07** (2,26)	0,12*** (4,63)
Current Ratio	+	-0,04 (-0,43)	-0,03 (-0,31)	-0,04 (-0,42)	-0,01 (-0,11)
Volatility	–	-0,20*** (-18,51)	-0,31*** (-7,52)	-0,20*** (-18,05)	-0,20*** (-15,01)
Firm Size	+	0,63*** (8,78)	0,70*** (9,78)	0,63*** (8,76)	0,67*** (9,29)
Volatility Squared	+		0,002*** (2,95)		
Leverage Squared	+			1,47 (0,48)	
Constant		11,11*** (9,70)	19,93*** (9,88)	11,32*** (8,72)	n/a
Observations		950	950	950	950
Adj. R-squared		0,62	0,62	0,61	n/a

Robust t-statistics in parentheses
*** p<0,01, ** p<0,05, * p<0,1

Table 2 presents the estimated regression coefficients for the independent variables in Model 1 using the specification:

$$Ratings_{i,t} = A_0 + A_1(DOI_{i,t}) + A_2(Leverage_{i,t}) + A_3(Coverage_{i,t}) + A_4(Current_{i,t}) + A_5(Volatility_{i,t}) + A_6(Size_{i,t}) + A_7(DumYr_{i,t}) + A_8(DumInd_{i,t}) + e_{i,t}$$

T-statistics are given in parenthesis and are corrected for heteroskedasticity.

As indicated in Column 1 of Table 2, the DOI-variable has a positive and significant correlation with credit ratings when controlling for the factors firm size, firm leverage, current ratio, coverage ratio and volatility. This confirms RMA's findings that increasing levels of firm international activity is associated with a lower cost of debt financing. As for the control variables, firm size relates positively to credit ratings as predicted. Leverage and volatility are as expected, negatively correlated with credit ratings, since they both increase default risk. The coverage ratio shows a slight positive relation to credit ratings, in line with the intuition that companies with better possibilities of serving their debt costs on average have higher creditworthiness. The current ratio shows no significant effect.

Alternative specifications

In Column 2 of Table 2, we add volatility squared to test for the possibility of a non-linear relationship between volatility and credit ratings. The results yield very similar to those presented in the first specification, in Column 1, which resonates with RMA's findings. We further test for non-linearities between the firm leverage and credit ratings in Column 3. Also, in these findings, the DOI-measure is positive and significant. Lastly, in Column 4, we perform an ordered logit model as credit ratings are categorical data. This model tests for the likelihood of belonging to a higher or a lower category, which in our case is a higher or lower credit rating. Potential differences in the distance between credit ratings are in this way considered. For example, the jump from BBB to BBB+ might not be the same as from AA+ to AAA. Consistent with our prior results, we observe a higher likelihood of belonging to the top rating categories with increased Degree of Internationalization while controlling for firm size, leverage, volatility and firm liquidity.

Findings

Our multivariate testings from Model 1 reveals very similar results to those presented in RMA's article *"Firm Internationalization and the Cost of Debt Financing: Evidence from Non-Provisional Publicly Traded Debt".* Firms with a greater level of international activity receive on average higher credit ratings. However, we note in our sample that international activity more substantially effects the credit ratings compared to the findings of RMA. In our sample, we find that the average international firm receives a 0,41 higher numerical credit rating than a purely domestic firm, holding the other variables constant. RMA find the corresponding difference to be only 0,27.

Results from Model 2

TABLE 3
Model 2, dependent variable: Yield Spread

Independent Variables	Predicted Signs	Primary Specification	No Ratings Variable	Adjusted Credit Rating	Age Non-Linear	Age Binary Variable
		1	2	3	4	5
Degree of Internationalization	Research Focus	0,06** (2,01)	-0,07* (-1,96)	-0,06** (-2,05)	0,06* (1,92)	0,06* (1,96)
Firm Size	–	0,13*** (2,74)	-0,24*** (-7,51)	0,13*** (2,74)	0,13*** (2,84)	0,13*** (2,82)
Ratings	–	-0,34*** (-6,41)	n/a	-0,34*** (-6,41)	-0,35*** (-6,43)	-0,34*** (-6,41)
Age	+	0,01 (0,57)	-0,006 (-0,33)	0,01 (0,57)	0,02 (0,70)	0,05 (0,72)
Firm Leverage	+	-0,69* (-1,68)	2,61*** (7,58)	-0,69* (-1,68)	-0,71* (-1,77)	-0,68* (-1,68)
Constant		4,44*** (9,39)	3,87*** (8,99)	4,44*** (9,39)	4,46*** (9,61)	4,43*** (9,86)
Observations		950	1030	950	941	950
Adj. R-squared		0,36	0,23	0,36	0,36	0,36

Robust t-statistics in parentheses
*** p<0,01, ** p<0,05, * p<0,1

Table 3 presents the estimated regression coefficients for the independent variables in Model 2 using the specification:

$$Spread_{i,t} = B_0 + B_1(DOI_{i,t}) + B_2(Ratings_{i,t}) + B_3(Size_{i,t}) + B_4(Age_{i,t}) + B_5(Leverage_{i,t}) + B_6(DumYr_{i,t}) + B_7(DumInd_{i,t}) + e_{i,t}$$

T-statistics are given in parenthesis and are corrected for heteroskedasticity.

