

the Asian Journal of Technology Management

ISSN: 1075-4016
Vol. 7 No. 1 2014

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Home / Archives / Vol. 17 No. 2 (2024)

Published: September 27, 2024

Articles

Developing Innovative Work Behavior in Retail E-Commerce Workers: Investigating the Effects of High-Performance Work Systems and Other Mediating Variables

10.12695/ajtm.2024.17.2.1

Muhammad Farras Said, Niken Ardiyanti

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73-92

PDF

Muhammad Farras Said, Niken Ardiyanti

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An Empirical Analysis of The Trilemma: Inflation, Interest Rate and Exchange Rate Dynamics in Singapore

10.12695/ajtm.2024.17.2.2

93-107

PDF

Yong Jin Chow, Tze-Haw Chan

Read Statistic: 0

An ARDL Modelling Approach to Assess the Dynamic Effects of Economic Development and CO2 Emissions in Malaysia

10.12695/ajtm.2024.17.2.3

108-121

PDF

Kee Zheng Ding, Tze-Haw Chan

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Exploring The Dynamics of Inflation, Interest Rates, and Us Dollar Exchange Rates: A Comprehensive Quantitative Analysis From 2013 To 2023

10.12695/ajtm.2024.17.2.4

122-134

PDF

Edd Mund Yee, Tze-Haw Chan

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

10.12695/ajtm.2024.17.2.5

135-143

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

Sistya Rachmawati¹, Inugrah Ratia Pratiwi^{2*}, and Etty Murwaningsari³

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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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Received: August 1st, 2024; Revised: September 15th, 2024; Accepted: September 17th, 2024

Doi: <http://dx.doi.org/10.12695/ajtm.2024.17.2.5>. Print ISSN: 1978-6956; Online ISSN: 2089-791X.

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Published by Unit Research and Knowledge- School of Business and Management-Institut Teknologi Bandung

How to cite: Rachmawati, S., Pratiwi, I. R., & Murwaningsari, E. *The Impact of Other Comprehensive Income Volatility, Research and Development Investment, and Earnings Management on Cost of Capital: The Moderating Role of Agency Cost.* *The Asian Journal of Technology Management (AJTM)*, 17(2), 135-143. <https://doi.org/10.12695/ajtm.2024.17.2.5>

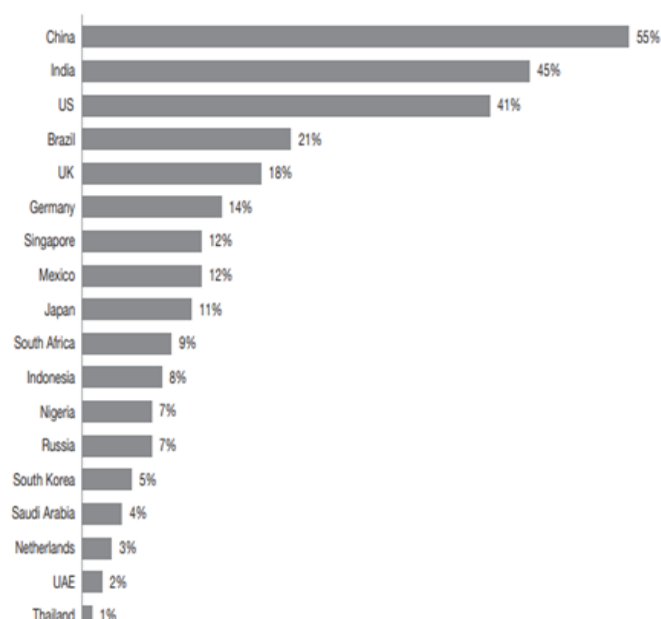


Figure 1

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	Correlation					
				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 (1565)		390				155				820				200							

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.

Funding statement

The authors declare that this research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Competing interest

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

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The Impact of Volatility OCI, R & D Investment, and Earning Management on Cost of Capital: The Moderating Role of Agency Cost

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Submission date: 31-May-2024 01:09PM (UTC+0700)

Submission ID: 2357543967

File name: AJTM_IRP_SR_EM_31052024.docx (143.48K)

Word count: 3763

Character count: 21240

The Impact of Volatility OCI, R & D Investment, and Earning Management on Cost of Capital: The Moderating Role of Agency Cost

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Abstract. The motivation behind this study is to investigate (1) The impact of instability Other Exhaustive Pay (OCI), Research and development Speculation, and profit the board on the cost of capital, (2) Organization cost moderates unpredictability Other Extensive Pay (OCI), Research and development Venture, and income the executives on the cost of capital. The information was gathered from yearly reports and monetary information by Refinitiv Eikons data set. The exploration test comprises of 1,565 perceptions from 313 firms beginning around 2018-2022 of China, India, the US, and Indonesia recorded organizations in the energy area. Handling board information utilized the factual information science (STATA). The essential experimental outcome is that the income of the executives adversely influences the cost of capital. Expansionary Models (1) and (4) show that the coefficients on Research and development interest in China and Indonesia are negative and significant. Models (2) and (3) have contradictory results that the coefficients on Research and development interest in India and the US are positive and significant. To decrease the cost of capital, organizations are supposed to choose productive and manageability of future-arranged.

