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Mediating effects of information asymmetry and cost of capital on the relationship between financial reporting quality and investment efficiency of listed deposit money banks in Nigeria

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Abstract
Purpose: The purpose of this paper is to examine the serial mediating effects of information asymmetry (IA) and cost of capital (COC) on the relationship between financial reporting quality (FRQ) and investment efficiency (IE) of listed Deposit Money Banks (DMBs) in Nigeria over ten-year period (2008-2017) using Barron and Kenny's (1986) mediation model steps.
Methodology: The paper employed ex-post facto research design. Its population covered fourteen (14) DMBs that remained listed from 31st December, 2008 to 31st December, 2017. The data required for the study was available and so, census sampling technique was used to cover the entire fourteen (14) banks. Secondary sources of data comprising published annual reports and accounts of the listed DMBs and Thomson Reuters Data stream were used. The techniques of data analysis used are OLS, GLS and FGLS regression.
Results and conclusion: The results found are that FRQ affects both Underinvestment (Underinv) and Overinvestment (Overinv) directly and indirectly through its effect on IA and COC of listed DMBs in Nigeria. Hence, the paper concluded that IA and COC mediate the relationship between FRQ and Underinv/Overinv of listed DMBs in Nigeria.
Implication of findings: Practically, the findings imply that the level of IE in the Nigerian banking industry will improve if the listed DMBs adopt the practice of reporting comprehensive and relevant information to capital providers.

Keywords: Financial reporting quality, Information asymmetry, Cost of capital, Underinvestment, Overinvestment.

1. Introduction

Attempts to examine the relationship between FRQ and corporate investment efficiency (IE) dates from the formulation of theories that jointly explain the responsiveness of corporate IE to the quality financial reporting (see Biddle & Hilary, 2006; Beatty, Liao & Weber, 2007, McNichols & Stubben, 2008; Biddle, Hillary & Verdi, 2009). For instance, while Pecking order theory proposed that cost of capital (COC) (that is, a key determinant of IE according to Wang et al., 2015) could be explained by asymmetric information risks; Signaling Theory argued the level of IA and its associated risks in the capital market could be reduced by the extent of signaling, that is, a an activity or process (for instance, quality financial reporting) in which corporate firms convey relevant information to users of financial statements or borrowers convey relevant information to lenders.

According to Ren (2016), the terms IE can be seen as undertaking or embarking on all and only investment projects with positive net present value (NPV). Thus, by implication, a firm is said to be overinvesting when it accepts and executes projects proven to have negative NPV. It is also said to be underinvesting when it rejects investment projects with positive NPV. Both overinvestment and underinvestment are regarded as inefficiencies in investments (Du, 2014; Poorzamani & Keivanfar, 2014; Naseri & Habibi, 2014; Mricky, 2015). Studies on corporate IE have focused mostly on its direct relationship with FRQ thereby ignoring the effects of intervening variables like IA and COC (for instance,

see Kim & Kwon, 2015; Lenger et al, 2015; Ren, 2016; Rad et al, 2016; Hayati & Sedaghat, 2016; Asma, 2017; Harymawan,2020;Dewi et al., 2020; Ayagi & Salisu, 2023; Khan et al., 2025; Assad et al., 2026)

Moreover, studies that examined the mediated relationship have so far focused on simple mediating effects of either IA or COC. For instance, Bhattacharya et al. (2010) and Nuryaman (2014) have paid attention to the simple mediating effect of IA on the relationship between earnings quality and COE using path analysis in the large and stable American firms. Similarly, Daman and Mehr (2012) and Nurcholisah (2016), Indarti et al. (2019), Safrida and Surianti (2020), Diantimala et al. (2022), Hosseini et al. (2025) have specifically examined the mediating effect of IA and so, neglecting that of COC on the relationship between FRQ and IE.

Furthermore, Nurcholisah (2016) employed causal associative method which prevents the direct and mediated (indirect) effect of FRQ from being clearly established in the study. In a similar way, Ascioglu, et al. (2008) as cited in Xie (2013), Xie (2013), Firth et al. (2016) and Chen et al. (2017) works have only addressed the simple mediating effect of COC on the association between IA and IE. In fact, Firth et al. (2016) did not statistically use COC as a mediating variable in the relationship between IA and IE, it just aligned itself with the notion that IA affects IE through influence on COC.

Moreover, apart from being focused on unmediated relationships and simple mediating effect of either IA or COC, the relevant studies are yet to establish a clear direction of relationship between FRQ and IE due to differences in results found. As a matter of fact, findings from studies that examined the unmediated effect of FRQ have been in three sets i.e. positive relationship (Kim & Kwon, 2015; Ren, 2016; Rad, Embong, Mohd-Saleh & Jaffar ,2016; Hayati & Sedaghat, 2016), negative relationship (Gilaninia et al. 2012; Moradzadehfard et al. (2013); Poorzamani & Keivanfar, 2014; Naseri & Habibi ,2014; Lenger et al. 2015) and no relationship (Gilaninia et al. 2012; Asma, 2017).

Similarly, results from studies (Daman & Mehr, 2012; Shan-cun & Wei-ning, 2012; Konchitchki & Landsman, 2013; Nuryaman, 2014; Vander Bauwhede et al. 2015; Cuadrado-Ballesteros et al. 2016; Nurcholisah, 2016) that assessed the simple mediating effect of IA have been mixed and hence, suggest the need for more studies that would possibly provide a more comprehensive and improved findings through a change in approach/methodology (for instance, taking into account the sequential mediating effects of both IA and COC).

Also, aside from being mixed in terms of their findings, the relevant studies found so far have mostly been carried out in developed economies. For, to this point, few studies (Joel, 2009; Ayagi & Kurawa, 2019) were found to have been carried out in emerging economies. And in Nigeria, the area can be said to have been neglected if not for the work of Ayagi and Kurawa (2019). As a matter of fact, there is paucity of works that examined either the mediating effects of IA and COC on the relationship between FRQ and IE of listed Deposits Money Banks (DMBs) in Nigeria. And this provides a research gap which this study attempts to fill. Consequently, this study aims at adopting Barron and Kenny's (1986) mediation model steps in order to examine the mediating effects of IA and COC on the relationship between FRQ and IE of listed Deposit Money Banks in Nigeria over a period of ten years (2008-2017).

