

The Impact of Other Comprehensive Income Volatility, Research and Development Investment, and Earnings Management on Cost of Capital: The Moderating Role of Agency Cost

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Abstract. *In 2025, forecasts indicate that Asian companies, especially from China and India, will dominate the IPO market. Understanding global capital cost drivers is essential, particularly as energy sector costs increase. Research highlights that superior accounting information can narrow the investor-management gap, reducing equity and debt. This study investigates the impact of Other Comprehensive Income (OCI) volatility, Research and Development (R&D) investment, and earnings management on cost of capital, considering the potential moderating effect of agency costs. The analysis includes 1,565 observations across 313 firms from 2018 to 2022, focusing on the energy sector in China, India, the United States, and Indonesia. The study uses panel data regression to examine the relationships between OCI volatility, R&D investment, earnings management, and cost of capital, focusing on agency costs' moderating role. Initial findings reveal that earnings management significantly and negatively influences cost of capital. Further, R&D investments in China and Indonesia show a negative and significant impact on cost of capital, contrary to positive and significant findings in India and the United States. Companies are advised to sustain efficient, future-oriented project selections.*

Keywords: *OCI Volatility, R&D investment, earnings management, agency cost, cost of capital*

1. Introduction

The Economist Intelligence Unit predicts that companies from the East will dominate the IPO market by 2025. Approximately 80% of respondents estimate China will be the home base for most new issuers by 2030. China and India are expected to be the top countries regarding stock issuance and capital-related activities. India ranked second on the list of issuers but third in capital.

Currently, China and India are leading the way. However, their expected importance has decreased significantly, possibly due to a better understanding of political realities and restrictions in these markets and growing investor interest in the wider region. As the US seeks to withdraw or modify trade and other foreign agreements, China has expanded its influence through the Belt and Road Initiative. China's increased influence underscores the growing need for increased inter-country funding (PWC, 2019).

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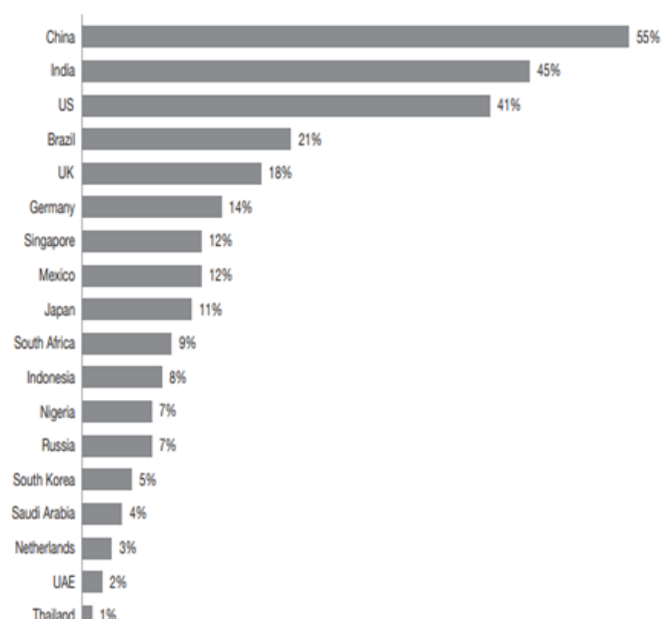


Figure 1

The Economist Intelligence Unit

Note. Figure 1 illustrates which countries are expected to lead in capital acquisition (financing) by 2030.

The increase in actual financial market activities can lead to a greater risk diversification and lower funding expenses due to reduced asymmetric data. Greater risk diversification and lower funding expenses, in turn, can result in a decreased cost of capital, especially with advancements in technology in the energy market. On the other hand, a rise in the number of issuers may indicate increased funding, which can directly raise the cost of capital.

According to KPMG's (2020) research, the Weighted Average Cost of Capital (WACC) has increased from 6.9% in 2019 to 6.6% in 2020. WACC is experiencing a decrease in cost of capital in almost every sector except for the energy sector. One of the primary challenges for energy businesses is to engage in the sustainable transformation process of their operations, which may be connected to access to financing channels (Morrone et al., 2022). Companies in the energy field are highly concerned with the topic of cost of capital (WACC) due to the complex structure of their investments and the long-term timeline of investment reimbursement, as well as the numerous risks that influence their business operations in various economic, social, and geopolitical spheres (Franc-Dąbrowska et al., 2021).