Keywords: Volatility OCI, Earnings Management, Agency Cost, Cost of Capital

1. Introduction

The Economist Intelligence Unit predicts that companies from the East will dominate the Initial Public Offering (IPO) market by 2025. Approximately 80% of respondents estimate that China will be the home base for the majority of new emitters by 2030. China and India are the most expected top countries in terms of stock issuance and capital-related activities. India ranked second on the list of issuers, but third in capital. Today, China and India keep taking the lead, though their expected importance has lowered substantially, which could be attributed to an improved recognition of political realities and restrictions in those two important markets, as well as, possibly, rising investor interest in the wider area. As the US looks to withdraw or modify trade and other foreign agreements. Particularly, China has been expanding its impact on the Belt and Road Initiative. It emphasizes the growing necessity of enhanced inter-country funding (PWC, 2019)

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

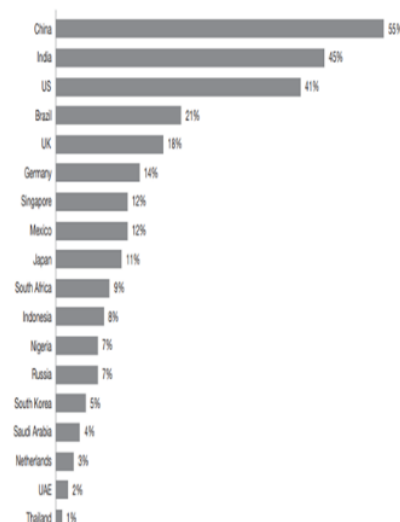


Figure 1. The Economist Intelligence Unit

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Received: XXX; Revised: XXX; Accepted: XXX

DOI: <https://dx.doi.org/10.12695/ajtm.202X.X.X.X>

Print ISSN: 1978-6956; Online ISSN: 2089-791X.

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Expanding of truly monetary. market exercises can build the enhancement of dangers and limit the subsidizing costs because of less topsy-turvy information, bringing about the decreased expense of capital in the event of headways in innovation in the energy market. The opposite is an expansion in the number of backers. may show an. increment. in financing which can straightforwardly expand the expense of capital.

As per KPMG's (2020) research, the expense of capital, which is determined through the Weighted Normal Expense of Capital (WACC), has ascended from 6.9 percent in 2019 to 6.6 percent in 2020. WACC is encountering a decline in the cost of capital in pretty much every area, aside from the. energy area. One of the essential difficulties for energy organizations, which is to connect on the manageable change cycle of the organization activities, might be associated with the entrance of funding channels (Morrone, D., et. al 2022) The organizations in the energy field are so drawn in with the subject of the cost of capital (WACC), given not just the confounded design of the speculation made and the drawn-out course of events of venture repayment, yet the various dangers which impact their business activity and that can be distinguished in different monetary, social, and international circles. Franc-Dąbrowska, J, et al. (2021)

As indicated by certain bookkeeping hypothesis, financial backers put a high worth on data the monetary. explanations. Great bookkeeping data diminishes the difference in information among financial backers and the executives, prompting less expensive value and obligation capital expenses. In spite of the fact that there has been significant concentrate on the significance of Other Thorough Pay (OCI) that makes sense of value returns, there isn't a lot of experimental exploration on the impact of generally speaking pay and its components on the expense of capital. Observational examination into the viability of OCI in security markets yields consolidated discoveries. Hirst and Hopkins (1998), Maines and McDaniel (2000), Biddle and Choi (2006),

and Chambers et al. (2007) observed that OCI is gainful

Earlier explores on the connection of profit the board and capital costs in created markets have shown clashing outcomes (Francis et al, 2005; Dim et al, 2009; Ghosh and Olsen 2009; Houqe, Patro & Kanagaraj 2016; M. N., et. al, 2017; Kim, J.H., et. al, 2018; Ilyas et al. 2019; Kuong, N.V., et. al, 2021; Jin, J.B. et. al, 2022, Mariano G, artificial intelligence et al., 2023)