2. Literature review

Empirical review

Different research works from various parts of the world have examined the direct effect of FRQ on IE in different companies. For example, Biddel et al. (2009) developed a model for computing IE and

employed four models of computing FRQ. The results found indicated that improved FRQ would result in less overinvestment and under-investment problems in the sampled firms. Jamhuri (2009) used Biddel's et al. (2009) IE model in the analysis of 34 firms quoted on the Nairobi Stock Exchange and the result obtained supported the Biddel's et al. (2009) position on the positive relationship between FRQ and IE.

Similar research works carried out (for instance, Baik et al., 2010; Kangarlouei et al., 2011; Abdul Jalil, 2014; Zhu et al. 2014; Du, 2014; Micky, 2015; Wang et al., 2015; Ren, 2016, Rad et al., 2016, Harymawan,2020; Kumar et al., 2023; Khan et al., 2024; Khan et al. 2024; Le et al., 2024; Susilawati et al., 2024; Oziegbe et al., 2024; Hundal et al., 2024; Gita & Oriavwote, 2025;Assad et al., 2026) aligned with the stance of Biddel et al. (2009). In contrast, research conducted by Gilaninia et al. (2012), Moradzadehfard et al. (2013), Naseri and Habibi (2014), Poorzamani and Keivanfar (2015) and Lenger et al. (2015) established a negative association between FRQ and IE. Moreover, the findings of Gilaninia et al. (2012) and Asma (2017) obtained no evidence to indicate that FRQ influences IE of the selected firms.

Efforts to examine the mediating effect have majorly paid attention to the simple mediation of either IA or COC. For instance, employing path analysis, Bhattacharya et al. (2010) assessed the simple mediating effect of IA on the link between earnings quality and COE of big and stable American firms. The result found suggested an evidence of direct relationship between earnings quality and COE, and then indirect relationship that is passed through IA. Likewise, Shan-cun and Wei-ning (2012), Barth et al. (2013), Nuryaman (2014), Vander Bauwhede et al. (2015) and Cuadrado-Ballesteros et al. (2016) specially examined the mediating effect of IA on the link between FRQ and COC in different corporate organizations.

Moreover, Daman and Mehr (2012) and Nurcholisah (2016), Indarti et al. (2019), Safrida and Surianti (2020), Diantimala et al. (2022), Hosseini et al. (2025) assessed the mediating effect of IA and thus, neglecting that of COC on the link between FRQ and IE despite the causal associative method employed by Nurcholisah (2016). Similarly, Ascioglu et al. (2008), Xie (2013), Firth et al. (2016) and Chen et al. (2017) specially assessed the simple mediating effect of COC on the association between IA and IE. And it should be noted that Firth et al. (2016) did not specifically use COC as mediating variable on the nexus between IA and IE; it merely back the notion that IA influences IE via influence on COC.

Furthermore, results obtained by the studies that examined the simple mediating effect of either IA or COC on the link between FRQ and IE (for example, Daman & Mehr, 2012; Shan-cun & Wei-ning, 2012; Barth et al. 2013; Nuryaman, 2014; Vander Bauwhede et al. 2015; Cuadrado-Ballesteros et al. 2016; Nurcholisah, 2016) have been mixed and thus, suggest the need for more research works that would employ different methods to mediation. And in response to this, the following hypotheses were formulated in null form:

H_{01}: FRQ does not significantly affect IE of listed DMBs in Nigeria:
- H_{01A}: FRQ does not significantly affect Underinv of listed DMBs in Nigeria.
- H_{01B}: FRQ does not significantly affect Overinv of listed DMBs in Nigeria.

H_{02}: FRQ does not significantly affect IA of listed DMBs in Nigeria.
H_{03}: IA does not significantly affect COC of listed DMBs in Nigeria.
H_{04}: COC does not significantly affect IE of listed DMBs in Nigeria:
- H_{04A}: COC does not significantly affect Underinv of listed DMBs in Nigeria.
- H_{04B}: COC does not significantly affect Overinv of listed DMBs in Nigeria.

$H_{05:}$ FRQ does not significantly affect COC via IA of listed DMBs in Nigeria.
$H_{06:}$ IA does not significantly affect IE via COC of listed DMBs in Nigeria:
$H_{06A:}$ IA does not significantly affect Underinv via COC of listed DMBs in Nigeria.
$H_{06B:}$ IA does not significantly affect Overinv via COC of listed DMBs in Nigeria.
H_{07}: FRQ does not significantly affect IE via IA and COC of listed DMBs in Nigeria:
H_{07}: FRQ does not significantly affect Underinv via IA and COC of listed DMBs in Nigeria.
H_{07}: FRQ does not significantly affect Overinv via IA and COC of listed DMBs in Nigeria.

Theoretical review

The study used a combination of five relevant theories. They are agency theory, theory of asymmetric information, pecking order theory, Issue-invest decision theory and signaling theory. Agency theory was used to explain how the agency relationship/problems between corporate managers and investors bring about asymmetric information. Theory of asymmetric information was used to complement agency theory and to further set a theoretical basis for the relationship between IA and information asymmetric risks, that is, adverse selection and moral hazards. Because, according to the theory, imperfect knowledge or IA brings about imbalance of power between parties to a transaction and further creates information asymmetric problems/risks such as adverse selection and moral hazards (Xie, 2013).

Furthermore, while Pecking Order Theory was employed to explain how information asymmetric risks affect COC; Issue-invest Decision Theory explained the way in which the change in COC affects corporate IE. Finally, signaling theory was used to justify how FRQ can serve as a signal/information used in reducing the level of asymmetric information in the capital market; hence, lower financing cost and then improve in corporate IE. This is because signaling is an activity in which an individual provides others with relevant information in order to influence the level of confidence they have in him, and that signal is expected to trim down the IA (Spence, 1973).