The multivariate testing results from Model 2 are presented in Table 3, Column 1. The variable DOI is positive and significant, implying the yield spread to increase with higher levels of firm internationalization. These results indicate that MNCs face higher debt costs, which would contradict our findings from Model 1. However, as stated under the Model 2 description, the inclusion of the Ratings-variable changes the interpretation of these results. This is because ratings are expected to already capture firm-specific information regarding the default risk of companies. We also note that the firm size has a significant positive sign, and that the leverage has a negative sign with the inclusion of the Ratings-variable. These results imply that our model for ratings over-incorporate the control variables effects on the firms' default risks in comparison to what the market anticipates. That is, the market values the effects of the control variables less as predictors for firm default risk than our model does.

Alternative specifications

A re-run of the regression excluding the Ratings-variable is presented in Column 2 of Table 3. This specification yields results more in line with the sign predictions of the control variables. In this regression, we also note a negative and significant coefficient sign of the DOI variable, in line with our findings using Model 1. However, the results reveal a rather small effect on the yield spread.

In Column 3, we remove the effects of internationalization in the control variable Ratings. We perform this adjustment by reducing the predicted Ratings-variable by the product of DOI and its estimated coefficient from Table 2, Column 1. This allows us to identify the full effect that the DOI-variable has on the yield spread. We note a significant negative relationship, confirming the findings in Model 1.

In Column 4 and 5, we test using an alternative method of measuring bond liquidity. First, we replace the Age-variable with the natural logarithm of age, and second, we consider age as a binary variable, denoting bonds that are less than three years old. The specifications results are almost identical to our initial specification in Column 1.

Findings

The multivariate testings from Model 2 confirm a lower cost of debt for more international firms. However, the effect we find is lower than the one presented in RMA's study. The results from Column 3 in Table 3, implies that the average international firm has approximately 6,9 basis points lower cost of debt financing than the average domestic firm has, holding firm rating and the other control variables constant.[5] In monetary terms, this means that for each billion of dollars in debt, the average international firm pays 690 000 dollars less in interest payments every year. RMA found in their sample, that the average international firm pays approximately 2,4 million dollars less in interest payments every year per billion dollars of debt. Thus, our results point to a significant, but smaller, effect of internationalization on the cost of debt compared to RMA's results.

In contrast to RMA, we do not find any evidence for the assertion that Model 1 does not fully incorporate the effect of firm internationalization on the cost of debt. We instead note the opposite, meaning that the model includes more of the firm internationalization component and, therefore, considers it more as a predictor of firm default risk than the market does. If we assume that Model 1 is accurately measuring credit ratings, these results indicate that rating agencies over-incorporate firm international activity in their analysis. It, therefore, results in an upward bias in credit ratings for MNCs.

Limitations

Our main limitations can be attributed to data shortages. The excerpt we got hold of from the Lehman Brothers Database lacked variable descriptions. We suspect that the database is not the complete original one and contains measurement errors as well as fewer observations. We did notice errors regarding the issue cusips, making the merging of certain observations impossible. Even if a firm was registered in both the WorldScope and the Lehman Brothers databases, it would not end up as a match because of the faulty cusip in the Lehman Brothers database. We believe that the merge is the main reason why we were not able to recreate the same dataset as RMA. Even when our sample was manually checked after merging on both issuer cusips and

[5] This is calculated by multiplying the average DOI-value in the sample (1,17) with the coefficient estimate DOI has on the yield spread in Table 2, Column 3 (-0,06).

prospect names, the method has a risk to create faulty matches, leading to noisy data. The initial matching on issuer cusips could potentially be a problem, as the issuer cusips do not change when a bond issue is adopted by a different firm than the original issuer. It becomes the case when a company goes through a merger or acquisition.

Consequences of our limited dataset beyond noise from faulty matching include potential biases in size, industry or other characteristics as we cannot assure that the excerpt we use does not include any systematic biases. We note larger firms in our sample compared to RMA's, as our mean of the firm size measure is higher and has a lower standard deviation. This is also noticed as our sample has a lower yield spread mean in comparison to RMA's sample. We also observe more observations with international activity. While RMA's dataset consists of an approximately 50/50 distribution of MNCs and DCs, our sample consists of 324 DCs and 721 MNCs, or, almost ⅔ of MNCs.

As the results from Model 1 affects the outcome of Model 2, our conclusions drawn from Model 2 are vulnerable to potential inaccuracies in Model 1. The observed upward bias in credit ratings for international firms in Model 2 could be a result of this.

However, it is difficult to draw valid conclusions, on exactly how and to what degree our limitations undermine our findings regarding the relationship between the debt cost of capital and the Degree of Internationalization.

