The Relationship of Intangible Capital and ESG Score on Capital Structure: Evidence from Thailand

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จุฬาลงกรณ์มหาวิทยาลัย
CHULALONGKORN UNIVERSITY

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การศึกษาความสัมพันธ์ระหว่างสินทรัพย์ไม่มีตัวตน และคะแนน ESG ต่อโครงสร้างเงินทุนของบริษัทในประเทศไทย

น.ส.ชลิตา รัมมะวาส

Independent Study Title	The Relationship of Intangible Capital and ESG Score on Capital Structure: Evidence from Thailand
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Field of Study	Finance
Thesis Advisor	Associate Professor KANIS SAENGCHOTE, Ph.D.

Accepted by the FACULTY OF COMMERCE AND ACCOUNTANCY, Chulalongkorn University in Partial Fulfillment of the Requirement for the Master of Science

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ชลิตา รัมมะวาส : การศึกษาความสัมพันธ์ระหว่างสินทรัพย์ไม่มีตัวตน และคะแนน ESG ต่อ
โครงสร้างเงินทุนของบริษัทในประเทศไทย. (The Relationship of Intangible
Capital and ESG Score on Capital Structure: Evidence from
Thailand) อ.ที่ปรึกษาหลัก : รศ. ดร.คณิสร์ แสงโชติ

This study examines whether intangible capital influences capital structure which influent to cost of debt. Moreover, this study also analyzes more whether adding the effect of and ESG performance as risk reduction together with intangible capital affect to capital structure by using financial leverage and WACC cost of debt as the dependent variable and using intangible capital and ESG performance as independent variable.

The empirical results of this study show intangible capital and financial leverage are not relevant under these equations. Moreover, they also have no relationship between intangible capital and cost of debt, and there is a 10% chance that the observed a negative relationship between the companies which have the increase in intangible capital with the higher ESG score and financial leverage due to random chance rather than a true association. However, the interesting parts is when we focus within firm, increasing in ESG score is associated with increasing in cost of debt. These results are opposite to the primary expectation that ESG score would reduce that risk. The backup information of these results is mainly associated with Gonçalves, Dias et al. (2022) who concluded that creditors believe that the sustainability activities with the borrower's firms are considered as a waste of a firms' cost under the overinvestment theory.

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          Advisor: Assoc. Prof. KANIS SAENGCHOTE, Ph.D.

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Field of Study:	Finance	Student's Signature
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Academic Year:	2022	Advisor's Signature
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INTRODUCTION

In the modern world, intangible capital becomes the important part of business operation. As we know, intangible asset is the asset which we cannot perceive in the physical, but it still has value and can generate revenue to the firm. Peters and Taylor (2017) specified that intangible capital consists of knowledge capital, which is come from R&D expenditure, and organization capital, which is partly interpret from SG&A as human skill, firm branding, customer relationship and administration system. Moreover, Eric Hazan (2021) indicated that the investment share of intangibles has growth to 29 percent compared to the 13 percent of decreasing in tangible asset and showed that the companies which invest more in intangible asset are growth more than tangible investors.

However, as a financial institution point of view, investing in intangible asset more than tangible asset (such as, property plant and equipment) will reflect the high risk of the company. The article associated with Loumioti (2012) which found that loans with intangible asset are significantly increases in loan pricing to firms. Moreover, Lilly and Reed (2004) described the reason behind the high risk of intangible capital which is the time lag for realize the asset. Because intangible capital is uniqueness, there are no market or exchange exists. Therefore, intangible assets are often difficult to value and cannot be used as collateral for debt financing. As a result, lenders may be hesitant to provide credit to companies with high levels of intangible capital, which can limit their ability to use debt financing to grow their business, or in can be implied that intangible asset is recognized as a bad collateral for financial institution.

In the meantime, as the lender and investor point of view, focusing just financial disclosure might not reflect the real value of the company. Thus, Environmental, social, and governance (ESG) disclosure becomes the importance part for consideration along with financial information, because it reflects the sustainability long run growth of that company, correlated Settrade article which said that Business that has well perform in ESG will reflect competitive ability and long-term growth of the firm. Moreover, ESG performance also concerns about economic risk, social risk, and environmental risk. In addition, there has research from (Lodh 2020) that companies with high ESG performance have lower costs of capital compared to companies with poor ESG scores in both developed and emerging markets.

Therefore, I would like to examine whether intangible capital influences on capital structure which influent to cost of debt. Moreover, I would like to analyze more whether adding the effect of and ESG performance as risk reduction together with intangible capital affect to capital structure by using financial leverage and WACC cost of debt as the dependent variable and using intangible capital and ESG performance as independent variable.

LITERATURE REVIEW

To examine whether intangible capital and ESG performance influence financial leverage and cost of debt, there are several studies which support the relationship between them.

Intangible capital and Capital Structure

Lim, Macias et al. (2020) found that intangible assets have relationship with debt financing as tangible assets. Then, Hosono and Akizawa (2017), which study in intangible capital and the choice of external financing sources, showed that companies with higher intangible capital ratios are more likely to choose equity issuance rather, and likely to choose bond issues rather than loans. To support their conclusion, Huang and Shang (2019), who studied whether local intangible capital or social capital influences firms' use of debt financing, found that high social capital firms are indeed associated with lower leverage and less short-term debt. However, there has the study of the impact of web-based intellectual capital (IC) reporting on firm's value and its cost of finance by Orens, Aerts et al. (2009). They found that the disclosure of intellectual capital is lower implied cost of equity capital and lower rate of interest paid from the lower information asymmetry. Then, Horsch, Longoni et al. (2021) found that firms that obviously utilize their intangible assets to support the debt financing (in term of collateral), intangible capital is a key support for their leverage.

Intangible capital and ESG

Reboredo and Sowaity (2021) studied in the relationship between the intellectual capital or intangible capital efficiency of firms and ESG disclosure. They found that intellectual capital has a relation with governance and social information disclosure, but unrelated to environmental information disclosure. Moreover, another study as Gao, Li et al. (2022) who studied in the relationship between intangible capital investment decision and ESG performance found the increasing in intangible capital decision results in the rising of enterprise performance which drives to ESG performance.

ESG and Cost of Capital

There is the evidence that there is a connection between ESG disclosure and the cost of capital. Johnson (2020) who studied how ESG disclosure is related to the cost of capital (WACC) found that ESG disclosure has negative relationship with WACC for goods and services industries, but positive relationship for the other sectors. Khanchel and Lassoued (2022), who tested how the cost of capital over a period of time is influenced by ESG disclosure, found the short-term impact of governance disclosure is a reduction in the cost of capital, but over the long-term, the effect becomes positive. Social disclosure increases the cost of capital, in contrast with environmental. Furthermore, Apergis, Poufinas et al. (2022) who analyze the correlation between the cost of debt and ESG performance found that the better ESG rating, the lower cost of unsecured debt in the primary bond market. Zhang (2022), who investigate how ESG scores relate to corporate bond yields and bond portfolio performance, also support Apergis, Poufinas et al. (2022). They found that bond yields negatively have relationship with ESG scores. In addition, Piechocka-Kałużna, Tłuczak et al. (2021), who studied the relationship between individual ESG elements, ESG score, and the weighted average cost of capital, the cost of equity, and debt, reported ESG and its components has influent to the weighted average cost of capital in both equity and debt.