3. Methodology

This study employed ex-post facto research design. Its population is made up of fourteen (14) listed DMBs in Nigeria that stayed listed from 31st December, 2008 to 31st December, 2017. The data required for the study was available and so census sampling technique was used to cover the entire fourteen banks. Secondary sources of data comprising published annual reports and accounts of the listed DMBs and Thomson Reuters Data stream were used. The study variables are in two categories, i.e., dependent and explanatory variables. The dependent variable is IE of the banks, and it was measured based on Zhu et al. (2014) expected investment model. The model is as follows:

$$Investment_{i,t} = \alpha_0 + \alpha_1 Growth_{i,t-1} + \alpha_2 Leverage_{i,t-1} + \alpha_3 Cash_{i,t-1} + \alpha_4 Size_{i,t-1} + \alpha_5 Return_{i,t-1} + \alpha_6 Age_{i,t-1} + \alpha_7 Investment_{i,t-1} + \varepsilon_{i,t}$$

Where:

$Investment_{i,it}$ = sum of capital expenditures, R&D expenditures, and acquisitions minus sales of property, plant, and equipment, scaled by lagged total asset for firm i at the end of year t-1
$Growth_{i,t-1}$ = annual revenue growth rate for firm i at the end of year t-1
$Leverage_{i,t-1}$ = asset-liability ratio of firm i at the end of year t-1
$Cash_{i,t-1}$ = ratio of cash to total asset of firm i at the end of year t-1
$Size_{i,t-1}$= log of total assets of firm i at the end of year t-1
$Return_{i,t-1}$= stock returns of firm i at the end of year t-1
$Age_{i,t-1}$ = log of the number of years that a bank has been listed with Nigerian stock exchange
$Investment_{i.t-1}$ = lag of investment.

It should be noted that $Investment_{i,t}$ was modified to cover other investment expenditures that are peculiar to the banking industry, for instance, investments in key business segments, innovative banking products and services, technology-led innovation projects, recapitalisation of subsidiaries, remodeling of branch infrastructures, branch network expansion, upgrade of IT structure and e-channels and IT transformation projects (see listed DMBs published Annual Reports and Accounts, 2008 -2017)

$Investment_{i,t}$ = sum of capital expenditures, R&D expenditures, acquisitions minus sales of property, plant, and equipment and other investments peculiar to the listed DMBs scaled by lagged total asset for firm i at the end of year t-1

The study explanatory variables are independent, mediating and control variables. The independent variable is the FRQ of listed DMBs in Nigeria. It was quantified using Chang et al (2008) Loan Loss Provision Model employed by Hassan (2015). The choice of this model was first justified by the fact that the study is conducted in banking industry. Chang et al. (2008) as cited in Hassan (2015) also justified the choice of the model based on a practice in which most bank managers decide on the amount of loan loss provisions every month, in line with individual risk assessment on potential uncollectible loans and loans charge-offs. Computing discretionary Loan loss provision involves the following steps:

LLP= f (LCO, BBAL) …….…… (i)
Where:
LLP = Loan loss provision
LCO = loan charge-offs
BBAL = beginning balance of allowance for bad and doubtful debts

Since discretionary accruals cannot be determined directly, they are computed first, by regressing LLP on the explanatory variables as follows:

$LLP_t = \alpha_0 1/TA_{t-1} + \alpha_1 LCO/ TA_{t-1} + \alpha_2 BBAL/ TA_{t-1} + \varepsilon_{i,t}$ ……..……(ii)

Therefore, the discretionary loan loss provision (DLLP) or earnings management is the error term, that is, LLP less LCO for the year and the BBAL.

$DLLP = \varepsilon_{i,t} = LLP_t - (\alpha_0 1/TA_{t-1} + \alpha_1 LCO/ TA_{t-1} + \alpha_2 BBAL/ TA_{t-1})$……..……(iii)

In line with previous studies like Bidel et al. (2009), Chen et al. (2010), Zhu et al. (2014) and Rad et al. (2016), the absolute value of the residuals were multiplied by -1 so that higher value of the residuals signifies higher FRQ

The mediating variables are IA and COC. IA was computed using Bid-Ask Spread model developed by Chiang and Vinkatesh (1986) and used in previous studies like Fu et al. (2012), Fu et al. (2013), Eid, (2015), Nurcholisah (2016), Heydari et al. (2016) and Ayagi and Kurawa (2019). The model is:

$$Spr_{i,t} = \frac{Ap_{i,t} - Bp_{i,t}}{\frac{Ap_{i,t} + Bp_{i,t}}{2}}$$

Where:
$Spr_{i,t}$ = Bid-ask spread of firm i in the year t
$Ap_{i,t}$ = Average of the ask price of firm i in the year t
$Bp_{i,t}$ = Average of the bid price of firm i in the year t

The Bid-ask spread represents the level of IA between the banks and their capital providers and it is expressed in absolute value.

COC was measured using Kazemi and Rahmani (2013) model as follows:

$$COE = \frac{1}{[P/E-(e_0-d_o)/e_0]}$$

Where:
COE= the cost of equity capital
e_0: net profit per share at the beginning of financial period,
d_0: dividends per share at the beginning of financial period,
P: final price per share in financial period,
E: net profit per share at the end of financial period.

$$COD = \frac{\text{Financial costs based on income statement at the end of each year}}{\text{Aggregated interest-bearing liabilities}} * 1-t$$

Where:
COD = cost of debt
Aggregated interest-bearing liabilities = current financial liabilities, long-term payable notes and long-term financial liabilities based on current year balance sheet

$$t = \frac{\text{tax expense}}{\text{profit before interest and tax}}$$

WACC was then computed by multiplying book value of liabilities by common stock at their own respective cost rates.