Part II, Extension

Data and Methodology

Databases

Thomson Reuters WorldScope Database	WRDS Bond Returns	Federal Reserve Bank Reports (WRDS RATES)
The WorldScope Database contains detailed financial statement data and profile-data on public companies globally. The database offers fundamental data including annual and quarterly data, financial statement content, per share data etc. Comprehensive annual history dates back to 1980 and is statistically significant from January 1985 and onwards (Wharton, n.d.).	The WRDS Bond Returns Database is a cleaned database for US Corporate Bond research. It incorporates two feeds: - FINRA's TRACE (Trade Reporting and Compliance Engine) consisting of end of month bond transactions. - Mergent FISD data for bond issues and issuer characteristics. The WRDS Bond database includes a link to equity data in the database CRSP, making it easy to link bond issues to corresponding equity data (Wharton, n.d.).	The WRDS RATES database is based upon the Federal Reserve Board's H.15 release that contains selected interest rates for US Treasuries and private money market and capital market instruments. The dataset includes end-of-month treasury constant maturities. All rates are reported in annual terms (Wharton, n.d.).

To extend our study, we obtain data mainly from the Thomson Reuters WorldScope Database and the WRDS Bond Returns Database. Equity data and measurements of firm international activity are taken from the WorldScope database while bond time sales data and bond specific information is taken from the WRDS Bond Return database. The merging process is executed in three steps. First, using the WRDS-CRSP link that the WRDS database provides, we link each bond observation from WRDS Bond Returns with the CRSP database to obtain unique 8-digit equity cusips for every bond issue. Secondly, we merge each bond issue to the WorldScope database using the obtained 8-digit equity cusips from step one. In our third step, we merge each observation on monthly dates to the Federal Reserve Bank Reports (WRDS RATES) database, achieving corresponding treasury constant maturities for each date that every issue is observed. For a firm-year observation to be included in the dataset, the data must exist on the following variables:

Worldscope Database: *Foreign Sales, Total sales, Foreign assets, Total assets, Total debt, Number of Geographic Segments, Stock volatility, Current ratio, Coverage ratio and Standard Industry Classification codes (SIC codes)*

WRDS Bond Returns: *Bond Yield to Maturity, Issue and maturity date, Modified duration, Credit Ratings from S&P, Moody's or Fitch, Offering Amount*

CRSP Database: *8-digit Equity Cusips*

After merging the databases, we perform a cleaning of the observations. Firstly, we exclude firms that belong to the industries finance, public administration and utility firms.[6] Secondly, we exclude defaulted bonds as they do not contain information about the risk of the bond defaulting.[7] Further, we only keep the last observed bond year observation per bond, since it is the most representative one for the year, as the data from WorldScope is end-of-year data. Observations that are not quoted in December each year during 2002-2018 are excluded.[8] Due to lack of bond data for December 2019, observations from September 2019 are used instead. Measurements with obvious errors are cleaned by replacing their values to missing. Ratios that cannot take values over one are removed. We replace the following variable values to missing:

- debt to asset ratios > 1
- foreign sales to total sales > 1
- foreign assets to total assets > 1
- foreign assets to total assets < 0

To minimize survivorship bias, we only drop observations that have missing values on variables that are used in all regressions. We exclude convertible bonds as this is done by RMA.[9]

The final sample comprises 1244 firms and 9372 firm-year observations from the years 2002-2019.

Variable Measurements

In line with the measurement of the Degree of Internationalization (DOI) in Part I, we use a primary factor from a principal-component factor analysis, consisting of the three variables:

i) Foreign sales to total sales.
ii) Foreign assets to total assets.
iii) The number of geographical segments that the firm operates in.

The factor analysis yields a high loading on a single factor, which explains approximately 73,74 % of the variance in the three variables.[10]

(1) $Size = \ln(Total\ Assets)$
Firm size is measured as the natural logarithm of total assets. Using both the natural logarithm of total sales and the natural logarithm of the market value of equity as measurements of firm size yields similar results.

(2) $Leverage = \frac{Total\ Debt}{Total\ Assets}$
Consistently with how we measure firm size using total assets, we measure firm leverage using the total debt to total assets ratio.[11]

[6] The motivation for excluding these firms is that high leverage in these firms most likely does not have the same implication compared to other industries. Financial firms tend to have high leverage-ratios without this implying that the company is at risk for financial distress. A similar conclusion can be drawn about firms that have a potential linkage to the state. Noteworthy though, is that the inclusion of these firms yields very similar results in our multivariate testings.

[7] Our aim is to measure the cost of debt, and indirectly the default risk of companies. Already defaulted bonds do not contain information about the default risk.

[8] Including observations that are not quoted in the last month of the year yields 2469 more observations but excluding these does not give different results.

[9] Including convertible bonds, does not change the outcomes of our regressions.

[10] Details of the factor analysis can be found in the appendix.

[11] Our findings are robust to using other commonly used measurements of leverage.