HYPOTHESIS DEVELOPMENT

As mentioned above in the literature review, it can be implied that intangible capital might affect the increasing in cost of debt from Hosono and Akizawa (2017) who found that the firm with higher intangible capital ratios are more likely to choose equity rather than debt financing. However, even the company which has the high portion of intangible capital trend to invest in equity rather than borrowing in loan, Orens, Aerts et al. (2009) found that intangible capital disclosure is a key support for their financial leverage. Therefore, I would like to find the relationship between leverage ratio and intangible capital, whether they have the positive relationship each other. Finally, it comes up with the first hypothesis as follow.

Research Question #1: Is intangible capital influences on the lower financial leverage?
Hypothesis 1a: Intangible capital and financial leverage are not relevant.
Hypothesis 1b: Intangible capital has a negative impact on financial leverage.

Then, I would like to take ESG score factor to test whether intangible capital adding with ESG score factor influences on the higher financial leverage or it can be transferred in Research Question and Hypothesis as follow.

Research Question #2: Is intangible capital adding with ESG score factor influences on the higher financial leverage?

Hypothesis 2a: There is no impact among each variable.

Hypothesis 2b: Intangible capital and ESG score have positive impact on financial leverage.

Moreover, I would like to observe the relationship between intangible capital and cost of debt due to focusing the intangible capital as firm character rather than focusing as collateral. Therefore, it comes up with the third Research Question and Hypothesis as follows.

Research Question #3: Is intangible capital influences on the higher cost of debt?

Hypothesis 3a: Intangible capital and cost of debt are not relevant.

Hypothesis 3b: Intangible capital has positive impact on cost of debt.

Finally, I also added ESG score to Research Question #3 to find the effect of intangible capital and ESG performance on cost of debt which transfer to hypothesis as follows.

Research Question #4: Is intangible capital adding with ESG score factor influences on the lower cost of debt?

Hypothesis 4a: There is no impact among each variable.

Hypothesis 4b: Intangible capital and ESG score has negative impact on cost of debt.

For Research Question #1 and #2 , I expect that it would be reject Ha as the higher intangible capital might be riskier and reduce financial leverage, and ESG score will reduce that risk. Then, it might improve firm leverage, if take the ESG score variable.

In addition, for Hypothesis Question #3 and #4, I expect that it would be reject Ha as the higher intangible capital might be riskier and increase cost of debt, and ESG score will reduce that risk. Then, it might be reducing cost of debt, if take the ESG score variable.

DATA

First, I stared to collect the sample data of non-financial and non-utilities listed companies in Thailand from fiscal year 2017 to 2022 (6 years) in Refinitiv to examine this research questions, since I would like to test the effect of the intangible capital in Thailand. To calculate the data, I need to drop observations that do not have enough information to calculate the variables described.

Then, I will use this information to calculate variable as follows.

Dependent Variable:

1. *Financial Leverage*

Based on Huang and Shang (2019), financial leverage is calculated from total debt divided by total book value. Moreover, I put this financial leverage as a control variable in cost of debt regression model, since I expect that the high portion of financial leverage will affect the high cost of debt.

$$LEV = \frac{Total\ Debt}{Total\ Book\ Values}$$

2. *WACC Cost of Debt*

As Refinitiv (2022) formular, weighted average cost of capital (WACC) is the combination of weighted average cost of capital under the CAPM Model and after-tax weighted cost of debt, which can describe as the equation as follow.

$$WACC = (C_E * W_E) + (C_D * W_D) + (C_P * W_P)$$

$WACC$: Weighted Average Cost of Capital

C_E: WACC Cost of Equity

W_E: WACC Equity Weight

C_D: WACC Cost of Debt

W_D: WACC Debt Weight

C_P: WACC Cost to Preferred

W_P: WACC Preferred Weight

For WACC cost of debt, Refinitiv (2022) calculates data by using short-term and long-term debt costs from the current credit curve which depends on company-specific information such as industry, credit rating, and currency.

$$C_D = ((C_{D-Short} * W_{D-Short}) + (C_{D-Long} * W_{D-Long})) + (1 - Tax)$$

$C_{D-Short}$: The pre-tax short term debt cost (1-year yield on the appropriate credit curve for the company)

C_{D-Long}: The pre-tax long term debt cost (10-year yield on the appropriate credit curve for the company)

$W_{D-Short}$ and W_{D-Long}: proportion of the company's debt that is short-term and long-term, respectively.

Independent Variable:

1. Intangible Capital

Due to intangible capital is not included in reported assets under accounting standard, I will calculate intangible capital base on Peters and Taylor (2017) assumption which is begun from.

$$intang = K_{i,t} + O_{i,t}$$

where,

$K_{i,t}$: Knowledge capital, as the intangible capital by spending on research and development (R&D)

$O_{i,t}$: Organizational capital, as the combine of human skills, brand, client relationship and system

However, Peters and Taylor (2017) had dropped their missing R&D. Then, they tested the result that their methodology still explains intangible capital equally well. Therefore, I will follow Peters and Taylor (2017) by drop $K_{i,t}$, and calculate $O_{i,t}$ (or $Intang_{i,t}$) under the perpetual inventory method as follow.

$$intang_{i,t} = (1 - \delta_0)Intang_{i,t-1} + 30\% \, SG\&A_{i,t}$$

where,

δ_0: Depreciation rate which Peters and Taylor (2017)

For Depreciation rate (δ_0), I examined appropriateness of depreciation rate between 10% - 50% to find the suitable depreciation rate. Finally, the result for depreciation rates have not different from each other as the result in Appendix B and Appendix C. Therefore, I will use the depreciation rate as 20% followed by Peters and Taylor (2017) result.

To calculate initial value of intangible asset (or $Intang_0$), I will use the calculation based on Eisfeldt and Papanikolaou (2013) model.

$$intang_0 = \frac{SG\&A_1}{g + \delta_0}$$

where,

g: the average growth rate of SG&A which use 10% followed by Eisfeldt and Papanikolaou (2013).

After intangible capital calculation, I will use 6-years data of intangible capital from 2017 – 2022 for my analysis. In addition, Peters and Taylor (2017) had already tested that their assumption is appropriate for intangible capital estimating. Eventually, intangible capital will be calculated based on Peters and Taylor (2017) model which all financial information comes from Refinitiv database.

2. ESG Score

To use ESG score from Refinitiv, I researched about their mythology from Refinitiv's website. The ESG score from Refinitiv evaluates a firm's environmental, social, and governance performance through publicly available information. The score is determined by analyzing over 630 ESG metrics, with a selected group of 186 being the most relevant and important for each respective industry to influence the overall evaluation and scoring of the company. TRBC Sector Classification was used as the benchmark for industry group classification. The scores are relied on ESG factors relative performance with business sector, which are for environmental and social, and country of incorporation, which is for governance. The ranges of Refinitiv's ESG score are between 1 and 100.