The control variables used in this study are presented in Table 3.1 below.

Table 1: Control variables

SN	Variables	Measurement
I	Return on asset	Profit after tax divide by total asset This was used in Gray et al. (2009), Poorzamani and Keivanfar (2015)
II	Cash flow from operation1	Cash flow from operation divide by total revenue. This was used in Biddle et al.(2009)
III	IFRS adoption	Binary variable which takes the value one if a firm applies IFRS and zero otherwise. It was used by Lenger et al.(2015), Biddle (2011),
IV	Book value per share	Shareholders fund divide by number of issued and fully paid ordinary shares.
V	Firm size (total market value of equity)	Log of total market value of equity as used by Gray et al. (2009), Bahmani (2014), Barron et al. (2012), Fu et al. (2012)
VI	Leverage	Total debt (interest bearing liabilities) to total assets as used by Gray et al. (2009), Kazemi and Rahmani (2013), Zhu et al.(2015), Ben-Nasr and Al-Dakheel (2015), Rezaei and Shabani (2015)
VII	Market to book value ratio	market value per share divide by book value per share as used by Kazemi and Rahmani (2013), Xie (2013), Muhammadi (2014), Ben-Nasr and Al-Dakheel (2015)
VIII	Firm size (asset)	Log of firms' total assets as used by Kangarlouei et al. (2011), Zhu et al.(2015), Poorzamani and Keivanfar (2015), Rezaei and Shabani (2015),

The technique of data analysis used is multiple regressions. It was used to determine the impact of changes in explanatory variables on the dependent variable. Due to longitudinal nature of the data, panel data regressions were used to test the hypothesis formulated. Thus, OLS and GLS regressions were used based on the results obtained from different Post estimation tests (multicolleanearity, hetroscedasticity, normality and hausman specification) conducted. For the purpose of assessing the effect of the independent variable (FRQ) on the dependent variable (IE) via mediators (IA and COC), the paper adopted Barron and Kenny's (1986) causal steps. The causal steps alongside the study's models are:

a. Regress the dependent variable (IE) on the independent variable (FRQ) to verify or confirm that the FRQ is a significant predictor of the IE:

$$IE = a_0 + a_1FRQ + \varepsilon_1 \quad \text{.....(i)}$$

b. Regress the first mediator (IA) on the independent variable (FRQ) to confirm that the independent variable is a significant predictor of the first mediator.

$$IA = b_0 + b_1FRQ + \varepsilon_2 \quad \text{.....(ii)}$$

c. Regress the second mediator (COC) on the first mediator (IA) to confirm that the IA is a significant predictor of the COC:

$$COC = c_0 + C_1IA + \varepsilon_3 \quad \text{.....(iii)}$$

d. Regress IE on COC to statistically establish whether IE can be significantly explained by COC:

$$IE = d_0 + d_1COC + \varepsilon_4 \quad \text{.....(iv)}$$

e. Regress COC on FRQ and IA to confirm whether COC can be predicted by FRQ via IA:

$$COC = e_0 + e_1FRQ + e_2IA + \varepsilon_5 \quad \text{.....(v)}$$

f. Regress the IE on IA and COC to prove that the IE can be influenced by IA through COC:

$$IE = f_0 + f_1IA + f_2COC + \varepsilon_6 \quad \text{.....(vi)}$$

g. Regress IE on FRQ, IA and COC to establish whether IA and COC are significant predictors of IE, and whether the coefficient of FRQ is now smaller than that of model (i).

$$IE = g_0 + g_1FRQ + g_2IA + g_3COC + \varepsilon_7 \quad \text{.....(vii)}$$

It is important to note at this point that:
g_2 and g_3 are expected to be significant
total effect = a_1
direct effect = g_1
indirect/mediated effect = $a_1 - g_1$
g_1 is expected to be smaller than a_1 of model (i)

Since corporate IE is determined indirectly by measuring the extent of overinvestment (Overinv) and underinvestment (underinv) by a firm, the IE in models i, iv, vi and vii is replaced by Overinv / underinv as follows:

$$\text{Overinv / underinv} = a_0 + a_1FRQ + \varepsilon_1 \quad \text{.....(i)}$$
$$\text{Overinv / underinv} = d_0 + d_1COC + \varepsilon_4 \quad \text{.....(iv)}$$
$$\text{Overinv / underinv} = f_0 + f_1IA + f_2COC + \varepsilon_6 \quad \text{.....(vi)}$$
$$\text{Overinv / underinv} = g_0 + g_1FRQ + g_2IA + g_3COC + \varepsilon_7 \quad \text{.....(vii)}$$

In summary, the current study models are:

$$\text{Overinv / underinv} = a_0 + a_1FRQ + \varepsilon_1 \quad \text{.....(i)}$$
$$IA = b_0 + b_1FRQ + FSTMVE + IFRS + ROA + \varepsilon_2 \quad \text{.....(ii)}$$
$$COC = c_0 + C_1IA + \varepsilon_3 \quad \text{.....(iii)}$$
$$\text{Overinv / underinv} = d_0 + d_1COC + \varepsilon_4 \quad \text{.....(iv)}$$
$$COC = e_0 + e_1FRQ + e_2IA + \varepsilon_5 \quad \text{.....(v)}$$

Overinv / underinv = $f_0 + f_1IA + f_2COC + \varepsilon_6$……..….(vi)
Overinv / underinv = $g_0 + g_1FRQ + g_2IA + g_3COC + \varepsilon_7$……..(vii)