(3) $Yield\ Spread = Bond\ YTM_m - Treasury\ YTM_m$

where *m* represents the time to maturity. The *yield to maturity (YTM)* is a security's discount rate at which the sum of all future cash flows from the security is equal to the current price. This includes all coupon payments and the principal amount.

The *yield spread* is the difference between the yield to maturity of the corporate bond and the yield to maturity on a Treasury security with a similar time to maturity. The yield to maturity is provided for each bond in the WRDS Bond Returns database, and the corresponding treasuries are taken from the Federal Reserve Bank H.15 Reports. Bond maturities that do not precisely correspond to a Treasury maturity are interpolated using the Nelson Siegel Svensson model.[12] This measure is calculated for every bond and then weighted together on all of each firm's outstanding bond amount, creating one yield spread per firm-year observation. That is, we achieve a weighted average yield spread of each firm's outstanding bonds per year.

(4) $Age = \frac{Bond\ Observation\ Date - Bond\ Issue\ Date}{365}$

The Age-variable is the same as the measure used in Part I. It is the time that each bond has been outstanding measured in years. Like the measurement of yield spread, the Age-variable is weighted together into one observation per firm-year using the total outstanding bond amount per firm during the same year.

(6) $Ratings = Average\ (S\&P\ Rating; Moody's\ Rating; Fitch\ Rating)$

The variable measure Ratings consists of the average of S&P, Moody's and Fitch bond credit ratings at the time of the bond observation. The ratings are transformed into numerical ratings where the number 1 represents a D-rated bond, 2 a C-rated bond, all the way to the numerical rating 22, which represents the highest credit rating AAA. The conversion table used can be found in the appendix.

As in Part I, further control variables include the accounting measures Current Ratio and Coverage Ratio as well as the volatility of the stock price.

[12] See appendix for an explanation of our method for using the NSS-model.

Descriptive Statistics

TABLE 4
Descriptive Statistics and Industries

Exhibit 1, Descriptive Statistics

Variable	Mean	Median	Standard Deviation	Minimum	Maximum
DOI	1,08	0,98	1,00	0,00	4,57
Size	15,71	15,65	1,46	8,32	20,50
Leverage	0,35	0,32	0,18	0,00	1,00
Yield (%)	6,12	5,29	5,21	0,15	100
Spread (%)	3,62	2,33	5,27	-0,73	98,59
Rating	12,30	13,00	3,69	1,00	22,00
Age	4,03	3,54	3,31	0,03	88,90
Volatility (%)	28,61	26,49	10,24	8,76	79,40
Current Ratio	1,82	1,53	1,32	0,07	27,38
Coverage Ratio	12,74	4,32	428,65	-17211,79	34931,20

Exhibit 2, Industries

SIC Code	Title of Industry	No, of Observations
0	Agriculture, Forestry and Fishing	14
1	Mining	1045
2	Construction	261
3	Manufacturing	4726
4	Transportation	959
5	Wholesale Trade	309
7	Retail Trade	804
8	Services	1254

Exhibit 1 of Table 4 provides summary statistics of the data-sample used in our analysis for the extension of the study. The dataset consists of 9,372 firm-year observations during the years 2002-2019. Descriptive statistics are presented in exhibit 1 and include the degree of firm internationalization (DOI), firm size (Size), firm leverage (Leverage), weighted average yield (Yield), the weighted average yield spread (Spread), the average credit rating (Ratings), weighted average bond age (Age), the stock volatility (Volatility), the current ratio (Current Ratio) and the coverage ratio (Coverage Ratio).

Exhibit 2 of Table 4 includes the number of total firm-year observations in the sample for each industry group using single-digit Standard Industrial Classification codes (SIC-codes), where the SIC-code six is excluded as it belongs to the financial industry. The industries that are included are agriculture, forestry and fishing, construction, manufacturing, transportation, wholesale and retail trade as well as services.

A correlation matrix between all variables used in our analysis can be found in the appendix.

Multivariate Models

Model 3

$$Ratings_{i,t} = C_0 + C_1(DOI_{i,t}) + C_2(Leverage_{i,t}) + C_3(Coverage_{i,t}) + C_4(Current_{i,t}) + C_5(Volatility_{i,t}) + C_6(Size_{i,t}) + C_7(DumYr_{i,t}) + C_8(DumInd_{i,t}) + e_{i,t}$$

where i represents firm i at time t for the variables above. The dependent variable is the firm credit rating (Ratings), and the independent variables are:

- *the Degree of Internationalization (DOI),*
- *firm leverage (Leverage),*
- *coverage ratio (Coverage),*
- *current ratio (Current),*
- *firm volatility (Volatility),*
- *firm size (Size),*
- *dummy variables for both year and industry.*

The same specification is used in Model 3 as in Model 1. Our primary focus it the relationship between the DOI-variable and Ratings. A positive C_1-coefficient implies that firms with higher international activity on average receive higher credit ratings, providing support for the arguments for a lower cost of debt. On the other hand, a negative C_1 would mean that increasing firm internationalization is related to higher costs of debt financing.