2. Literature Review/Hypotheses Development

1 The impact of volatility OCI towards cost of capital

Ball (2001) states that the data in budget summaries should influence bondholders. Thus, OCI ought to have. a significant effect on the cost of acquired capital. Past concentrate likewise demonstrates that budget reports affect on the expense of value capital. Bao, M. X., et. al (2019) find that the instability of gradual OCI impacts default. likelihood, advance expense, and credit score. In general, examination show that loan bosses use data from OCI to survey corporate credit. chance and cost obligation contracts. OCI parts are connected to future execution and give significant data, guaranteeing Graham and Lin (2018). In any case, various analysts, including Cheng, Cheung, and Gopalakrishnan (1993), O'Hanlon and Pope (1999), Dhaliwal, Subramanyamm, and Trezevant (1999), believe that OCI offers almost no worth. As per Rees and Shane (2012), self-segment predisposition and restricted little example sizes might have added to the problematic discoveries in prior research on exhaustive pay. Earlier exploration has exhibited that the bookkeeping information that organizations supply influences the credit cost. For instance, Easley and O'Hara (2004) laid out that the degree of lucidity in data bookkeeping impacts the expense of capital. The more prominent the lucidity of the data, the less expensive the expense of capital. Lambert, Leuz, and Verrecchia (2007) show that the nature of the

information on the pay explanation fundamentally affects the expense of capital. A great income report further develops participation between the organization and its financial backers. Therefore, data risk is diminished, prompting a lower cost of capital. Higher instability OCI makes unsafe and can increment capital expenses. Hypothesis 1: Volatility OCI influences decidedly on the Cost of Capital

The effect of R&D investment towards cost of capital

Sami et al (2014) states that Research and development hypothesis have an impressive effect on the unpredictability of stock returns in cutting-edge ventures, exhibiting the significance of Research and development exercises. Andreas et al (2019) utilize a worldwide example of public securities and confidential partnered credits made by open non-monetary ventures to concentrate on the effect of Research and development costs benefiting from the obligation market. First off, they exhibit that partnerships put more into research and development in a year than they are bound to give securities as opposed to getting cash secretly from the partnered credit market the following year. Second, they show the promoted ventures decrease the expense of obligation. Promoting Research and development passes on to industry peers an organization's assumption for future benefits from Research and development spending. Subsequently, industry rivalry for activities might escalate, prompting higher restrictive expenses. Hypothesis 2: R&D investment influence on cost of capital.

The effect of earnings management towards cost of capital

Kim, J.H., et al (2018) analyzed the association between the genuine profit of the board and capital costs in the US. They find that ordinary, the degree of genuine profit the board is well connected with the expense of advance funding. Besides, they find that obligation financial backers charge higher expenses on the cost of capital for undertakings in nations

with more created obligation markets. Ilyas et al. (2019) broke down the impact of the profit of the board on the cost of capital in Pakistan. The discoveries show that undertakings participating in procuring the board have a huge expense of capital because controlled data brings down open trust and makes them look for a higher pace of return. Expanded business size and ROA adversely affect capital costs. Kuong, N.V., et. al. (2021) examined the connection between's genuine profit the executives and obligation cost in Vietnam. The discoveries uncovered a positive connection between genuine profit the executives are addressed by raising exchanges that straightforwardly affect fiscal reports, subsequently influencing investors' expense of obligation. Optional accumulations affect the expense of obligation and cost of value (Mariano et al., 2023). Exact outcomes that genuine income the executives essentially raises the expense of obligation in the wake of adapting to optional gatherings (Jin, J.B. et. al., 2022). Houqe, M. N., et. al. (2017) explore what review quality means for profit the executives and cost of value capital for the organizations remembered for India. The finding additionally uncovered that organizations in the business bunch have lower levels of profit the executives and cost of value. Given the clarification over, the exploration speculation that can be created is: Hypothesis 3: Profit The executives influence decidedly on Cost of Capital

Agency cost strengthens the effect of volatility OCI on cost of capital

In light of the organization hypothesis, directors may not necessarily work in the best terms of their proprietors, which could bring about irreconcilable circumstance, imbalance of data, and the presence of office costs (Jensen and Meckling, 1976). Here, corporate divulgences, like monetary reports, are urgent for diminishing imbalance of data and limiting the irreconcilable situation including the two players. Profit are likewise a preferred indicator of future sources of income over current working sources of income since gatherings shift the perceived functional capital across

time to decrease crisscrossing and timing hardships in sources of income. As per flagging hypothesis, directors are encouraged to give more data to the financial exchange to acquire financial backer trust, upgrade the procuring capability of their protections, and limit their expense of capital (Healy and Palepu, 2001); (Mahadeo et al., 2011). On the off chance that other complete pay changes instability where the organization circumstance is likewise seen hole among the board and proprietor will make a motion that the closely involved individuals will get data that is hazardous and can build the expense of funding the organization. Speculation 4: Organization cost reinforces the impact of instability OCI towards cost of capital