Taking into consideration the effects of relevant control variables, the models read as follows:
Overinv/underinv = $a_0+a_1FRQ+ a_2BVPS+ a_3ROA + a_4CFO1+ a_5IFRS+\varepsilon_1$…….....(i)
IA = $b_0 + b_1FRQ+b_2FSTMVE+ b_3IFRS+ b_4ROA+ \varepsilon_2$…….....(ii)
COC = $c_0 + C_1IA+ C_2ROA+ C_3MB+ C_4FSASSET+ C_5LEV +\varepsilon_3$……..…..(iii)
Overinv/Underinv=$d_0+d_1COC+d_2BVPS+d_3ROA+d_4CFO1+d_5IFRS+\varepsilon$……..……...……..(iv)
COC=$e_0+e_1FRQ+e_2IA+e_3ROA+e_4MB+e_5FSASSET+e_6LEV+\varepsilon_5$……..….....(v)
Overinv/underinv=$f_0+f_1IA+f_2COC+f_3BVPS+f_4ROA+f_5CFO1+f_6IFRS+\varepsilon_6$…….....……..(vi)
Overinv/underinv=$g_0+g_1FRQ+g_2IA+g_3COC+g_4BVPS+g_5ROA+g_6CFO1+g_7IFRS+\varepsilon_7$…….....(vii)

Also, it is important to note that the main models required for determining the serial mediating effects of IA and COC are:
Overinv/underinv = $a_0+a_1FRQ+ a_2BVPS+ a_3ROA + a_4CFO1+ a_5IFRS+\varepsilon_1$…….....(i)
Overinv/underinv=$g_0+g_1FRQ+g_2IA+g_3COC+g_4BVPS+g_5ROA+g_6CFO1+g_7IFRS+\varepsilon_7$…….....(vii)
Where:
BVPS = book value per share
ROA = return on assets
FSASSET= firm size (assets)
FSTMVE= firm size (total market value of equity)
CFO1= cash flow from operation
IFRS = Internal financial reporting standard
MB = market to book value ratio
LEV= leverage.

4. Results and discussion

Table 2: Regression results (OLS robust) of model one (FRQ and IE)

	FRQ & Underinv _Underinvesting Banks			FRQ & Overinv_Overinvesting Banks		
Variables	**Coefficient**	**T**	**p>/t/**	**Coefficient**	**T**	**p>/t/**
Constant	-0.067136	-0.31	0.754	-0.1811	-1.39	0.17
FRQ	-21.47001	-1.47	0.146	-2142.2*	-1.82	0.075
BVPS	-0.009557***	-2.93	0.005	-0.0071**	-2.36	0.22
ROA	0.4488616***	2.87	0.006	-0.3293	-0.73	0.472
CFO1	0.0005407***	2.73	0.008	0.00031***	3.89	0
IFRS	-0.012909	-0.95	0.345	-0.0476*	-1.63	0.108
Mean VIF			1.39			1.63
Hettest			0			0.015
Hausman			0.386			0.883
xttest0			0.219			1
Obs			77			
R^2			0.405			0.281
F(10, 66)/ F(9, 53)			3.82			28.81
Prob > F			4E-04			0

Source: STATA 13.0 outputs based on data generated (2008 - 2017)
, and *** mean significant at the 10% , 5% and 1% level respectively*

From Table 2 (Underinvesting Banks), the negative coefficient of FRQ (-21.47) suggests that FRQ has negative impact on Underinv. However, the impact is insignificant considering its t-value (-1.47) and p-value (0.146) which suggest that the paper cannot reject H_{O1A}. This result is in line with the position reached in Gilaninia et al. (2012) and Moradzadehfard et al. (2013). However, it disagreed with the stance reached in studies like Poorzamani and Keivanfar (2014) and Naseri and Habibi (2014) that focused on the direct effect of FRQ on Underinv. On the level of significance, the result also contradicted what has been obtained in Lai, Liu and Wang (2014), Zhu, et al. (2014), Gomariz and Ballesta (2014), Mohammadi (2014), Amini and Moradi (2014) and Du (2014).

Moreover, as confirmed by the negative coefficient of FRQ (-2142.2), t-value (-1.82) and p>/t/ (0.075) from Table 2 (Overinvesting Banks), FRQ has negative and significant impact on Overinv. That is to say, with high quality reporting in the listed DMBs, the chances of accepting projects with negative net present values will reduce significantly. This supported relevant studies on FRQ and Overinv (Biddle et al. 2009; Abdul Jalil, 2014; Wang, Zhu & Hoffmire, 2015; Wang et al. 2015; Zhu et al. 2015; Alizadeh et al. 2015; Kim & Kwon, 2015; Ren, 2016; Hayati & Sedaghat, 2016)

Table 3: Regression results (OLS robust) of model two (FRQ and IA)

Variables	Coefficient	T	p>/t/	
Constant	2.445192	3.45	0.001	
FRQ	-38.65071	-1.19	0.235	
FSTMVE	-0.22601	-2.62***	0.01	
IFRS	-0.374573	-3.53***	0.001	
ROA	-0.487987	-0.44	0.659	
Mean VIF				1.07
Hettest				0.0000
Hausman				0.7655
xttest0				0.161
R^2				0.1541
F(4, 135)				7.15
Prob > F				0.0000

Source: STATA 13.0 outputs based on data generated (2008 - 2017).
, and *** mean significant at the 10% , 5% and 1% level respectively*

From Table 3, t and p>/t/ values suggest that FRQ exerts insignificant effect on IA and hence, the paper failed to reject $H_{03.}$ Moreover, the negative coefficient of FRQ (-1.19) implies that FRQ has negative effect on IA. This implies that the level of IA between management of listed DMBs and capital providers will be diminishing with high quality reporting. Therefore, in terms of the negative association established, the result supports the signaling theory argument and positions reached in Bhattacharya et al. (2008), Nanyondo et al. (2013), Yaghoobnezhad et al. (2013), Bahmani (2014), Beshkooh et al.(2015), Ajina et al. (2015), Ali and Abdelfettah (2016) and Abdelghany (2016). The result however disagrees with the findings of Ajward and Takehara (2010), Cerqueira and Pereira (2013) and Nilabhra et al. (2013) that established positive relationship between FRQ and IA. It also contradicts Purwanti and Kurniawan (2013), who found no proof to suggest that FRQ could lessen the level of IA between managers and providers of finance.