Leverage and Volatility are expected to be negatively correlated to Ratings since they indicate greater default risk. As larger firms on average have a lower risk of financial distress, Size is expected to be positively related to credit ratings. We expect the Current and Coverage Ratios to have positive coefficients as they measure firm liquidity. Higher ratios imply better capabilities for the firm to serve its debt costs. The dummy variables control for differences between industries and years of measurement.

Model 4

$$Spread_{i,t} = D_0 + D_1(DOI_{i,t}) + D_2(Ratings_{i,t}) + D_3(Size_{i,t}) + D_4(Age_{i,t}) + D_5(Leverage_{i,t}) + D_6(DumYr_{i,t}) + D_7(DumInd_{i,t}) + e_{i,t}$$

where i represents firm i at time t for the variables above. The dependent variable is the yield spread (Spread), and the independent variables are:

- *the Degree of Internationalization (DOI),*
- *credit ratings (Ratings),*
- *firm size (Size),*
- *average bond age (Age),*
- *firm leverage (Leverage),*
- *dummy variables for both year and industry.*

Model 4 includes the predicted variable Ratings from Model 3 as a control variable, which allows testing for a further link between the control variables beyond the explanatory power in Model 3. Our main interest is again the association between the independent DOI-variable and the dependent variable Spread. A negative D_1-coefficient would indicate that firms with higher degrees of internationalization have lower yield spreads on average. On the other hand, a positive coefficient would be an indication that greater levels of firm internationalization are associated with higher yield spreads on average. However, as the predicted variable Ratings is included as a control variable, the D_1-coefficient may be insignificant even in the case of a significant internationalization effect. This is because the internationalization effect may

already be captured by the Ratings-variable. Ratings are predicted to be negatively correlated with Spread as firms with lower credit ratings face higher costs of debt. We expect a negative coefficient for Size as larger firms have lower risks of financial distress. Leverage is anticipated to be positively correlated with Spread. The age of the bond is also expected to be positively related to yield spread as lower bond liquidity should mean lower prices in the market as opposed to less seasoned bonds. Dummy variables are added to control for differences between industries and years of measurement.

Multivariate testing results

In the following section, the results from regression models 3 and 4 are presented.

Results from Model 3

TABLE 5
Model 3, dependent variable: Credit Rating

Independent Variables	Predicted Signs	Regression Results	Non-Linear Volatility	Non-Linear Leverage	Ordered Logit	Firm Fixed Effects
		1	2	3	4	5
Degree of Internationalization	Research Focus	0,34*** (12,37)	0,33*** (12,23)	0,33*** (12,13)	0,30*** (11,76)	-0,04 (-0,77)
Firm Leverage	–	-4,71*** (-30,38)	-5,00*** (-31,24)	-9,54*** (-16,34)	-4,26*** (-27,65)	-3,95*** (-18,01)
Coverage Ratio	+	0,00002 (0,49)	0,00002 (0,52)	-0,00001 (-0,19)	0,00002 (0,67)	-0,0001*** (-2,97)
Current Ratio	+	0,13*** (4,17)	0,14*** (4,59)	0,12*** (3,99)	0,11*** (4,71)	0,02 (0,74)
Volatility	–	-0,17*** (-46,33)	-0,32*** (-22,53)	-0,17*** (-44,98)	-0,15*** (-36,76)	-0,11*** (-25,44)
Firm Size	+	0,88*** (44,08)	0,87*** (40,91)	0,88*** (43,55)	0,81*** (42,20)	0,61*** (10,45)
Volatility Squared	+		0,0023*** (11,07)			
Leverage Squared	+			5,80*** (9,04)		
Constant		4,39*** (11,58)	7,00*** (13,45)	5,41*** (12,54)		7,29*** (7,69)
Observations		8881	8881	8881	8881	8749
Adj. R-squared		0,66	0,67	0,67		0,88

Robust t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 5 presents the estimated regression coefficients for the independent variables in Model 3 using the specification:

$$Ratings_{i,t} = C_0 + C_1(DOI_{i,t}) + C_2(Leverage_{i,t}) + C_3(Coverage_{i,t}) + C_4(Current_{i,t}) + C_5(Volatility_{i,t}) + C_6(Size_{i,t}) + C_7(DumYr_{i,t}) + C_8(DumInd_{i,t}) + e_{i,t}$$

T-statistics are given in parenthesis and are corrected for heteroskedasticity.

In Column 1 of Table 5, the DOI-variable coefficient is significant and positive, demonstrating a positive relationship between firm internationalization and credit ratings. This indicates that MNCs on average receive higher credit ratings than DCs, resonating with both our previous

findings in Model 1 and RMA's conclusions. Both the coefficients for Firm Leverage and Volatility are negative and significant, implying that increases in financial leverage or stock volatility are associated with lower credit ratings on average. The coefficients of both the Firm Size and Current Ratio are significant and positive, meaning that increases in firm size and firm liquidity on average lead to higher credit ratings.