Agency cost strengthens the effect of earnings management on cost of capital

Jewel (1991) and Vurro and Perrini (2011) found that the straightforwardness of monetary data limits lopsidedness of data and lessens an organization's expense of capital. Entrepreneurial administrators, then again, are bound to speak with procuring the executives to stress helpful information about the organization's drawn out possibilities and lessen the expense of capital by distorting income during the gathering (Demirtas and Cornaggia, 2013) Speculation 5: Organization cost reinforces the impact of profit the executives towards cost of capital.

3. Methodology

The monetary information was gathered from the Refinitiv Eikon data set. Our information remembered all energy organizations for China, India, US and Indonesia that distributed the important data for this exploration. We got the information across these nations in light of a 3-top country by The Financial expert Canny Unit's review which are supposed to lead the capital funding. We likewise contrasted and the Indonesia information. Subsequent to barring exceptions and missing information, the leftover information included a fair board of 4 nations; 1,565 perceptions; 317 organizations for the period from 2019 to 2023.

To identify the factor relating to agency cost which can moderate the relationship among Volatility OCI, Research & Development, and Earnings Management on Cost of Capital, we propose to test the following regression model:

$$\begin{aligned} WACC_{it} = & \beta_0 + \beta_1 OCI_{it} + \beta_2 RND_{it} + \beta_3 ERM_{it} \\ & + \beta_4 AGC_{it} + \beta_5 OCI_{it} * AGC_{it} + \\ & \beta_6 RND_{it} * AGC_{it} + \beta_7 ERM_{it} * AGC_{it} \\ & + \beta_8 ROA_{it} + \beta_9 SZE_{it} + \epsilon_i \dots \dots (1) \end{aligned}$$

WACC = Weighted Average Cost of Capital

OCI = Volatility OCI

ERM = Earnings Management

AGC = Agency cost

ROA = Return on Assets

SZE = Firm size

WACC is an overall ward variable that addresses the expense of capital (Gitman L. J, 2016). The primary autonomous variable is the unpredictability of other far-reaching pay, which surveys the amount OCI adds to the general instability of the organization's exhaustive pay. Unpredictability OCI is determined by taking away the standard deviation from the company's complete pay altogether (Dirk E, 2013). Research and development venture are the second autonomous variable. We decide on undertakings that might have promoted a portion of their Research and development speculations north of a year in which they revealed a Research and development resource or potentially an amortization. This resource was accounted for immediately preceding the advance issue date. We follow Mazzi et al (2018). We decide how much Research and development an organization promoted in the financial year quickly going before the credit issue date. The profit of the board is the third autonomous variable. As profit the board is not noticed, this observational exploration follows the methodology in Dechow et al. (2011) writing to appraise optional accumulations and spotlight on non-cash working capital gatherings quality. Variable controls are return on resources and firm size.

5. Findings and Discussion

Findings

Table I presents gauge board information relapse boundaries figured in three stages (CEM_Common Impacts Model; FEM_Effects Model; REM Impacts Model). The Chow test was led to decide the utilization of the CEM or FEM model with the rules that if the p-esteem is $0.0000 < 0.05$ then the chosen model is FEM. Hausman test was directed to decide the utilization of the FEM or REM. If the p-esteem is $0.2723 > 0.05$, It was found that the Irregular Impacts Model (REM) is OK. To reconfirm the outcome, we likewise noticed the breush agnostic lagrangian multiplier test and the last model is REM.

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

REM can assess the impact or effect of time-invariant variables. REM's parameters take the form of random variables. This model assumes the intercept of a unit is selected at random from a broader population. The error term combines time-series and cross-sectional errors. In REM, the error term and the independent variable do not correlate. If the population or observations are big and the model's assumptions are valid, REM outperforms FEM. As stated by Gujarati (2004), REM applies the Generalized Least

Square (GLS) method to validate classical assumptions. If the chosen model is REM, then the classical assumption test is unnecessary.

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

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

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
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 percent; **Significant at a level of 5 percent; *Significant at a level of 10 percent.

