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- Examining the Association between Optimal Hedging Strategy and Cost of Capital: Evidence from Egypt**
Menna Gamal, Magdy Abdel-Kader, and Kholoud Abdelkarim 1-12
- Educating the Next Generation of Accountants: Linking Learning Objectives and Cognitive Ability**
Matthew J. Sargent and Bradley G. Winton 13-30
- Perceived Talent Management and Turnover Intention: Mediating Role of Career Adaptability**
Abdullah Khalfan Alrushadi, Kamisah Supian, and Nor Azah Jahari 31-41
- The Impact of Electric Vehicles on Automotive Aftermarket in 4-Wheeler Car Segment**
Saurav Nandi, A. Seetharaman, K. Maddulety, and Nada Sayarh Lebbar 42-56
- Green Footprint Through the Development of a Sustainability Reporting Concept for Karangpring Village**
Siska Aprilia Oktaviani, Fitriya Andriyani, Oryza Ardhiarisca, Prillinaya Yudhistira, Berlina Yudha Pratiwi, and Dessy Putri Andini 57-73
- Costing Techniques in Supply Chain Cost Management: A Systematic Literature Review**
Bilkis Akhter and Md. Maksudur Rahman Sarker 74-97
- Exploring ESG Corporate Tax Honesty Behind Ownership Structure and Financial Constraints**
Agustina R. Pangaribuan and Dielanova Wynni Yuanita 98-114
- Is Covid-19 the Ideal Period for Boosting the Use of Impression Management in Annual Reports?**
Ruksana Parvin 115-140
- Unveiling the Nexus of Digital Transformation and Change Management: A Pioneering Bibliometric Analysis**
Pallavi Singh, Rinki Joshi, Prachi Pathak, and Vaishali Aswal 141-161
- The Role of Government Internal Supervisory Apparatus and Corruption Control on Regional Independence**
Deswita Martinez, Rudy Usman, and Latifah Sukmawati Yuniar 162-175

Examining the Association between Optimal Hedging Strategy and Cost of Capital: Evidence from Egypt

Menna Gamal*
Magdy Abdel-Kader†
Kholoud Abdelkarim‡

Abstract

This paper aims to examine whether the adoption of the optimal additional hedging strategy, which was developed through an optimization model by Ebach et al. (2016), contributes to reducing the cost of capital (COC) arising from the high degree of the risk of earnings volatility which induced by way of measuring financial derivatives at fair value method. The analysis is performed on all 13 Egyptian banks listed in Egyptian exchange (EGX 100) from 2015-to 2020, resulting in 78 observations. Pearson correlation and multiple regression analysis are used to test the research hypothesis. Findings of the study showed a strong negative significant association between the optimal hedging strategy (OHS) and COC, which implies that the application of the optimal additional hedging strategy developed by Ebach et al. (2016) leads to reducing the costs of earnings volatility which represents the COC.

Keywords: optimal hedging strategy (OHS), earnings volatility, financial derivatives, fair value method, cost of capital (COC).

I. INTRODUCTION

Risk can be described in different ways, but the most common explanation about risk is the uncertainty of meeting goals or the potential loss and incomplete control over the outcomes of decisions; furthermore, risk management is the process of identifying those uncertainties to achieve the firm's goals effectively (Malz, 2011). Because hedging is one of the most essential and standard techniques of risk management, the terms "hedging" and "risk management" are used somewhat interchangeably in the existing literature (Barnes, 2001).

Hedging involves adopting strategies and employing techniques to reduce risks that the firm may face. However, Derivatives are one of the most common instruments which can be used for financial risk management and hedging purposes; in other words, derivative is defined in paragraph 9 of IAS 39 as a financial instrument that is settled at a future date or other contracts that its value changes in response to the change in the value of the underlying asset such as a specified interest rate, financial instrument price, commodity price, foreign exchange rate, index of prices or rates, credit rating or credit index, or another variable.

Derivatives play a vital and basic role in hedging and risk management, in other words, derivatives can contribute to minimizing and transferring the risk from hedgers who don't want to bear the risk to other parties who are willing more to bear the risk.

* Accounting and Finance Department, Cairo University, Cairo, Egypt. E-mail: menna_1989@live.com.

† Accounting Department, Cairo University, Cairo, Egypt. E-mail: Magdy.Abel-Kader@foc.cu.edu.eg.

‡ Accounting Department, Cairo University, Cairo, Egypt. E-mail: Kholoud_abdelkarim@foc.cu.edu.eg.

Correspondingly, investors can also use derivatives for speculation and arbitrage purposes. Additionally, a derivative is defined by the BIS (1995) as “a contract whose value depends on the price of the underlying asset, but it doesn’t require any initial investment of principal in those assets”. Subsequently, derivatives can contribute to adding balance to the business and its financial transactions by reducing risks associated with it.