Table 4: Regression results (OLS robust) of model three (IA and COC)

Variables	Coefficient	T	p>/t/	
Constant	-1.11147***	-4.32	0.000	
IA	0.019188	1.09	0.279	
ROA	0.1493665	0.65	0.518	
MB	-0.002718	-1.12	0.266	
FSASSET	0.136919***	4.86	0.000	
LEV	0.0866436*	1.65	0.102	
Mean VIF				1.38
Hettest				0.0173
Hausman				0.1944
xttest0				0.4816
R^2				0.2098
Adj. R2				0.1803
Prob > F				0.0000

Source: STATA 13.0 outputs based on data generated (2008 - 2017).
, and *** mean significant at the 10% , 5% and 1% level respectively.*

Although IA relates positively with COC as revealed by the positive coefficient (0.019188) in Table 4, its effect on COC is not significant (t = 1.09, p-value = 0.279 and thus, H_{03} cannot be rejected). Besides, its contribution to the overall R^2 is only 2% approxiamately. This makes the result distinct from previous studies (Barron et al. 2012; Kazemi and Rahmani, 2013; He et al. 2013; Derrien et al. 2014; Levi and Zhang, 2014; Eid, 2015; Asadbakhti and Malgharni, 2016) in terms of the level of significance. However, the result agreed with them on the positive relationship between IA and COC, and also supported the first propostion of Pecking Order Theory which argues that corporate COC rises with an increase in IA.

Table 5: Regression results (OLS robust) of model four (COC and IE)

	COC & Underinv _Underinvesting Banks			**COC & Overinv_Overinvesting Banks**		
Variables	**Coefficient**	**T**	**p>/t/**	**Coefficient**	**T**	**p>/t/**
Constant	0.0204827	0.09	0.926	-0.3097	-0.52	0.609
COC	0.1110041*	1.63	0.108	0.05988	0.57	0.574
BVPS	-0.0088***	-3.06	0.003	-0.007	-1.27	0.208
ROA	0.40304***	2.86	0.006	-0.3142	-0.69	0.494
CFO1	0.000382***	2	0.05	0.0003128***	2.89	0.006
IFRS	-0.01247	-1	0.32	-0.0353	-1.11	0.272
Mean VIF			1.4			2.67
Hettest			0			0.0105
Hausman			0.0239			0.9258
xttest0			1			1
R2			0.4056			0.2199
F(10, 66)/F(10, 52)			4.89			25.1
Prob > F			0			0

Source: STATA 13.0 outputs based on data generated (2008 - 2017).
, and *** mean significant at the 10% , 5% and 1% level respectively.*

From Table 5 (Underinvesting Banks), the result suggests that the effect of COC on Underinv is significant (t=1.63, p-value=0.108) and so, the paper failed to reject $H_{04A.}$ Moreover, the result suggests that the effect is positive (coefficient =0.1110041), implying that the extent of Underinv in the listed DMBs will increase whenever there is an increase in COC. Also, it agrees with Issue-invest Decision Theory which proposed that higher COC prevents corporate firms from undertaking capital investments with positive net present value.

Also, from Table 5 (Overinvesting Banks), the effect of COC on Overinv is not significant (p-value = 0.574 and so, $H0_{4B}$ cannot be rejected). The positive coefficient (0.05988) suggests that Overinv problem will increase as long as there is a rise in COC, and vice versa. Thus, this result is in conflict with the findings of He Jingeng (2002) as cited in Lin et al. (2015) who confirmed that if the COE capital is low, corporate firms expand the scale of their investments through excessive equity financing, which may result in overinvesting the amount raised from the capital market. Hence, He Jingeng's (2002) result suggests that we should expect negative relationship between COC and Overinv.

Table 6: Regression results of model five (FRQ, IA and COC)

	Unmediated Model			**Mediated Model**			**Difference**	
	FRQ and COC (OLS)			**FRQ, IA and COC()**			**Mediated effect**	**Sig. level**
Variables	**Coeff.**	**T**	**p>/t/**	**Coeff.**	**T**	**p>/t/**	**abs.value**	(Mediator)
Constant	-1.16	-4.4	0.000	-1.21	-4.7	0.000		
FRQ	-55.6	-2.4	0.017	-54.57	-13.76	0.000	1.03	
IA				0.01	0.6	0.547		not sig.
ROA	0.11	0.5	0.615	0.13	0.5	0.616		
IFRS	-0.03	-1.4	0.155	-0.03	-1.23	0.222		
LEV	0.12	2.0	0.046	0.12	2.65	0.009		
MB	0.00	-1.04	0.301	0.00	-1.22	0.226		
FSASSET	0.14	4.86	0.000	0.15	5.03	0.000		
Mean VIF			1.48			1.46		
Hettest			0.026			0.014		
Hausman			0.276			0.211		
xttest0			1.000			1.000		
Obs			140			140		
R^2			0.244			0.248		
F(7, 132)						130.89		
Prob > F			0.000			0.000		

Source: STATA 13.0 outputs based on data generated (2008 - 2017).
, and *** mean significant at the 10% , 5% and 1% level respectively.*

From Table 6, the total effect of FRQ is given by the absolute value of its coefficient from unmediated model, that is, 55.6. The direct effect is represented by the absolute value of its coefficient from mediated model, that is, 54.75. The mediated/indirect effect (1.03) is computed by deducting the direct effect from the total effect. This implies that apart from direct effect, FRQ has indirect/mediated effect (through IA) on COC. It also suggests that IA partially mediates the relationship between FRQ and COC. This result agreed with the positions of Saini (2010), Bhattacharya et al. (2010), Fu, Kraft and