As of Dec 2022, there are 179 companies in Thailand that have available ESG score data in Refinitiv. Therefore, I used 6-year ESG score data from 2017 to 2022 of non-financial and non-utilities listed companies in Thailand which are counted for 138 firms, and assumed maximum backfill ESG data for the 5-year period for the firms which are not have sufficient ESG score. In addition, I removed firms that had no available data of ESG score from my analysis.

Control Variables:

1. *Collateral*

   Van Binsbergen, Graham et al. (2010) used collateral (COL) as a control variable which calculated as follow.

$$Collat = \frac{(PPE + Inventory)}{Total\ Book\ Values}$$

   In addition, Van Binsbergen, Graham et al. (2010) also tested the relation between collateral and cost of debt and found that they have negative relationship with each other, or it can imply that the high collateral companies have low cost of debt.

2. *Book to Market Equity*

   Based on Van Binsbergen, Graham et al. (2010), they focused on book to market equity (BTM) due to the firm growth opportunities. They also found that BTM has negative impact on cost of debt. The firms which have high BTM or growth firms have high cost of debt.

$$BTM = \frac{Total\ Equity}{(FS\ closed\ price\ \cdot\ Common\ share\ outstanding)}$$

3. *Cash Flow*

   Van Binsbergen, Graham et al. (2010) indicated that cash flow is implied as the pecking order theory. They also found that the companies which have high usage cash flow trends to have higher costs and using less debt.

$$CF = \frac{Cash\ Flow}{Total\ Book\ Values}$$

4. *Profitability*

   Profitability is one of the components of cost of debt. Regarding Fernández-Cuesta, Castro et al. (2019) who found that profitability was given negative relationship with cost of debt, the high profitability expects the negative relationship with cost of debt.

$$Profit = \frac{EBITDA}{Total\ Book\ Values}$$

5. *Firm Size*

Both Khanchel and Lassoued (2022) and Fernández-Cuesta, Castro et al. (2019) indicated that firm size has a negative and relationship with cost of capital and cost of debt which shown the smaller of firm, the riskier of their company.

$$Size = Logarithm\ of\ Total\ Assets$$

Table 1 *Variable Description*

Variable	Description	Frequency	Source
$Cd_{i,t}$	WACC Cost of Debt	annual	Refinitiv
$intang_{i,t}$	$intang_{i,t} = \dfrac{\left((1-\delta_0)Intang_{i,t-1} + 30\%\ SG\&A_{i,t}\right)}{Total\ BV}$	static	Calculation
$ESG_{i,t}$	ESG Score (score range from 0 – 100)	annual	Refinitiv
$Collat_{i,t}$	Collateral = (PPE + Inventory) / Total BV	static	Calculation
$BTM_{i,t}$	Book to Market = Total Equity / (FS closed price * Common share outstanding)	static	Calculation
$CF_{i,t}$	Cash Flow / Total BV	static	Calculation
$Lev_{i,t}$	Financial Leverage = Total Debt/ Total BV	static	Calculation
$Profit_{i,t}$	Profitability = EBITDA/ Total BV	static	Calculation
$Size_{i,t}$	Firm Size = logarithm of total assets	static	Calculation
YEAR	Year fixed effect	static	-
STOCK	Firm fixed effect	static	-

METHODOLOGY

(H1) and (H2) To test the relationship of intangible and ESG score on financial leverage, I conduct the regression and statistical test mainly apply from Huang and Shang (2019), and add the interaction variable $Intang_{i,t} \cdot ESG_{i,t}$ from Gao et al. (2022) who found that intangible capital has relationship with ESG performance as follows.

$$Lev_{i,t} = \beta_0 + \beta_1 intang_{i,t} + \beta_2 ESG_{i,t} + \beta_3 intang_{i,t} \cdot ESG_{i,t} + CONTROL + YEAR + STOCK + \varepsilon_{i,t}$$

where,

$$CONTROL = \beta_4 Collat_{i,t} + \beta_5 BTM_{i,t} + \beta_6 CF_{i,t} + \beta_7 Profit_{i,t} + \beta_8 Size_{i,t}$$

(H3) and (H4) To examine the relationship between intangible assets and ESG performance on cost of debt, I conduct the regression and statistical test mainly from Binsbergen et al. (2010) which applied model from Khanchel and Lassoued (2022) and Fernández-Cuesta, Castro et al. (2019), and add the interaction variable $Intang_{i,t} \cdot ESG_{i,t}$ from Gao et al. (2022) who found that intangible capital has relationship with ESG performance.

$$Cd_{i,t} = \beta_0 + \beta_1 intang_{i,t} + \beta_2 ESG_{i,t} + \beta_3 intang_{i,t} \cdot ESG_{i,t} + CONTROL + YEAR + STOCK + \varepsilon_{i,t}$$

where,

$$CONTROL = \beta_4 Collat_{i,t} + \beta_5 BTM_{i,t} + \beta_6 CF_{i,t} + \beta_7 Lev_{i,t} + \beta_8 Profit_{i,t} + \beta_9 Size_{i,t}$$

For methodology, I use ordinary least squares (OLS), fixed effects panel regressions for estimating, as the time series, cross-sectional data, and individual firm data by adding fixed estimator for controlling year fixed effect (or $YEAR$) and firm fixed effect (or $STOCK$). Then, I use clustered standard errors function for accuracy of the standard errors.

CONTRIBUTIONS

For contribution of my special project, this study would be supportive for debt financing companies, or the firm which need to take advantage from tax reduction. Moreover, it will provide useful information for intangible capital-based firms who want to finance by debt. In addition, this study encourages the firm to be more concerned about sustainability which is correlated with the risk reduction of the firms.

RESULTS AND DISCUSSION

1. Descriptive Statistics

For data collection, there are start with the listed firm in Thailand which have ESG data as of fiscal year 2022 which consist of 179 companies. Then, this data is filtered by financial institutions and utilities firms due to the accuracy in capital structure analysis. Finally, the data for this study remains 138 companies of non-financial and non-utilities listed companies in Thailand from fiscal year 2017 to 2022 (6 years) which have the available ESG score in 2022, and assumed maximum backfill ESG data for the 5-year period for the firms that are not have sufficient ESG score. Then, the other missing variables are replaced as zero. Therefore, it comes up with 828 observations for this study, which all variables are winsorized at 5% and 95% level for dealing with extreme values.

Table 2 reports summary statistics of each variable in this study. For dependent variables, the financial leverage (Lev) ratio of this data contains the range between 0.001 and 2.23 which shows the mean and standard error of financial leverage (Lev) as 0.37 and 0.25 respectively. The median of financial leverage (Lev) shows as 0.38, which means that this financial leverage (Lev) data is slightly skewed. For the cost of debt (Cd), they have cost of debt (Cd) around 0.03 or 3.0% on average nearly the same as median. Moreover, the standard deviation of cost of debt (Cd) shows 0.02 or 2.0% which means the moderate amount of cost of debt (Cd) in the dataset.