Alternative Specifications

We test for non-linearities in the relationship between credit ratings and the two independent variables Volatility and Firm Leverage in Column 2 and 3, respectively. The specifications lead to a minor increase in adjusted R-squared and has a limited impact on the DOI-estimate. Further, in Column 4, we perform an ordered logit regression as credit ratings are categorical data. We observe a significantly higher likelihood of belonging to the top rating categories with increased internationalization.

In Column 5, we introduce firm fixed effects, only comparing observations from different years within each firm for the regression. The results indicate no significant impact of internationalization on credit ratings.

Findings

With the use of newer and more data, we confirm RMA's findings that MNCs on average are given higher credit ratings than DCs. However, the effect found explained by the composite measure for Degree of Internationalization does not show a significant relationship when we introduce firm fixed effects.

Results from Model 4

TABLE 6
Model 4, Dependent variable: Yield Spread

Independent Variables	Predicted Signs	Regression Results	No Ratings Variable	Adjusted Credit Rating	Firm Fixed Effects
		1	2	3	4
Degree of Internationalization	Research Focus	0,22*** (3,51)	-0,013 (-0,19)	-0,13** (-2,37)	0,06 (0,59)
Firm Size	–	0,39*** (4,29)	-1,01*** (-12,35)	0,39*** (4,29)	0,70*** (4,46)
Age	+	0,07*** (4,62)	0,08*** (5,23)	0,07*** (4,62)	0,09*** (4,04)
Firm Leverage	+	-0,59 (-1,09)	5,95*** (6,94)	-0,59 (-1,09)	1,26 (1,46)
Ratings	–	-1,02*** (-10,89)			
Adjusted Ratings	–			-1,02*** (-10,89)	-1,30*** (-9,57)
Constant		9,89*** (11,24)	17,11*** (15,26)	9,89*** (9,89)	7,90*** (4,29)
Observations		8881	9372	8881	8749
Adj. R-squared		0,38	0,30	0,38	0,59

Robust t-statistics in parentheses
*** p<0,01, ** p<0,05, * p<0,1

Table 6 presents the estimated regression coefficients for the independent variables in Model 4 using the specification:

$$Spread_{i,t} = D_0 + D_1(DOI_{i,t}) + D_2(Ratings_{i,t}) + D_3(Size_{i,t}) + D_4(Age_{i,t}) + D_5(Leverage_{i,t}) + D_6(DumYr_{i,t}) + D_7(DumInd_{i,t}) + e_{i,t}$$

T-statistics are given in parenthesis and are corrected for heteroskedasticity.

In Column 1 of Table 6, the DOI-variable coefficient is positive and significant, implying a positive relationship to the yield spread. Consistent with our findings from using Model 2, we note this positive relationship when including the predicted Ratings from Model 3 as a control variable. The inclusion of predicted ratings as a control variable implies that we test for further association beyond the effects explained by Model 3. The interpretations of the other coefficients when the control variable predicted ratings is included are different, as we expect the Ratings-variable to include firm-specific information regarding the credit risk. We observe positive and significant signs for both the coefficients of DOI and Firm Size. The coefficients reveal that the predicted ratings estimate the impact that the two variables have on firms' default risks is higher than what the market anticipates. The predicted ratings suggest a lower debt cost of capital for MNCs than what the market expects for firms with the same DOI, Firm Size and Firm Leverage.

Alternative Specifications

In Column 2 of Table 6, the DOI-variable does not seem to have any explanatory power when we drop the Ratings control variable. However, we note outliers in our data for yield spreads, with values of almost 100 %. These data points influence the result of the regression. Handling the outliers by changing the dependent variable yield spread to the natural logarithm of yield spread makes the coefficient of DOI negative and significant, supporting the findings from Model 3.[13]

In Column 3 of Table 6, we adjust the Ratings variable to not include the effect that DOI has on the predicted value. The adjustment is made by reducing the predicted ratings by the product of DOI and its estimated coefficient in Table 5, Column 1. This allows us to measure the full effect that DOI has on the yield spread. Again, we note that DOI has a negative effect on yield spread.

In Column 4 of Table 6, the firm fixed effects model shows no significant relationship between the DOI-variable and the yield spread. Further, we note a positive and significant association between the yield spread and the firm size, age as well as firm leverage. Similar to the interpretation in Column 1, we expect the Ratings variable to include firm-specific information regarding the firm's credit risk.

Findings

Consistent with RMA's findings and our replication, we note that a higher Degree of Internationalization is associated with higher credit ratings and lower yield spreads on average. Our analysis of the sample spanning from 2002 to 2019 shows that the average firm with international activity has approximately 14 basis points lower cost of debt financing. We calculate this by multiplying the mean value of DOI in the sample (1,07) by the DOI-coefficient estimate from Column 3 of Table 6 (-0,13). This implies that for every billion dollars of debt, the average firm with international activity pays 1,4 million dollars less in interest payments every year compared to the average domestic firm, holding firm rating and the other control variables constant.