Note: OCI: Volatility OCI, RND: R&D Investment, ERM: Earnings Management, AGC: Agency Cost,

Based on the partial regression test result shown in Table II, Volatility OCI has sig. point of $0.722 > 0.05$ and regression coefficient point of $-1.59e-07$, meaning that volatility OCI is not significant at the level of 5%. It implies that the first hypothesis is rejected, it means that volatility OCI does not affect cost of capital. This result also applies to other variables.

Earnings management has sig. point of $0.000 < 0.05$ and regression coefficient point of $-4.62e-06$, meaning that earnings management is significant at level of 5%. It implies that the third hypothesis is accepted, indicating the earnings management is negatively significant affects cost of capital.

Discussion

Table II shows the relationship between volatility OCI and the cost of capital for energy is recorded. organizations in 4 nations. It was normal. that the connection between profit the board. furthermore, the expense of capital was positive because higher. chances require better yields. However, we track down observational proof. on the different impacts of volatility OCI on the cost of capital that adversely affects the cost of capital. This is to the aftereffects of examination directed by Gao et al (2020), the impact of discretionary accumulations. on the expense of value is lower in arising nations than in created nations.

Table III shows the assessment results. for the effect of volatility OCI, Research and development hypothesis, and income the executives. on cost of capital: the directing job of organization cost in four models. Model (1) remembers organizations for the energy area of China. Model (2) remembers organizations for the mining area which catches the expense of capital in India. Model (3) disaggregates. the expense of capital in the US. Finally, model (4) shows in the effect of unpredictability OCI, Research and development Investment, and profit the executives. on the expense of capital with the directing of organization cost in Indonesia. Model (1) and (4) show that the coefficients on Research and development interest in China and Indonesia are negative and critical at the 10 and 1 percent level ($\beta_2 = -0.0362$ and -0.04948 separately). This is presumably because of the different normal qualities and geology in each countrt, China and Indonesia. have likenesses in. terms of populace, when Research and development venture increments however how much products created. is huge or mass, according to the perspective of organizations, they can proficiently make due. the expense of low costs of products, subsequently the expense of capital abatements. This is in accordance with the idea of economies. of degree found by Salvatore (1996) where the hypothesis behind the economy of extension is that. the typical complete expense of creation of an organization diminishes. at the point when an

ever-increasing number of things are created. The economy of degree gives an expense benefit to organizations while making an extensive variety of a complementary products while still. zeroing in on the organization's center competencies.

In any case, Models (2) and (3) have disconnected results that the coefficients on Research and development interest in India and the US are positive and critical. at the 5 and 1 percent level ($\beta_2 = 0.25273$ and 0.0297 separately). The relationship. between the US. furthermore, India is one of the most key and considerable of the 21st hundred years. The US and India share a dream for enormous scope. development of environmentally friendly power, as seen by the two nations' optimistic 2030 environment activity and clean energy targets. (US Branch of State, 2023). This drawn out target requires. a lot of assets and hence is probably going to increment interest in innovative work and increment the ongoing expense of capital, which is a potential adverse impact, yet on the off chance that we check out at the effect from here on out, the Research and development speculation. made by India and the US can have a major effect, as long as all nations consider maintainability situated projects.

We likewise record in Models (1) and (2) that more noteworthy organization cost is related with a higher Research and development Venture to expand the expense of capital in China. Our proof cosntrasts. with the view in India that organization costs weaken the connection between Research and development invetsment and the expense of capital.

Table III depicts that the coefficients on the control factors have anticipated signs, exept for the coefficient on SIZE at Model (3) in the US and ROA at Model (2) in India. We consider that control factors SIZE and ROA have an adverse impact. on the expense of capital, when an organization fills in size and uses resources really, it has great turn of events and, thus negligible gamble. Generally safe prompts less capital use beyond the firm (Kim et al, 2018)

Tabel III. Expansionary. Dependen Variable: Cost of Capital (WACC)

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

Variables	Predictions	Model 1 China					Model 2 India					Model 3 United States					Model 4 Indonesia				
		Coefficient	Sig	Correlation		VIF	Coefficient	Sig	Correlation		VIF	Coefficient	Sig	Correlation		VIF	Coefficient	Sig	Correlation		VIF
				Tolerance					Tolerance					Tolerance					Tolerance		
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		-0.03713	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			
SIZE	-	-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 (1565)		390					155					820					200				

Source: Author's calculations based on collecting data. Notes: OCI*AGC = Interaction of Volatility OCI and Agency Cost; RND*AGC = Interactions of RND Investment and agency cost. ERM*AGC = Interactions of Earnings Management and Agency Cost. Table includes 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 < 0.01

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