For the independent variable, ESG score (ESG), which normally have the ranges between 1 and 100, have 50.89 on average, and have the median as 50.97. Additionally, the standard deviation of 16.03 indicates a moderate amount of ESG score (ESG). Moving to intangible assets, I followed Peters and Taylor (2017) for the intangible asset capitalization method and examined appropriateness of depreciation rate between 10% - 50% to find the suitable depreciation rate. Finally, the result for depreciation rates have not different from each other as the result in Appendix A. Therefore, I will use the intangible asset capitalized depreciation rate as 20% (intang20) followed by Peters and Taylor (2017). Then, I divided intangible asset (intang20) by total book value for transform in the ratio. The intangible asset (intang20) ratio has a mean of 0.36 and a median of 0.22, indicating that the data has right skewed. Moreover, the standard deviation of intangible asset (intang20) is 0.52 which means the intangible asset of the firm is volatile.

Table 2: Data Summary

Table 2 reports summary statistics of each variable. (Dependent Variable) Financial Leverage (Lev) and WACC Cost of Debt (Cd), (Independent Variable) ESG score (ESG), intangible assets which capitalized at 20% (intang20), (Control Variable) profitability (Profit), firm size (Size), collateral (Collat), cashflow (CF), and book to market (BTM). To decrease the effect of outliner, all variables are winsorized at 5% and 95% level. The variables have 828 observations which replace the missing variable as zero. For ESG, they came from non-financial and non-utilities listed companies in Thailand from fiscal year 2017 to 2022 (6 years) which composite as 138 companies.

	Obs.	mean	sd	median	min	max
Dependent Variables						
Lev	828	0.370	0.250	0.380	0.001	2.230
Cd	828	0.030	0.020	0.030	0.000	0.110
Independent Variables						
ESG	828	50.890	16.030	50.970	13.470	92.100
intang20	828	0.360	0.520	0.220	0.044	5.750
Control Variables						
Profit	828	0.150	0.150	0.140	-1.060	1.800
Size	828	10.250	1.290	10.300	1.430	12.530
Collat	828	1.010	0.630	1.010	0.058	2.026
CF	828	0.140	0.130	0.120	-1.070	1.500
BTM	828	0.650	0.990	0.570	-18.650	3.260

2. Correlations

From the collection of data, the correlation among the variables was shown in *Table 3*. Leverage Ratio of financial leverage (Lev) has significantly positive correlation with the cost of debt (Cd), firm size (Size), and collateral (Collat) at 1% significant level, in contrast with significantly negative correlation with intangible assets (intang20), profitability of the firm (Profit), cash flow of the firm (CF) and firm book to market (BTM). However, the correlation between financial leverage (Lev) and ESG score (ESG) is statistically insignificant.

For the correlations among the cost of debt (Cd) and the other variables, Cd has significantly positive correlation with ESG score (ESG) and firm size (Size), but it has significantly negative correlation with intangible assets (intang20), profitability of the firm (Profit), and cash flow of the firm (CF) at 1% significant level.

The results can be implied as the initial evidence that intangible assets (intang20) can reduce financial leverage (Lev), and cost of debt (Cd). However, ESG score (ESG) has not influenced financial leverage (Lev), even ESG score (ESG) can affect the increasing in cost of debt (Cd).

Table 3: Correlations Matrix

	Lev	Cd	ESG	intang20	Profit	Size	Collat	CF	BTM
Lev	1								
Cd	0.435***	1							
ESG	0.042	0.129***	1						
intang20	-0.124***	-0.154***	-0.077*	1					
Profit	-0.321***	-0.219***	0.023	0.259***	1				
Size	0.344***	0.234***	0.251***	-0.146***	-0.048	1			
Collat	0.118***	0.016	-0.007	0.128***	0.244***	0.261***	1		
CF	-0.315***	-0.199***	0.023	0.262***	0.969***	-0.051	0.233***	1	
BTM	-0.307***	-0.058	0.078*	-0.147***	-0.035	-0.019	-0.310***	-0.024	1

Computed correlation used pearson-method with listwise-deletion.

Significant Level: *'***'0.001, '**'0.01, '*'0.05*

3. Empirical Result

To examine effect of intangible capital adding with ESG score on financial leverage and cost of debt, the model for study these effects is the ordinary least squares (OLS), fixed effects panel regressions for estimating, as the time series, cross-sectional data, and individual firm data by adding fixed estimator for controlling year fixed effect (or YEAR). After that, the firm fixed effect (or STOCK) will be taken to focus the result within the firm. Moreover, this study also examined appropriateness of depreciation rate between 10% - 50% for capitalized SG&A to calculate intangible capital. Finally, the result for depreciation rates have not different from each other as the result in Appendix B and Appendix C. In addition, all standard errors have been clustered for the accuracy of standard errors.

The regressions start from the relationship between intangible asset (intang20) and Leverage Ratio (Lev) without firm fixed effect. After that, the firm fixed effect is added later to focus the effect within firm for testing the **Hypothesis 1** whether intangible capital has negative impact on financial leverage. Then, I add the ESG score (ESG) variable in the regression model to answer the **Hypothesis 2** whether intangible capital and ESG score have positive impact on financial leverage by testing without firm fixed affect and adding the firm fixed effect. Finally, the result is shown in *Table 4*.

In addition, I replete this testing in cost of debt model to find the relationship between intangible asset and ESG score on cost of debt (Cd) to answer the **Hypothesis 3 and 4**, which the result is shown in *Table 5*.

Table 4:
The relationship between intangible asset and ESG score on Leverage Ratio (Lev)

Table 4 summarizes the results of the relationship among intangible assets which capitalized at 20% (intang20) and ESG score (ESG) on Financial Leverage (Lev) from ordinary least squares (OLS), fixed effects panel regression. I estimate the coefficient in equation. (1) The effect of intang20 on Lev without firm fixed effect (2) The effect of intang20 on Lev with firm fixed effect (3) The effect of intang20 adding with ESG on Lev without firm fixed effect, and (4) The effect of intang20 adding with ESG on Lev with firm fixed effect. For equations (3) and (4), they are added by the interaction term (intang20.ESG). All variables including control variables; collateral (Collat), book to market (BTM), cashflow (CF), profitability (Profit), and firm size (Size) are winsorized at 5% and 95%. Standard errors clustering has been all complied. *, **, and *** denote statistical significance at 10%, 5% and 1%, respectively.

	Lev			
	(1)	(2)	(3)	(4)
Constant	-0.133	-1.062	-0.149	-1.044
	(0.190)	(0.733)	(0.189)	(0.680)
intang20	-0.022	-0.034	0.04	0.125
	(0.020)	(0.042)	(0.059)	(0.098)
ESG			0.0001	0.0004
			(0.001)	(0.001)
intang20.ESG			-0.002	-0.004*
			(0.002)	(0.002)
Collat	0.009	0.069***	0.012	0.082***
	(0.029)	(0.021)	(0.030)	(0.024)
BTM	-0.080***	-0.052***	-0.080***	-0.051***
	(0.013)	(0.011)	(0.013)	(0.010)
CF	0.059	0.231	0.063	0.22
	(0.451)	(0.304)	(0.447)	(0.293)
Profit	-0.592*	-0.435**	-0.587*	-0.416**
	(0.346)	(0.208)	(0.340)	(0.207)
Size	0.061***	0.157**	0.062***	0.152**
	(0.018)	(0.068)	(0.020)	(0.064)
Year Fixed Effect	Yes	Yes	Yes	Yes
Firm Fixed Effect	No	Yes	No	Yes
No. of obs.	816	679	814	677
Adjusted R-square	0.302	0.848	0.302	0.852

Regarding *Table 4*, the results in column (1) and (2) provide the initial results to indicate **Hypothesis 1**. However, the intangible assets (intang20) are not statistically significant even taking firm fixed effect to focus the result within the firm in column (2). Thus, it can be implied that intangible capital (intang20) and financial leverage (Lev) are insignificantly relevant under these equations.