However, the alternative testing in Model 3 reveals that RMA's findings concerning the Degree of Internationalization and credit ratings do not hold firm level, as the DOI-variable becomes insignificant after adding firm fixed effects to the model. Similarly, the alternative testing on Model 4 in Column 4 of Table 6 shows no significant relationship between the Degree of Internationalization and the Spread.

Limitations

Our most crucial parameter for determining if and to what extent MNCs face lower debt costs than DCs is the Degree of Internationalization (DOI) measure. The analysis relies on how well the variable can capture what it means to be an MNC. Our measure of internationalization is rather simplistic, and more parameters could potentially be incorporated. For instance, Aggarwal et al. (2011) suggest imposing a classification system that scholars should agree on. The proposed system is intended to consider the breadth and depth of a firm's multinational engagement. Prior studies have used different definitions of the Degree of Internationalization, making them inadequate for proper comparisons. However, this should only to a limited extent

[13] The regression with the natural logarithm of yield spread as a dependent variable can be found in the appendix.

undermine the conclusions drawn from our three-composite. Our DOI-measure should, logically, capture the main aspects of being an MNC.

Sing and Nejadmalayeri (2004) proposes the argument that there exists a certain point where firms do not benefit from becoming more international in terms of lower debt cost. We ask ourselves if a company that has all of its sales and assets in a foreign country is a company that should be classified as the most international firm in the world. It is difficult to make a distinction of where this line for being "too international" should be drawn. We instead believe in finding a measure that incorporates more dimensions to capture the essence of multi-nationality.

Further, it is likely that the DOI-measurement is correlated with other unknown variables that fundamentally differ MNCs from DCs. Theoretically, there could be a fixed level of internationality where the firm can start to benefit from a lower cost of debt. If we run the regression on Model 3, excluding purely domestic firms (i.e. firms where DOI = 0), we observe a weaker correlation between DOI and credit ratings. Further, the regression indicates that at a certain point, at approximately DOI = 0.8, the measure in the model becomes insignificant to explain variations in the credit rating. This might explain why the DOI-measure lacks a significant effect on the cost of debt in the firm fixed effects model. The DOI-measure does not have enough explanatory power to describe the differences between very similar levels of internationalization. Another limitation of measuring the effects on firm-level might be that we have too few data-points per firm. Counting the observations per firm used in the fixed effects regression shows a number of firms that use less than five observations for the estimation. However, excluding firms that have fewer than any number of observations does not change the outcome of the regression. To draw a more reliable conclusion about if the effect holds on a firm-level, a study should be made with more observations over a longer period. Preferably, also with a more precise measurement of multi-nationality.

Conclusion

There has been limited recent research evaluating Reeb, Mansi and Allee's (2001) findings that increased firm internationalization is rewarded with higher credit ratings and results in lower yield spreads. Replicating the study done by RMA, we find evidence for their claims that internationalization is linked to lower debt cost of capital. Further, we conclude that increased internationalization yields higher credit ratings controlling for firm size, firm leverage, volatility, current and coverage ratio, year and industry using a sample from the years 2002-2019. We also find evidence for that MNCs has on average 14 basis points lower cost of debt financing compared to their domestic counterparts, holding firm rating and the other control variables constant. However, when replacing the industry fixed effects with firm fixed effects, we observe no significant effect of internationalization on the cost of debt. Future research should investigate whether the insignificant effect in the firm fixed effects model, can be attributed to the way of measuring internationalization or to that no effect exists. One should also consider using global data instead of only US-data.

When looking at individual companies, our results imply that firms should not go international if their sole objective is to receive a lower cost of debt. Going international could provide other benefits which are not captured by the models such as the possibilities to reduce expenses of labour, logistics or taxes. If the firm exploits the benefits of being present in multiple countries successfully, this could in a later stage lead to lower debt costs.

If a firm seeks to lower its debt cost, it has a better opportunity to do so by analyzing both their domestic and international peers to get insights into which ways they differ from them. It is essential to underline the possibility that the different factors are not only because of internationalization. Our data shows no proof that individual firms, on average, achieve lower debt costs by solely evolving to having revenues or assets in foreign countries.

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Appendix

Part I

Factor analysis, DOI Measure

Factor	Eigenvalue	Difference	Proportion	Cumulative	**Variable**	Loading
Factor1	2.56133	2.23761	0.8538	0.8538	Foreign sales ratio	0.95
Factor2	0.32372	0.20876	0.1079	0.9617	Foreign assets ratio	0.94
Factor3	0.11496	.	0.0383	1.0000	No. of Geographical segments	0.88

LR test: indep. vs. sat.: chi2(3) = 2452.02 Prob>chi2 = 0.0000

Conversion table for bond ratings

Bond numerical Credit Rating Conversions used in Part I

Conversion No.	S&P Ratings	Moody's Ratings
23	AAA+	Aaa+
22	AAA	Aaa
21	AA+	Aa1
20	AA	Aa2
19	AA-	Aa3
18	A+	A1
17	A	A2
16	A-	A3
15	BBB+	Baa1
14	BBB	Baa2
13	BBB-	Baa3
12	BB+	Ba1
11	BB	Ba2
10	BB-	Ba3
9	B+	B1
8	B	B2
7	B-	B3
6	CCC+	Caa1
5	CCC	Caa2
4	CCC-	Caa3
3	CC	Ca
2	C	C
1	D	D