2. Literature Review/Hypotheses Development

Agency Theory

Agency theory deals with the conflicts of interest that can arise between managers (agents) and owners (principals) within a company. These conflicts occur because of information asymmetry—managers often have more information than shareholders and might act in ways that do not align with the shareholders' interest. In this study, agency costs are considered as a moderating factor that can amplify the effects of OCI volatility and earnings management on the cost of capital. When agency costs are high, managers may not fully act in the best interest of company's owners, leading to increased capital costs (Jensen & Meckling, 1976). Higher financial reporting transparency through better disclosures can reduce information asymmetry and conflicts of interest, thereby lowering capital costs.

The Impact of OCI Volatility Towards Cost of Capital

Ball (2001) suggests that the information presented in financial statements intends to impact bondholders, thus affecting the cost of borrowed capital. Previous studies have also shown that financial statements influence the cost of equity capital. Bao et al. (2019) found that the volatility of OCI affects default probability, loan

cost, and credit rating, demonstrating that creditors use OCI information to evaluate corporate credit risk and price debt contracts. Graham and Lin (2018) claim that OCI components are linked to future performance and provide valuable information. However, some researchers, including Cheng, Cheung, and Gopalakrishnan (1993), O'Hanlon and Pope (1999), and Dhaliwal, Subramanyam, and Trezevant (1999), believe that OCI offers very little value. Rees and Shane (2012) suggest that self-selection bias and limited sample sizes may have contributed to contradictory findings in earlier research on comprehensive income. Previous research has shown that the accounting data businesses provide affects the cost of loans. For instance, Easley and O'Hara (2004) established that the clarity of accounting information influences the cost of capital, leading to lower cost of capital. Lambert, Leuz, and Verrecchia (2007) demonstrate that the quality of data on the income statement significantly impacts the cost of capital. A high-quality earnings report improves cooperation between a company and its investors, reducing information risk and leading to a lower cost of capital. Higher OCI volatility can be perceived as risky and can increase cost of capital.

H1: OCI volatility has a positive impact on cost of capital.

The Effect of R&D Investment Towards Cost of Capital

Sami et al. (2014) found that R&D investments significantly impact the volatility of stock returns in high-tech enterprises, highlighting the importance of R&D activities. Andreas et al. (2019) conducted a study using a global sample of public bonds and private syndicated loans made by public non-financial enterprises to examine the effect of capitalizing R&D costs on the debt market. They discovered that companies investing more in R&D are more likely to issue bonds than privately borrowed cash the following year. Additionally, they demonstrated that capitalizing R&D investments reduces the cost of debt. By capitalizing on R&D, companies convey their expectation of future benefits from R&D spending to industry peers. This may lead to increased competition for projects and higher proprietary costs.

H2: R&D investment has a positive effect on the cost of capital.

The Effect of Earnings Management Towards Cost of Capital

A study by Kim et al. (2018), examined the relationship between real earnings management and cost of capital in the United States. They

found that actual earnings management positively correlates with loan financing cost. Furthermore, they discovered that debt investors charge higher premiums on the cost of capital for companies in countries with more developed debt markets. Ilyas et al. (2019) analyzed the impact of earnings management on Pakistan's capital cost. The results indicate that companies engaging in earnings management experience a higher cost of capital due to decreased public trust resulting from manipulated information, leading investors to seek a higher rate of return.

Moreover, increased business size and return on assets (ROA) significantly negatively impact capital expenses. Kuong et al. (2021) investigated the relationship between natural earnings management and debt cost in Vietnam. The findings revealed a positive association between actual earnings management and escalating transactions that directly affect financial statements, subsequently impacting stockholders' cost of debt. Discretionary accruals affect the cost of debt and the cost of equity (Mariano et al., 2023). Empirical evidence showed that actual earnings management significantly increases the cost of debt after adjusting for discretionary accruals (Jin et al., 2022). Houque et al. (2017) examined how audit quality impacts earnings management and the cost of equity capital for companies in India. The findings also indicated that companies in business groups have lower levels of earnings management and cost of equity. Based on the explanations above, the research hypothesis formulated is:

H3: Earnings management has a positive impact on the cost of capital.

Agency Cost Strengthens the Effect of OCI Volatility on Cost of Capital

Based on the agency theory, managers may not always work in the best terms of their owners, leading to conflicts of interest, information imbalances, and the occurrence of agency costs (Jensen & Meckling, 1976). In this context, corporate disclosures, such as financial reports, are crucial for reducing information imbalances and minimizing conflicts of interest between both parties. Earnings are also a better indicator of future cashflows than current operating cash flows because accruals help to spread out the recognized operational cash flow over time, reducing mismatching and timing difficulties in cash flows. According to signaling theory, managers are encouraged to provide more information to the stock market to build investor trust, enhance the

earning potential of their securities, and minimize their cost of capital (Healy & Palepu, 2001; Mahadeo et al., 2011). If changes in OCI volatility reflect a gap between management and owners, it signals that interested parties will receive risky information, potentially increasing the company's cost of financing.