To considerate more by adding ESG variable in column (3) and (4) for the reassure in **Hypothesis 1** and answering **Hypothesis 2**, the results in *Table 4* indicate that relationship among intangible capital (intang20) and ESG score (ESG) variable on financial leverage (Lev) are insignificant relevant in column (3).

After taking the firm fixed effect in column (4), the coefficient of interaction term (intang20.ESG) is negatively associated with financial leverage (Lev) compared to column (3) as evidenced by coefficient of -0.004 at the 10% significant level. As a result, it can be implied that there is a 10% chance that the observed a negative relationship between the companies which have the increase in intangible capital with the higher ESG score and financial leverage due to random chance rather than a true association, which in contrast with the prediction in **Hypothesis 2**. The result is opposite to the primary expectation that ESG score would reduce that risk.

For control variables, firm size (Size), profitability of the firm (Profit), firm book to market (BTM) and collateral (Collat) after taking firm fixed effect as the consider are all statistically significant relationship with financial leverage (Lev). However, the coefficients, which are insignificant on financial leverage (Lev), are collateral (Collat) without firm fixed effect and cash flow of the firm (CF) for all columns.

Table 5:
The relationship between intangible asset and ESG score on cost of debt (Cd)

Table 5 summarizes the results of the relationship among intangible assets which capitalized at 20% (intang20) and ESG score (ESG) on WACC Cost of Debt (Cd) from ordinary least squares (OLS), fixed effects panel regression. I estimate the coefficient in equation. (1) The effect of intang20 on Cd without firm fixed effect (2) The effect of intang20 on Cd with firm fixed effect (3) The effect of intang20 adding with ESG on Cd without firm fixed effect, and (4) The effect of intang20 adding with ESG on Cd with firm fixed effect. For equations (3) and (4), they are added by the interaction term (intang20.ESG). All variables including control variables; financial leverage (Lev), collateral (Collat), book to market (BTM), cashflow (CF), profitability (Profit), and firm size (Size) are winsorized at 5% and 95%. Standard errors clustering has been all complied. *, **, and *** denote statistical significance at 10%, 5% and 1%, respectively.

	Cd			
	(1)	(2)	(3)	(4)
Constant	0.003	0.012	0.002	0.004
	(0.007)	(0.068)	(0.006)	(0.068)
intang20	-0.001	-0.002	-0.002	-0.003
	(0.001)	(0.002)	(0.003)	(0.005)
ESG			0.0001*	0.0002***
			(0.000)	(0.000)
intang20.ESG			0.00003	0.00004
			(0.000)	(0.000)
Collat	-0.0003	-0.00001	-0.0002	0.00001
	(0.001)	(0.002)	(0.001)	(0.002)
Lev	0.023***	0.014**	0.023***	0.014**
	(0.003)	(0.007)	(0.003)	(0.007)
BTM	0.001	0.0001	0.001	0.0001
	(0.001)	(0.001)	(0.001)	(0.001)
CF	0.031*	0.016	0.031*	0.015
	(0.017)	(0.015)	(0.018)	(0.016)
Profit	-0.032**	-0.014	-0.033**	-0.012
	(0.014)	(0.009)	(0.015)	(0.009)
Size	0.001	0.002	0.001	0.002
	(0.001)	(0.007)	(0.001)	(0.007)
Year Fixed Effect	Yes	Yes	Yes	Yes
Firm Fixed Effect	No	Yes	No	Yes
No. of obs.	815	678	813	676
Adjusted R-square	0.304	0.498	0.312	0.505

In *Table 5*, the results in column (1) and (2) provide the primary results of **Hypothesis 3**, which are not insignificant for the intangible assets (intang20) variable even taking firm fixed effect to focus the result within the firm in column (2). Hence, it can be implied that intangible capital and cost of debt are insignificantly relevant under these equations.

After taking ESG score (ESG) on cost of debt (Cd) equation in column (3) and (4) with interaction term between intangible asset (intang20) and ESG score (ESG). For equation in column (3) without firm fixed effect, the result shows that the coefficient of ESG score (ESG) is statistically positive impact at 10% significant level. Moreover, adding the firm fixed effect in the regression in column (4) results that the coefficient of ESG score (ESG) in column (4) at 0.0002 has statistically positive impact on cost of debt (Cd) at 1% significant level. In addition, we can interpret the result of column (4) in the economically meaning that the increasing in ESG score by one standard deviation (or 16.03 point) is associated with the relative increasing in cost of debt (Cd) by 0.0032 percentage point (coefficient at 0.0002*S.D. of ESG score at 16.03), which account for 10.69% (0.0032 percentage point relative to Cd's mean at 3.0%). In addition, this result is opposite to our prediction in **Hypothesis 4** which expects that intangible capital and ESG score has negative impact on cost of debt from the assumption that ESG score will reduce the firm risk. However, there is a backup reason from Gonçalves, Dias et al. (2022) who found that lenders believe that the sustainability activities of the firm borrower are considered as a waste of a firms' cost under the overinvestment theory. Moreover, there also has been the study of the relationship between the ESG score and the cost of capital from Priem and Gabellone (2022), who found that the increasing in cost of debt come from the higher leverage of the firm. However, our model has already taken the firm fixed effect as the control variable. Therefore, this paper could not explain our result.

For control variables, the coefficient of financial leverage (Lev) is statistically and significantly positive impact on cost of debt (Cd) for all the equation, which implies that the high leverage firm influences to the increasing in cost of debt, and the rising in financial leverage effects the increasing in cost of debt. For the other control variable, they are all statistically insignificant for all columns.

CONCLUSION

   This study analyzes whether intangible capital or intangible asset influences on the capital structure which would be effect to cost of debt. Moreover, this paper also investigates more whether adding the effect of and ESG performance as risk reduction together with intangible capital affect to capital structure by using financial leverage and WACC cost of debt as the dependent variable and using intangible capital, which capitalized by the level of depreciation rate, and ESG performance as independent variable.

   The empirical results of this study show intangible capital and financial leverage are not relevant under these equations. Moreover, they also have no relationship between intangible capital and cost of debt, and there is a 10% chance that the observed a negative relationship between the companies which have the increase in intangible capital with the higher ESG score and financial leverage due to random chance rather than a true association. However, the interesting parts is when we focus within firm, and the increasing in ESG score by one standard deviation (or 16.03 point) is associated with the relative increasing in cost of debt by 0.0032 percentage point which account for 10.69% relative to cost of debt variable's mean at 3.0%. These results are opposite to the primary expectation that ESG score would reduce that risk. The backup information of these results is mainly associated with Gonçalves, Dias et al. (2022) who concluded that creditors believe that the sustainability activities with the borrower's firms are considered as a waste of a firms' cost under the overinvestment theory.