Correlation Matrix

		1	2	3	4	5	6	7	8	9
1	DOI	1,00								
2	Firm size	0,29***	1,00							
3	Firm Leverage	-0,27***	-0,14***	1,00						
4	Yield	-0,17***	-0,26***	0,21***	1,00					
5	Yield Spread	-0,19***	-0,29***	0,31***	0,81***	1,00				
6	Rating	0,29***	0,48***	-0,43***	-0,56***	-0,64***	1,00			
7	Age	0,11***	0,27***	0,01	-0,14***	-0,07**	0,11***	1,00		
8	Volatility	-0,13***	-0,33***	0,21***	0,43***	0,54***	-0,60***	-0,18***	1,00	
9	Coverage Ratio	0,22***	0,12***	-0,41***	-0,17***	-0,22***	0,36***	-0,07**	-0,03	1,00
-	Current Ratio	0,05	-0,36***	-0,14***	0,16***	0,18***	-0,19***	-0,07**	0,25***	0,07**

Significance levels using a two tailed t-test
*** p<0,01, ** p<0,05, * p<0,1

Part II

Factor analysis, DOI Measure

Factor	Eigenvalue	Difference	Proportion	Cumulative	**Variable**	Loading
Factor1	2.21224	1.68072	0.7374	0.7374	Foreign sales ratio	0.92
Factor2	0.53152	0.27527	0.1772	0.9146	Foreign assets ratio	0.81
Factor3	0.25624	.	0.0854	1.0000	No. of Geographical segments	0.85

LR test: indep. vs. sat.: chi2(3) = 2452.02 Prob>chi2 = 0.0000

Conversion table for bond ratings

Bond Rating Numerical Conversions used in Part II

Conversion No.	S&P Ratings	Moody's Ratings	Fitch
22	AAA	Aaa	AAA
21	AA+	Aa1	AA+
20	AA	Aa2	AA
19	AA-	Aa3	AA-
18	A+	A1	A+
17	A	A2	A
16	A-	A3	A-
15	BBB+	Baa1	BBB+
14	BBB	Baa2	BBB
13	BBB-	Baa3	BBB-
12	BB+	Ba1	BB+
11	BB	Ba2	BB
10	BB-	Ba3	BB-
9	B+	B1	B+
8	B	B2	B
7	B-	B3	B-
6	CCC+	Caa1	CCC+
5	CCC	Caa2	CCC
4	CCC-	Caa3	CCC-
3	CC	Ca	CC
2	C	-	C
1	D	C	D

Nelson Siegel Svensson interpolation of Federal Reserve spot rates

$y(m) = \beta_0 + \beta_1 \frac{1-\exp(-m/\tau)}{m/\tau} + \beta_2 \left(\frac{1-\exp(-m/\tau)}{m/\tau} - \exp(-m/\tau)\right) + \beta_3 \left(\frac{1-\exp(-m/\tau_2)}{m/\tau_2} - \exp(-m/\tau_2)\right)$,
where m is maturity, $\beta_0, \beta_1, \beta_2, \beta_3, \tau$ and τ_2 are parameters fitted using a least-squares algorithm in Matlab provided by Kamil Kladivko (2020). The model used is based on the extension of the Nelson and Siegel model by Svensson L. O. (1995).

Correlation Matrix

		1	2	3	4	5	6	7	8	9
1	DOI	1,00								
2	Size	0,28***	1,00							
3	Leverage	-0,25***	-0,25***	1,00						
4	Yield	-0,14***	-0,34***	0,26***	1,00					
5	Yield Spread	-0,15***	-0,33***	0,28***	0,98***	1,00				
6	Rating	0,32***	0,62***	-0,47***	-0,48***	-0,50***	1,00			
7	Age	0,06***	0,13***	-0,16***	-0,02*	-0,02	0,10***	1,00		
8	Volatility	-0,13***	-0,45***	0,26***	0,46***	0,46***	-0,66***	-0,09***	1,00	
9	Coverage Ratio	0,02*	0,01	-0,04***	-0,01	-0,00	0,02	0,02*	-0,00	1,00
-	Current Ratio	-0,00	-0,21***	-0,08***	0,02**	0,04***	-0,08***	-0,05***	0,14***	0,03**

Significance levels using a two tailed t-test
*** p<0,01, ** p<0,05, * p<0,1

Model 4 with the natural logarithm of Yield Spread as the dependent variable

Column 2 of Table 6 Dependent variable: ln(Yield Spread)	
Degree of Internationalization	-0,02*** (-2,76)
Firm Size	-0,29*** (-40,81)
Age	0,02*** (6,99)
Firm Leverage	1,35*** (21,38)
Constant	4,90*** (46,11)
Observations	9362
Adjusted R-squared	0,56

Robust t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1