H4: Agency costs strengthen the impact of OCI volatility on the cost of capital.

Agency Cost Strengthens the Effect of Earnings Management on Cost of Capital

In their research, Diamond (1991) and Vurro and Perrini (2011) discovered that making financial information transparent helps to reduce information imbalances and reduces a company's cost of capital. On the other hand, opportunistic managers are more likely to engage in earnings management to highlight positive information about the company's long-term prospects and reduce the cost of capital by misrepresenting earnings during meetings (Demirtas & Cornaggia, 2013).

H5: The impact of earnings management on the cost of capital is amplified by agency cost.

3. Methodology

This study collected financial data from the Refinitiv Eikons database, focusing on energy companies in China, India, the United States, and Indonesia that provided the required information for our research. We selected these countries because of their economic significance and roles in the energy sector, as identified by the Economist Intelligent Unit (PWC, 2019), with Indonesia anticipated to lead in capital financing. This selection allows for an effective comparison in capital management, especially considering the 2030 clean energy targets of the United States and India.

We employed a purposive sampling technique, targeting energy sector companies with complete financial reports that are pertinent to our study variables, such as OCI volatility, R&D investment, and earnings management. After excluding outliers and missing data, our final dataset included balanced panel data from these four countries, yielding 1,565 observations across 313 companies for the period 2018-2022. Our research methodology tested four models corresponding to each country: (1) China, (2) India, (3) the United States, and (4) Indonesia.

We utilized STATA for data analysis, conducting primary and expansionary tests (Models 1-4) through the Chow test, Hausman Test, and Breusch-Pagan LM test to find the strongest model.

To investigate the factors related to agency cost that may influence the relationship among OCI volatility, R&D investment, and earnings management on cost of capital, we propose to test the following regression model:

$$WACC_{it} = \beta_0 + \beta_1 OCI_{it} + \beta_2 RND_{it} + \beta_3 ERM_{it} + \beta_4 AGC_{it} + \beta_5 OCI_{it} * AGC_{it} + \beta_6 RND_{it} * AGC_{it} + \beta_7 ERM_{it} * AGC_{it} + \beta_8 ROA_{it} + \beta_9 SZE_{it} + \varepsilon_i$$

(1)

Where:

- *WACC* is the Weighted Average Cost of Capital
- *OCI* is OCI Volatility
- *RND* is R&D Investment
- *ERM* is Earnings Management
- *AGC* is Agency cost
- *ROA* is Return on Assets
- *SZE* is Firm size

WACC is the dependent variable representing the cost of capital. It is the rate of return that the firm must achieve on long-term projects to maintain the firm's value (Gitman, 2016).

The first independent variable is OCI volatility, which measures the contribution of OCI to the overall volatility of the company's comprehensive income. OCI volatility is calculated by subtracting the standard deviation from the firm's comprehensive income (Dirk, 2013). R&D investment is the second independent variable. We identify companies that may have capitalized some of their R&D investments in a year where they reported an R&D asset and/or amortization. This asset was reported promptly before the loan issue date, following Mazzi et al. (2018). The amount of R&D a company capitalized in the fiscal year immediately preceding the loan issue date is determined.

Earnings management is the third independent variable. As earnings management is not clearly observed, this empirical research follows the approach in Dechow et al. (2011) literature to estimate discretionary accruals and focus on non-cash working capital accruals quality. Variable controls are ROA and firm size.

4. Findings and Discussion

Findings

The panel data regression parameters were analyzed using Common Effects Model (CEM), Fixed Effects Model (FEM), and Random Effects

Model (REM). The Chow test, indicating a preference for FEM over CEM, showed a p-value < 0.05. The Hausman test favored REM over FEM due to a p-value > 0.05. The Breusch-Pagan Lagrangian Multiplier test confirmed REM as the final model.

Table 1

Estimate Panel Data Regression

	CEM	FEM	REM
Constanta	-2.58904	-2.59474	-2.59221
OCI	1.50E-07	2.90E-07	2.35E-07
RND	3.84E-04	0.01585	0.008953
ERM	-4.61E-06	-4.77E-06	-4.71E-06
Observation	1.565	1.565	1.565
Prob	0.5692	0.1756	0.3136
Chow test		0.0000	
Hausman			0.2723
Breusch			
Pagan LM			0.0000
Model	Random Effect Model (REM)		

Note: OCI: OCI Volatility, RND: R&D Investment, ERM: Earnings Management.