   The limitation of the study might be from the data observation which has a few ESG score and period of data available from the firm in Thailand. In addition, this study would be supportive for debt financing companies, or the firm which needs to take advantage from tax reduction. Moreover, it will provide useful information for intangible capital-based firms who want to finance by debt.

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APPENDIX

Appendix A: Data Summary of all intangible assent capitalized by different depreciation rates (50%, 40%, 33%, 20%, and 10%) and Correlations.

Table I reports summary statistics of each variable. (Dependent Variable) Financial Leverage (Lev) and WACC Cost of Debt (Cd), (Independent Variable) ESG score (ESG), intangible assets which capitalized at 50%, 40%, 33%, 20%, and 10% (intang50, intang40, intang33, intang20, intang10), (Control Variable) profitability (Profit), firm size (Size), collateral (Collat), cashflow (CF), and book to market (BTM). To decrease the effect of outliner, all variables are winsorized at 5% and 95% level. The variables have 828 observations which replace the missing variable as zero. For ESG, they came from non-financial and non-utilities listed companies in Thailand from fiscal year 2017 to 2022 (6 years) which composite as 138 companies.

	Obs.	mean	sd	median	min	max
Dependent Variables						
Lev	828	0.370	0.250	0.380	0.001	2.230
Cd	828	0.030	0.020	0.030	0.000	0.110
Independent Variables						
ESG	828	50.890	16.030	50.970	13.470	92.100
intang50	828	0.120	0.180	0.070	0.017	1.970
intang40	828	0.160	0.240	0.100	0.022	2.630
intang33	828	0.210	0.300	0.120	0.026	3.230
intang20	828	0.360	0.520	0.220	0.044	5.750
intang10	828	0.650	0.920	0.380	0.069	10.510
Control Variables						
Profit	828	0.150	0.150	0.140	-1.060	1.800
Size	828	10.250	1.290	10.300	1.430	12.530
Collat	828	1.010	0.630	1.010	0.058	5.900
CF	828	0.140	0.130	0.120	-1.070	1.500
BTM	828	0.650	0.990	0.570	-18.650	3.260

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Table II: Correlations Matrix

	Lev	Cd	ESG	intang50	intang40	intang33	intang20	intang10	Profit	Size	Collat	CF	BTM
Lev	1												
Cd	0.435***	1											
ESG	0.042	0.129***	1										
intang50	-0.134***	-0.184***	-0.064	1									
intang40	-0.130***	-0.178***	-0.067	0.999***	1								
intang33	-0.128***	-0.171***	-0.070*	0.997***	0.999***	1							
intang20	-0.124***	-0.154***	-0.077*	0.985***	0.991***	0.995***	1						
intang10	-0.119***	-0.136***	-0.084*	0.964***	0.972***	0.980***	0.995***	1					
Profit	-0.321***	-0.219***	0.023	0.301***	0.288***	0.279***	0.259***	0.242***	1				
Size	0.344***	0.234***	0.251***	-0.152***	-0.149***	-0.148***	-0.146***	-0.145***	-0.048	1			
Collat	0.118***	0.016	-0.007	0.130***	0.130***	0.130***	0.128***	0.126***	0.244***	0.261***	1		
CF	-0.315***	-0.199***	0.023	0.299***	0.288***	0.279***	0.262***	0.246***	0.969***	-0.051	0.233***	1	
BTM	-0.307***	-0.058	0.078*	-0.124***	-0.128***	-0.133***	-0.147***	-0.160***	-0.035	-0.019	-0.310***	-0.024	1

Computed correlation used pearson-method with listwise-deletion.

Significant Level: *‘***’0.001, ‘**’0.01, ‘*’0.05*

Appendix B: The relationship between intangible asset and ESG score on Leverage Ratio (Lev) for the different depreciation rate.

Table III summarizes the results of the relationship among intangible assets which capitalized at 50% (intang50) and ESG score (ESG) on Financial Leverage (Lev) from ordinary least squares (OLS), fixed effects panel regression. I estimate the coefficient in equation. (1) The effect of intang50 on Lev without firm fixed effect (2) The effect of intang50 on Lev with firm fixed effect (3) The effect of intang50 adding with ESG on Lev without firm fixed effect, and (4) The effect of intang50 adding with ESG on Lev with firm fixed effect. For equations (3) and (4), they are added by the interaction term (intang50.ESG). All variables including control variables; collateral (Collat), book to market (BTM), cashflow (CF), profitability (Profit), and firm size (Size) are winsorized at 5% and 95%. Standard errors clustering has been all complied. *, **, and *** denote statistical significance at 10%, 5% and 1%, respectively.

	Lev			
	(1)	(2)	(3)	(4)
intang50	-0.045	-0.088	0.095	0.325
	(0.064)	(0.112)	(0.179)	(0.280)
ESG			0.0001	0.0004
			(0.001)	(0.001)
intang50.ESG			-0.004	-0.01
			(0.005)	(0.006)
Collat	0.008	0.069***	0.01	0.080***
	(0.029)	(0.022)	(0.030)	(0.025)
BTM	-0.079***	-0.051***	-0.080***	-0.050***
	(0.013)	(0.010)	(0.013)	(0.010)
CF	0.05	0.224	0.053	0.211
	(0.451)	(0.296)	(0.448)	(0.286)
Profit	-0.588*	-0.429**	-0.583*	-0.408**
	(0.344)	(0.204)	(0.339)	(0.203)
Size	0.062***	0.161**	0.063***	0.159**
	(0.018)	(0.067)	(0.020)	(0.063)
Constant	-0.139	-1.104	-0.152	-1.113
	(0.192)	(0.726)	(0.192)	(0.678)
Year Fixed Effect	Yes	Yes	Yes	Yes
Firm Fixed Effect	No	Yes	No	Yes
No. of obs.	816	679	814	677
Adjusted R-square	0.301	0.848	0.300	0.851

Table IV summarizes the results of the relationship among intangible assets which capitalized at 40% (intang40) and ESG score (ESG) on Financial Leverage (Lev) from ordinary least squares (OLS), fixed effects panel regression. I estimate the coefficient in equation. (1) The effect of intang40 on Lev without firm fixed effect (2) The effect of intang40 on Lev with firm fixed effect (3) The effect of intang40 adding with ESG on Lev without firm fixed effect, and (4) The effect of intang40 adding with ESG on Lev with firm fixed effect. For equations (3) and (4), they are added by the interaction term (intang40.ESG). All variables including control variables; collateral (Collat), book to market (BTM), cashflow (CF), profitability (Profit), and firm size (Size) are winsorized at 5% and 95%. Standard errors clustering has been all complied. *, **, and *** denote statistical significance at 10%, 5% and 1%, respectively.