Zhang (2012), Shan-cun and Wei-ning (2012), Konchitchki and Landsman (2013), Ben-Nasr and Al-Dakheel (2015), Oluoch et al. (2015), Rezaei and Shabani (2015), Vander Bauwhede (2015), Cuadrado-Ballesteros et al. (2016) and Rymar (2016) in terms of a mediating role that IA plays between FRQ and COC. However, IA is not significant predictor of COC as confirmed by its t statistics (0.6) and p-value (0.547). Thus, it does not significantly mediate the relationship between FRQ and COC. Hence, this further implies that the mediated effect of FRQ/mediating effect of IA is not significant and for this reason, this paper failed to reject $H_{05.}$

Table 7: Regression results of model six (IA, COC and Underinv)

	Unmediated Model			**Mediated Model**			**Difference**	
	IA and Underinv (GLS FE)			**IA,COC and Underinv(GLS FE)**			**Mediated effect**	**Sig. level**
Variables	**Coeff.**	**T**	**p>/t/**	**Coeff.**	**T**	**p>/t/**	**(abs.value)**	(Mediator)
Constant	-0.161	-0.25	0.80	-0.394	-0.6	0.55		
IA	0.022	1.07	0.29	0.017	0.82	0.41	0.0049	
COC				0.133	1.4	0.17		not sig.
BVPS	-0.01***	-4.69	0.00	-0.009***	-4.12	0.00		
ROA	0.278	1.45	0.15	0.254	1.33	1.19		
CFO1	0.000	0.55	0.59	0.000	0.36	0.72		
IFRS	0.004	0.13	0.89	-0.010	-0.33	0.74		
Obs			77			77		
Mean VIF			1.4			1.4		
Hettest			0.000			0.000		
Hausman			0.000			0.000		
R^2: within			0.4392			0.4594		
Between			0.0375			0.0174		
Overall			0.2603			0.2376		
F***			4.15			4.02		
Prob>F			0.0003			0.0003		

Source: STATA 13.0 outputs based on data generated (2008 - 2017).
, and *** mean significant at the 10% , 5% and 1% level respectively.*

From Table 7, the mediated effect of IA (0.005) was determined by deducting the direct effect (0.017) from the total effect (0.022). And it suggests that COC mediates the relationship between IA and Underinv, and that IA has indirect/mediated effect on Underinv. However, the insignificant effect of COC on Underinv suggests that the mediated effect is insignificant and thus, H_{06A} cannot be rejected. In other words, $H0_{6A}$ cannot be rejected, because COC does not have significant mediating effect effect the relationship between IA and Underinv in listed DMBs in Nigeria.

Table 8: Regression result of model six (IA, COC and Overinv)

Variables	Unmediated model IA and Overinv (OLS robust) Coeff.	T	p>/t/	Mediated Model IA,COCand Overinv(OLS robust) Coeff.	T	p>/t/	Difference Mediated effect abs.value	Sig. level (Mediator)
Constant	-0.340	-0.6	0.558	-0.278	-0.47	0.643		
IA	-0.036	-1.3	0.195	-0.037	-1.3	0.201	not mediating	
COC				0.070	0.67	0.509		not. sig.
BVPS	-0.007	-1.3	0.187	-0.008	-1.46	0.149		
ROA	-0.438	-1	0.345	-0.371	-0.82	0.417		
CFO1	0.000	2.26	0.028	0.0003**	2.11	0.039		
IFRS	-0.048	-1.5	0.147	-0.048	-1.52	0.135		
Obs			63			63		
Mean VIF			2.82			2.74		
Hettest			0.002			0.007		
Hausman			0.955			0.950		
xttest0			0.478			0.442		
R^2			0.2+46			0.254		
F			24.37			22.82		
Prob > F			0.000			0.000		

Source: STATA 13.0 outputs based on data generated (2008 - 2017).

, and *** mean significant at the 10% , 5% and 1% level respectively.*

On the other hand, the difference between the total and direct effects of IA on Overinv from Table 8 implies that COC of capital does not mediate the relationship between IA and Overinv, and that IA has no indirect/mediated effect on Overinv of listed DMBs in Nigeria. Because, with inclusion of COC as a mediating variable in the mediated model, the coefficient of IA increased to 0.037 in absolute terms. Hence, this paper rejects $H0_{6B}$.

Table 9: Regression results (OLS robust) of model seven (FRQ, IA, COC and Underinv)

	Model one (Unmediated) FRQ and Underinv (OLS robust)			Model Seven (Mediated) FRQ, IA, COC and Underinv(OLS robust)			Difference Mediated effect	Sig. level
Variables	**Coeff.**	**T**	**p>/t/**	**Coeff.**	**T**	**p>/t/**	**abs.(a1-g1)**	(Mediators)
Constant	-0.067	-0.31	0.754	-0.011	-0.05	0.96		
FRQ	-21.470	-1.47	0.146	-16.007	-0.94	0.353	5.46259	
IA				0.003	0.24	0.812		not sig.
COC				0.086	1.11	0.269		not sig.
BVPS	-0.009***	-2.93	0.005	-0.01***	-2.73	0.008		
ROA	0.448***	2.87	0.006	0.42***	2.84	0.006		
CFO1	0.001***	2.73	0.008	0.000**	2.11	0.039		
IFRS	-0.013	-0.95	0.345	-0.012	-0.95	0.347		
Mean VIF			1.39			1.44		
Hettest			0.000			0.000		
Hausman			0.3857			0.201		
xttest0			0.2189			1.000		
Obs			77			77		
R^2			0.4052			0.415		
F			3.82			4.00		
Prob > F			0.0004			1E-04		

Source: STATA 13.0 outputs based on data generated (2008 - 2017).
, and *** mean significant at the 10% , 5% and 1% level respectively .*

To test $H0_{7A}$, the regression results of both unmediated and mediated models of the study in respect of Underinv are presented in Table 9. From the Table, model one (unmediated) regression results show that the total effect of FRQ on Underinv (holding IA and COC constant) is -21.47. It is negative and insignificant, yet it is composed of direct and indirect effect of FRQ on Underinv of listed DMBs in Nigeria. On the other hand, model seven (mediated) regression results indicate that the direct effect of FRQ on Underinv is -16.0074. It is also negative and insignificant. In line with Kenny*y*'s (2016) argument (that the effects are considered in absolute value), the total and direct effects are 21.47 and 16.0074 respectively. Hence, the mediated effect as shown in Table 9 is 5.46259, and it is the reduction in absolute value of total effect as a result of introducing the two mediators (IA and COC) in sequence.