REM evaluates the impact of time-invariant variables, assuming the unit's intercept is randomly selected from a broader population. The model excels when the data set is large and its

assumptions hold, using the Generalized Least Square (GLS) method for validation. According to Gujarati (2004), REM does not require classical assumption tests if selected.

Table 2

The Effect of Volatility OCI and Earnings Management on Cost of Capital: The Moderating Role of Agency Cost

$$WACC_{it} = \beta_0 + \beta_1 OCI_{it} + \beta_2 RND_{it} + \beta_3 ERM_{it} + \beta_4 AGC_{it} + \beta_5 OCI_{it} * AGC_{it} + \beta_6 ERM_{it} * AGC_{it} + \beta_7 ERM_{it} * AGC_{it} + \beta_8 ROA_{it} + \beta_9 SZE_{it} + \epsilon_i$$

Variables	Predictions	Coefficients	p-value
C			
OCI	+	-1.59e-07	0.722
RND	+	.0005096	0.955
ERM	+	-4.62e-06	0.000***
AGC	+	-4.58e-06	0.163
OCI*AGC	+	2.82e-08	0.431
RND*AGC	+	1.54e-06	0.655
ERM*AGC	+	1.06e-10	0.853
ROA	-	.001475	0.000***
SZE	-	.0070107	0.237

Table 2. (Continued)

Variables	Predictions	Coefficients	p-value
R ²		0.4272	
Adj R ²		0.2827	
F-Statistic		2.96	
Prob (F-statistic)		0.0000	
Observation		1.565	

***Significant at a level of 1%; **Significant at a level of 5%; *Significant at a level of 10%.

Note. OCI is OCI Volatility, RND is R&D Investment, ERM is Earnings Management, AGC is Agency Cost, ROA is Return on Assets, and SZE is Firm Size.

Variables assessed included OCI volatility, R&D investment, earnings management, agency cost, and their interactions, along with ROA and firm size. Earnings management was significantly negative ($p\text{-value} < 0.05$), indicating it adversely affects the cost of capital, thereby affecting the third hypothesis. OCI volatility's influence on the cost of capital was not significant ($p\text{-value} > 0.05$), leading to the rejection of the first hypothesis. The model's R² was 0.4272, with an adjusted R² of 0.2827, and an F-statistic probability of 0.0000, based on 1,565 observations.

Discussion

Table 2 illustrates that, contrary to expectations, earnings management is negatively associated with the cost of capital in the energy sector across four countries. This finding aligns with Gao et al. (2020), who observed a lower impact of discretionary accruals on the cost of equity in emerging countries versus developed countries.

Table 3 presents the effects of OCI volatility, R&D investment, and earnings management on cost of capital, considering agency cost as a moderating factor through four models using panel data regression. Model (1) covers China's energy sector, showing the most substantial adjusted R² of 0.882 and indicating the R&D investment significantly reduces the cost of capital ($\beta_2 = -0.0362$, significant at the 10% level). Model (2) focuses on India's mining sector, and Model (3) on the US cost of capital, both showing a positive, significant relationship between R&D investment and the cost of capital. In contrast, Model (4) examines Indonesia, echoing China's findings with a significant negative relationship between R&D investment and the cost of capital at the 1% level.

These variations suggest that geographical and sectoral characteristics influence the relationship between R&D investment and the cost of capital. The economies of scope theory by Salvatore (1996) supports this, as it explains how diversifying product lines can reduce average total production costs, thereby decreasing cost of capital.

However, the evidence from India and the United States indicates a strategic emphasis on renewable energy development, requiring substantial R&D investment that, although increasing the cost of capital in the short term, promises significant long-term benefits. The study also notes an interesting dynamic between agency costs in China lead to increased R&D spending to offset the cost of capital, a relationship not observed in India.

Control variable analysis revealed unexpected signs for SZE in the United States (Model 3) and ROA in India (Model 2), suggesting that company growth and asset utilization negatively impact the cost of capital in these instances.

Key findings include a significant negative impact of earnings management on the cost of capital, with R&D investments reducing cost of capital in China and Indonesia but increasing them in India and the United States. The study highlights the non-significant moderating effect of agency costs on the studied relationships and emphasizes the role of high-quality accounting information in lowering cost of capital and fostering sustainable investments in the energy sector.