	Lev			
	(1)	(2)	(3)	(4)
intang40	-0.037	-0.064	0.076	0.253
	(0.047)	(0.083)	(0.131)	(0.208)
ESG			0.0001	0.0004
			(0.001)	(0.001)
intang40.ESG			-0.003	-0.008*
			(0.004)	(0.005)
Collat	0.008	0.068***	0.011	0.080***
	(0.029)	(0.021)	(0.030)	(0.024)
BTM	-0.080***	-0.051***	-0.080***	-0.050***
	(0.013)	(0.011)	(0.013)	(0.010)
CF	0.052	0.226	0.055	0.214
	(0.451)	(0.299)	(0.448)	(0.288)
Profit	-0.589*	-0.432**	-0.584*	-0.412**
	(0.345)	(0.205)	(0.340)	(0.204)
Size	0.062***	0.161**	0.063***	0.158**
	(0.018)	(0.067)	(0.020)	(0.063)
Constant	-0.138	-1.102	-0.151	-1.109
	(0.192)	(0.725)	(0.191)	(0.675)
Year Fixed Effect	Yes	Yes	Yes	Yes
Firm Fixed Effect	No	Yes	No	Yes
No. of obs.	816	679	814	677
Adjusted R-square	0.301	0.848	0.301	0.851

Table V summarizes the results of the relationship among intangible assets which capitalized at 33% (intang33) and ESG score (ESG) on Financial Leverage (Lev) from ordinary least squares (OLS), fixed effects panel regression. I estimate the coefficient in equation. (1) The effect of intang33 on Lev without firm fixed effect (2) The effect of intang33 on Lev with firm fixed effect (3) The effect of intang33 adding with ESG on Lev without firm fixed effect, and (4) The effect of intang33 adding with ESG on Lev with firm fixed effect. For equations (3) and (4), they are added by the interaction term (intang33.ESG). All variables including control variables; collateral (Collat), book to market (BTM), cashflow (CF), profitability (Profit), and firm size (Size) are winsorized at 5% and 95%. Standard errors clustering has been all complied. *, **, and *** denote statistical significance at 10%, 5% and 1%, respectively.

	Lev			
	(1)	(2)	(3)	(4)
intang33	-0.032	-0.052	0.063	0.207
	(0.036)	(0.067)	(0.104)	(0.167)
ESG			0.0001	0.0004
			(0.001)	(0.001)
intang33.ESG			-0.002	-0.007*
			(0.003)	(0.004)
Collat	0.008	0.068***	0.011	0.080***
	(0.029)	(0.021)	(0.030)	(0.024)
BTM	-0.080***	-0.051***	-0.080***	-0.050***
	(0.013)	(0.011)	(0.013)	(0.010)
CF	0.054	0.227	0.058	0.216
	(0.451)	(0.301)	(0.447)	(0.290)
Profit	-0.589*	-0.433**	-0.585*	-0.414**
	(0.345)	(0.206)	(0.340)	(0.205)
Size	0.062***	0.160**	0.062***	0.157**
	(0.018)	(0.067)	(0.020)	(0.063)
Constant	-0.136	-1.095	-0.151	-1.097
	(0.191)	(0.726)	(0.191)	(0.675)
Year Fixed Effect	Yes	Yes	Yes	Yes
Firm Fixed Effect	No	Yes	No	Yes
No. of obs.	816	679	814	677
Adjusted R-square	0.301	0.848	0.301	0.851

Table VI summarizes the results of the relationship among intangible assets which capitalized at 10% (intang10) and ESG score (ESG) on Financial Leverage (Lev) from ordinary least squares (OLS), fixed effects panel regression. I estimate the coefficient in equation. (1) The effect of intang10 on Lev without firm fixed effect (2) The effect of intang10 on Lev with firm fixed effect (3) The effect of intang10 adding with ESG on Lev without firm fixed effect, and (4) The effect of intang10 adding with ESG on Lev with firm fixed effect. For equations (3) and (4), they are added by the interaction term (intang10.ESG). All variables including control variables; collateral (Collat), book to market (BTM), cashflow (CF), profitability (Profit), and firm size (Size) are winsorized at 5% and 95%. Standard errors clustering has been all complied. *, **, and *** denote statistical significance at 10%, 5% and 1%, respectively.

	Lev			
	(1)	(2)	(3)	(4)
intang10	-0.014	-0.022	0.024	0.071
	(0.011)	(0.026)	(0.033)	(0.057)
ESG			0.0002	0.0005
			(0.001)	(0.001)
intang10.ESG			-0.001	-0.002*
			(0.001)	(0.001)
Collat	0.009	0.069***	0.012	0.083***
	(0.029)	(0.021)	(0.030)	(0.024)
BTM	-0.081***	-0.052***	-0.081***	-0.051***
	(0.013)	(0.011)	(0.013)	(0.010)
CF	0.064	0.236	0.069	0.224
	(0.451)	(0.308)	(0.447)	(0.296)
Profit	-0.595*	-0.437**	-0.590*	-0.418**
	(0.347)	(0.210)	(0.340)	(0.209)
Size	0.061***	0.153**	0.062***	0.145**
	(0.018)	(0.069)	(0.020)	(0.065)
Constant	-0.131	-1.016	-0.148	-0.97
	(0.189)	(0.745)	(0.188)	(0.693)
Year Fixed Effect	Yes	Yes	Yes	Yes
Firm Fixed Effect	No	Yes	No	Yes
No. of obs.	816	679	814	677
Adjusted R-square	0.303	0.848	0.303	0.851

Appendix C: The relationship between intangible asset and ESG score on cost of debt (Cd) for the different depreciation rate.

Table VII summarizes the results of the relationship among intangible assets which capitalized at 50% (intang50) and ESG score (ESG) on WACC Cost of Debt (Cd) from ordinary least squares (OLS), fixed effects panel regression. I estimate the coefficient in equation. (1) The effect of intang50 on Cd without firm fixed effect (2) The effect of intang50 on Cd with firm fixed effect (3) The effect of intang50 adding with ESG on Cd without firm fixed effect, and (4) The effect of intang50 adding with ESG on Cd with firm fixed effect. For equations (3) and (4), they are added by the interaction term (intang50.ESG). All variables including control variables; financial leverage (Lev), collateral (Collat), book to market (BTM), cashflow (CF), profitability (Profit), and firm size (Size) are winsorized at 5% and 95%. Standard errors clustering has been all complied. *, **, and *** denote statistical significance at 10%, 5% and 1%, respectively.

| | Cd | | | |
	(1)	(2)	(3)	(4)
intang50	-0.004	-0.004	-0.007	-0.01
	(0.004)	(0.006)	(0.009)	(0.014)
ESG			0.0001*	0.0002***
			(0.000)	(0.000)
intang50.ESG			0.0001	0.0001
			(0.000)	(0.000)
Collat	-0.0003	-0.0002	-0.0002	-0.0002
	(0.001)	(0.002)	(0.001)	(0.002)
Lev	0.023***	0.014**	0.023***	0.014**
	(0.003)	(0.007)	(0.003)	(0.007)
BTM	0.001	0.0001	0.001	0.0001
	(0.001)	(0.001)	(0.001)	(0.001)
CF	0.031*	0.016	0.031*	0.014
	(0.017)	(0.015)	(0.018)	(0.015)
Profit	-0.032**	-0.013	-0.032**	-0.012
	(0.014)	(0.009)	(0.015)	(0.009)
Size	0.001	0.002	0.001	0.002
	(0.001)	(0.006)	(0.001)	(0.007)
Constant	0.004	0.009	0.002	0.002
	(0.007)	(0.067)	(0.006)	(0.068)
Year Fixed Effect	Yes	Yes	Yes	Yes
Firm Fixed Effect	No	Yes	No	Yes
No. of obs.	815	678	813	676
Adjusted R-square	0.305	0.497	0.312	0.505