In other words, the mediated effect is an indirect influence of FRQ on Underinv that is transmitted through IA and COC. Moreover, since the introduction of IA and COC in model seven has caused reduction in the effect of FRQ on Underinv (16.0074 rather than 21.47 recorded in model one), then, IA and COC are said to be partially mediating the relationship between FRQ and Underinv, and that FRQ affects Underinv via IA and COC of listed DMBs in Nigeria. This supports Ayagi and Kurawa (2019) and

contradicts Nurcholisah's (2016) findings which suggest that IA could not mediate the relationship between FRQ and Underinv. Moreover, $H0_{7A}$ cannot be rejected since the indirect/mediated effect of FRQ on Underinv is not significant as suggested by the insignificant coefficients found in respect of the mediating variables.

Table 10: Regression results (OLS robust) of model seven (FRQ, IA, COC and Overinv)

	Unmediated FRQ and Overinv (OLS robust)			Mediated FRQ, IA, COC and Overinv(OLS)			Difference	
Variables	Coeff.	T	p>/t/	Coeff.	T	p>/t/	Mediated effect abs.(a1-g1)	Sig. level (Mediators)
Constant	-0.18	-1.39	0.17	-0.117	-0.91	0.366		
FRQ	-2142.2*	-1.82	0.075	-2023.4**	-2.16	0.036	118.8	
IA				-0.034	-1.45	0.153		not sig.
COC				0.059	0.66	0.514		not sig.
BVPS	-0.007	-2.36	0.22	-0.009***	-2.94	0.005		
ROA	-0.329	-0.73	0.472	-0.334	-0.69	0.493		
CFO1	0.000	3.89	0.000	0.000*	1.82	0.075		
IFRS	-0.048	-1.63	0.108	-0.058**	-2.1	0.041		
Mean VIF			1.63			1.84		
Hottest			0.0148			0.02		
Hausman			0.8834			0.937		
xttest0			1.000			0.445		
R2			0.2808			0.3132		
Adj. R^2			-			0.1651		
F			28.81			-		
Prob > F			0			0.036		

Source: STATA 13.0 outputs based on data generated (2008 - 2017)
, and *** mean significant at the 10% , 5% and 1% level respectively.*

To test $H0_{7B}$, the regression results of both unmediated and mediated models of the study in respect of Overinv are presented in Table 10. The t statistics and p-values of the mediators show that they have insignificant influence on Overinv. The absolute value of the total effect of FRQ on Overinv as presented under unmediated is 2142.16 and is significant at 10%. The absolute value of the direct effect (2023.44) under mediated model is also significant at 5%. The mediated effect, as can be observed from the Table is 118.8. It represents reduction in the total effect and also the indirect effect of FRQ on Overinv which is exerted via IA and COC.

Moreover, the mediated effect (118.8) suggests that IA and COC mediate the association between FRQ and Overinv and that FRQ has indirect effect on Overinv of listed DMBs in Nigeria. Furthermore, since with the inclusion of IA and COC in Model Seven, the total effect has not been reduced to zero, this paper considered them to be partially mediating the relationship. This finding agrees with Ayagi and Kurawa (2019) and disagrees with Nurcholisah's (2016) result which shows no proof to suggest that IA transmits the effect of FRQ to Overinv. Moreover, $H0_{7B}$ cannot be rejected, since the mediated effect of FRQ on Overinv is insignificant.

5. Conclusion

The following conclusions were drawn by the current study based on the analysis of models' results:

i. The extent of investment inefficiencies (Underinv and Overinv) in listed DMBs reduces with improvement in financial reporting.
ii. The IA between listed DMBs (or specifically, their banks' managers) and finance providers diminishes with high quality financial reporting.
iii. With high level of IA, listed DMBs in Nigeria will continue to incur higher cost of financing capital projects.
iv. Listed DMBs in Nigeria will continue to experience investment inefficiencies (especially, Underinv) if the cost of borrowing is on the higher side.
v. Provision of relevant, reliable, accurate and timely information by listed DMBs in Nigeria plays significant role in reducing the level of IA in the Nigerian capital market which consequently reduce the banks' cost of borrowing.
vi. Through its effect on COC, IA will continue to worsen the extent of Underinv problems in the Nigerian listed DMBs.
vii. FRQ affects both Underinv and Overinv directly and indirectly through its effect on IA and COC of listed DMBs in Nigeria. In otherwords, IA and COC mediate the relationship between FRQ and Underinv/Overinv in the Nigerian listed DMBs and so, quality financial reporting is a medium through which investment inefficiencies can be reduced in the industry.

The following recommendations were offered based on conclusions drawn:

i. The listed DMBs in Nigeria should adopt the practice of providing the capital providers with higher quality financial reports so that the level of IA and COC will reduce significantly to enable financing of viable investment projects of the banks. The information about capital investments proposals that the banks disclose voluntarily should be accurate and comprehensive enough to enable investors to assess the profitability of the projects and true financial state of the banks.
ii. Regulatory bodies (SEC, CBN and FRC) should ensure that the financial reports being published by listed DMBs in Nigeria provide the relevant information that assist the capital providers in assessing proposed projects' viability and true risk of investing in the banks. Regulating the content of the relevant information to be disclosed and forcing full compliance with IFRS can play significant role in this respect.
iii. To reduce the level of IA and hence COC, and to also expand the potential pool of their capital, First Bank and Zenith Bank maintain Investor Relation Function/Unit which manages relations between the banks and their investors. Thus, other listed banks should emulate this gesture by maintaining similar units/functions. For, that will be making it possible for investors to know more about the banks' investment proposals thereby enabling the banks to raise funds at reasonable rate.

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