Table 3

Expansionary Dependent Variable: Cost of Capital (WACC)

$$WACC_{it} = \beta_0 + \beta_1 OCI_{it} + \beta_2 RND_{it} + \beta_3 ERM_{it} + \beta_4 AGC_{it} + \beta_5 OCI_{it} * AGC_{it} + \beta_6 ERM_{it} * AGC_{it} + \beta_7 ERM_{it} * AGC_{it} + \beta_8 ROA_{it} + \beta_9 SZE_{it} + \epsilon_i$$

Variables	Predictions	Model 1					Model 2					Model 3					Model 4				
		China					India					United States					Indonesia				
		Coefficient	Sig	Correlation		Coefficient	Sig	Correlation		Coefficient	Sig	Correlation		Coefficient	Sig	Coefficient	Sig	Correlation		Coefficient	Sig
				Tolerance	VIF			Tolerance	VIF			Tolerance	VIF					Tolerance	VIF		
Constanta		-1.423				-1.385				-3.252				-2.2588							
OCI	+	0.00053	0.988	0.608598	1.64	-0.0006	0.508	0.485032	2.06	-6.44e	0.131	0.511411	1.96	-0.03713	0.737			0.923319	1.08		
RND	+	-0.0362	0.011 ***	0.888262	1.13	0.25273	0.026 **	0.683520	1.46	0.0297	0.003 ***	0.973927	1.03	-0.04948	0.080 *			0.932721	1.07		
ERM	+	0.00431	0.813	0.692657	1.44	0.00182	0.673	0.698842	1.43	-4.48e	0.081	0.951952	1.05	-0.0307	0.296			0.963567	1.04		
AGC	+	-0.0032	0.065 *			-0.0006	0.407			-4.25e	0.239			-0.01165	0.243						
OCI*AGC	+	0.00053	0.33			0.00234	0.186			2.15e	0.48			0.001509	0.569						
RND*AGC	+	0.0041	0.004 ***			-0.0015	0.033 **			1.12e	0.237			0.004036	0.415						
ERM*AGC	+	-0.00102	0.55			-0.0095	0.684			3.49e	0.646			0.00169	0.605						
ROA	-	-0.20534	0.072 *			0.0013	0.121			-0.0456	0.017 **			-0.02153	0.99						
SZE	-	-0.03584	0.000 ***			-0.0334	0.008 ***			0.0218	0.004 ***			-0.01484	0.49						
R-squared		0.0106				0.1025				0.0194				0.0352							
Adj R-squared		0.0882				0.0468				0.0085				0.0352							
F-Statistic		2.39				1.84				10.36				1.98							
Prob (F-statistic)		0.0000				0.0000				0.0000				0.0436							
Shapiro-Wilk		0.0940				0.1102				0.8748				0.6319							
Cook-Weisberg test		0.5513				0.2026				0.3465				0.7192							
Run Test		0.075				0.61				0.18				0.71							
Observation		390				155				820				200							
(1565)																					

Source: Author's calculations based on collecting data.

Notes. OCI*AGC is the Interaction of OCI volatility and agency cost, RND*AGC is the Interactions of R&D investment and agency cost, and ERM*AGC is the Interactions of earnings management and agency cost. Table 3 includes the regression model: **Model 1.** China (number of observations: 390; number of companies: 78), **Model 2.** India (number of observations: 155; number of companies: 31), **Model 3** United States (number of companies: 820; number of companies: 164), **Model 4.** Indonesia (number of observations: 200, number of companies: 40) with the significance level *** $p < 0.001$; ** $p < 0.05$; * $p < 0.0$.

5. Conclusions

The study reveals that earnings management significantly lowers a company's cost of capital. However, the impact R&D investment on cost of capital varies by country: it decreases costs in China and Indonesia, indicating beneficial effects, but increases them in India and the United States, suggesting a negative impact. The research also shows that agency costs do not significantly affect the relationship between OCI volatility, R&D investment, earnings management, and cost of capital. This underscores the role of high-quality accounting information in reducing cost of capital and fostering sustainable investment strategies in the energy sector.

Recommendations for energy companies include enhancing financial report transparency and improving accounting information quality to minimize information asymmetry between management and investors. This strategy can help reduce cost of capital amid growing global competition. Companies should also assess the long-term effects of R&D investments on cost of capital and prioritize projects that are cost-effective and sustainable.

Declarations

Author contribution

All authors contributed equally as the main contributors of this paper. All authors read and approved the final paper.

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Competing interest

The authors declare that they have no conflicts of interest to report regarding the present study.

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