Table VIII summarizes the results of the relationship among intangible assets which capitalized at 40% (intang40) and ESG score (ESG) on WACC Cost of Debt (Cd) from ordinary least squares (OLS), fixed effects panel regression. I estimate the coefficient in equation. (1) The effect of intang40 on Cd without firm fixed effect (2) The effect of intang40 on Cd with firm fixed effect (3) The effect of intang40 adding with ESG on Cd without firm fixed effect, and (4) The effect of intang40 adding with ESG on Cd with firm fixed effect. For equations (3) and (4), they are added by the interaction term (intang40.ESG). All variables including control variables; financial leverage (Lev), collateral (Collat), book to market (BTM), cashflow (CF), profitability (Profit), and firm size (Size) are winsorized at 5% and 95%. Standard errors clustering has been all complied. *, **, and *** denote statistical significance at 10%, 5% and 1%, respectively.

	Cd			
	(1)	(2)	(3)	(4)
intang40	-0.003	-0.003	-0.005	-0.007
	(0.003)	(0.004)	(0.007)	(0.010)
ESG			0.0001*	0.0002***
			(0.000)	(0.000)
intang40.ESG			0.0001	0.0001
			(0.000)	(0.000)
Collat	-0.0003	-0.0001	-0.0002	-0.0002
	(0.001)	(0.002)	(0.001)	(0.002)
Lev	0.023***	0.014**	0.023***	0.014**
	(0.003)	(0.007)	(0.003)	(0.007)
BTM	0.001	0.0001	0.001	0.0001
	(0.001)	(0.001)	(0.001)	(0.001)
CF	0.031*	0.016	0.031*	0.014
	(0.017)	(0.015)	(0.018)	(0.016)
Profit	-0.032**	-0.014	-0.033**	-0.012
	(0.014)	(0.009)	(0.015)	(0.009)
Size	0.001	0.002	0.001	0.002
	(0.001)	(0.006)	(0.001)	(0.007)
Constant	0.003	0.009	0.002	0.002
	(0.007)	(0.067)	(0.006)	(0.068)
Year Fixed Effect	Yes	Yes	Yes	Yes
Firm Fixed Effect	No	Yes	No	Yes
No. of obs.	815	678	813	676
Adjusted R-square	0.305	0.497	0.312	0.505

Table IX summarizes the results of the relationship among intangible assets which capitalized at 33% (intang33) and ESG score (ESG) on WACC Cost of Debt (Cd) from ordinary least squares (OLS), fixed effects panel regression. I estimate the coefficient in equation. (1) The effect of intang33 on Cd without firm fixed effect (2) The effect of intang33 on Cd with firm fixed effect (3) The effect of intang33 adding with ESG on Cd without firm fixed effect, and (4) The effect of intang33 adding with ESG on Cd with firm fixed effect. For equations (3) and (4), they are added by the interaction term (intang33.ESG). All variables including control variables; financial leverage (Lev), collateral (Collat), book to market (BTM), cashflow (CF), profitability (Profit), and firm size (Size) are winsorized at 5% and 95%. Standard errors clustering has been all complied. *, **, and *** denote statistical significance at 10%, 5% and 1%, respectively.

	Cd			
	(1)	(2)	(3)	(4)
intang33	-0.002	-0.003	-0.004	-0.006
	(0.002)	(0.004)	(0.005)	(0.009)
ESG			0.0001*	0.0002***
			(0.000)	(0.000)
intang33.ESG			0.0001	0.0001
			(0.000)	(0.000)
Collat	-0.0003	-0.0001	-0.0002	-0.0001
	(0.001)	(0.002)	(0.001)	(0.002)
Lev	0.023***	0.014**	0.023***	0.014**
	(0.003)	(0.007)	(0.003)	(0.007)
BTM	0.001	0.0001	0.001	0.0001
	(0.001)	(0.001)	(0.001)	(0.001)
CF	0.031*	0.016	0.031*	0.014
	(0.017)	(0.015)	(0.018)	(0.016)
Profit	-0.032**	-0.014	-0.033**	-0.012
	(0.014)	(0.009)	(0.015)	(0.009)
Size	0.001	0.002	0.001	0.002
	(0.001)	(0.006)	(0.001)	(0.007)
Constant	0.003	0.009	0.002	0.002
	(0.007)	(0.067)	(0.006)	(0.068)
Year Fixed Effect	Yes	Yes	Yes	Yes
Firm Fixed Effect	No	Yes	No	Yes
No. of obs.	815	678	813	676
Adjusted R-square	0.305	0.498	0.312	0.505

Table X summarizes the results of the relationship among intangible assets which capitalized at 10% (intang10) and ESG score (ESG) on WACC Cost of Debt (Cd) from ordinary least squares (OLS), fixed effects panel regression. I estimate the coefficient in equation. (1) The effect of intang10 on Cd without firm fixed effect (2) The effect of intang10 on Cd with firm fixed effect (3) The effect of intang10 adding with ESG on Cd without firm fixed effect, and (4) The effect of intang10 adding with ESG on Cd with firm fixed effect. For equations (3) and (4), they are added by the interaction term (intang10.ESG). All variables including control variables; financial leverage (Lev), collateral (Collat), book to market (BTM), cashflow (CF), profitability (Profit), and firm size (Size) are winsorized at 5% and 95%. Standard errors clustering has been all complied. *, **, and *** denote statistical significance at 10%, 5% and 1%, respectively.

	Cd			
	(1)	(2)	(3)	(4)
intang10	-0.0004	-0.001	-0.001	-0.002
	(0.001)	(0.002)	(0.002)	(0.003)
ESG			0.0001*	0.0002***
			(0.000)	(0.000)
intang10.ESG			0.00002	0.00002
			(0.000)	(0.000)
Collat	-0.0003	0.0001	-0.0002	0.0001
	(0.001)	(0.002)	(0.001)	(0.002)
Lev	0.023***	0.014**	0.023***	0.014**
	(0.003)	(0.007)	(0.003)	(0.007)
BTM	0.001	0.00004	0.001	0.00003
	(0.001)	(0.001)	(0.001)	(0.001)
CF	0.031*	0.017	0.031*	0.015
	(0.017)	(0.015)	(0.018)	(0.016)
Profit	-0.033**	-0.014	-0.033**	-0.012
	(0.014)	(0.009)	(0.015)	(0.009)
Size	0.001	0.002	0.001	0.002
	(0.001)	(0.007)	(0.001)	(0.007)
Constant	0.003	0.015	0.002	0.008
	(0.007)	(0.069)	(0.007)	(0.069)
Year Fixed Effect	Yes	Yes	Yes	Yes
Firm Fixed Effect	No	Yes	No	Yes
No. of obs.	815	678	813	676
Adjusted R-square	0.304	0.498	0.311	0.505

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