On the other hand, derivatives are measured at fair value in the balance sheet, so any changes in the fair market values of derivatives will affect the firm’s reported earnings and this will lead to increasing the risk of earnings volatility (Duh et al., 2012; Hodder et al., 2006). A considerable number of prior studies have proved that income smoothing is considered one of the effective measures that can reduce the degree of earnings volatility (Fudenberg & Tirole, 1995; Kanagaretnam et al., 2003). At the same time, Rountree et al. (2008) demonstrated that using hedging activities is negatively associated with earnings volatility, which means that hedging activities can reduce cash flow volatility and therefore generate positive market values.

The risk of earnings volatility is a significant source of business risk that can increase earnings uncertainty, risk premium, and raise the cost of capital (COC). (Brushwood et al., 2016). Munteanu (2011) defined COC as the cost of a firm’s funds and it consists of two components are the cost of debt and cost of equity, from an investor’s point of view, COC can be defined as the minimum rate of return which the investor accepts to earn on the securities issued by the company.

The COC is considered an essential item that can be used in the decision-making process of financial management. It helps evaluate capital investment proposals according to net present value (NPV) and internal rate of return (IRR). Furthermore, the COC can be helpful to compare between the alternative sources of funds to select the best alternative in terms of minimum cost and maximum return (Franceys et al., 2011; Krichene, 2013; and Satyannarayana, 2016).

Besides, the COC is the minimum rate of return that a firm must earn on its investment to maintain the firm’s market value and attract funds to a particular investment. Moreover, the COC is considered the required rate of return which belongs to equity, debt and retained earnings. However, if the firm earns a return lower than the expected return, the market value will decline and therefore it will cause a major reduction in the shareholders’ wealth (Paramasivan & Subramanian, 2009; Satyanarayana, 2016).

Ebach et al. (2016) developed an optimization model which accounts for the COC resulting from the high degree of earnings volatility risk when deciding the optimal hedging strategy (OHS) by proposing a quantitative model which represents the trade-off between the (utility of) costs of earnings volatility and the reduction of expected returns resulting from additional hedging based on a research project initiated by a large German bank. The study demonstrated that the hedging of earnings volatility according to the risk-return profile of the organization can lead to reducing the degree of earnings volatility, but it can’t fully capture the effects of earnings volatility in the income statement. So, the remaining earnings volatility may require more effective and additional degree of hedging to entirely eliminate any adverse effects in the income statement and maximize utility.

Based on the given theoretical and empirical insights, the objective of this study is to investigate whether the adoption of the OHS suggested by Ebach et al. (2016) can help to reduce the COC resulting from the high degree of earnings volatility induced by fair value accounted financial derivatives used by financial institutions in one of the developing countries in the middle east, Egypt.

However, many previous empirical studies seek to examine hedging strategies and techniques which contribute to minimizing the risk of earnings volatility, but they provided little evidence about how to reduce the costs associated with earnings volatility because costs of earnings volatility require an additional type of hedging to be eliminated. This calls for a need for a hedging strategy that aimed to mitigate not only the risk of earnings volatility but also reduce the COC, so this study contributes to accounting and finance literature in several ways. First, to the best of the authors' knowledge, it is considered to be the first study in Egypt that investigates and determines the OHS, which focuses mainly on reducing costs associated with a high degree of earnings volatility resulting from the way of measuring derivatives at fair value by following an optimization model developed by Ebach et al. (2016). Second, this study can help organizations better understand the risk of earnings volatility and its effects on the derivative portfolio by providing some initial and important guidelines. Finally, the study of Ebach et al. (2016) used only simulated data to determine the OHS which can help to minimize the costs of earnings volatility; however, this study contributes to the prior literature by using secondary data related to the Egyptian listed banks and the regression analysis to analyze this data.

The remainder of this paper is organized as follows. Section 2 provides a theoretical background concerning the research variables. Section 3 explains and reviews the theoretical and empirical literature which examines the impact of applying and adopting hedging strategies on the COC followed by the hypothesis development. Section 4 develops the research model. Section 5 presents the sample and data collection. Section 6 outlines the research design. Section 7 discusses the results. Finally, Section 8 concludes some recommendations for future research.

1.1. Background

The concept of hedging first emerged in Japan in the late 17th century. It is considered the inception of the future market in rice to help suppliers protect themselves from risks associated with bad weather. The future derivative market was first created in the USA with the Chicago board of trade, created in 1848, allowing investors to trade wheat, pork belly, and copper futures as early as in the 1860s.

Stulz (1984) discussed the managerial risk aversion theory, which stated that risk-averse managers tend to adopt hedging strategies because they don't want to bear risks, so they have incentives to use derivatives as financial hedging instruments to minimize risks maximize their personal wealth.

Mian (1996) confirmed that hedging is engaging in some activities aimed at smoothing the volatility in the value of an investment and mitigating the impact of uncertainties associated with this volatility. Nance et al. (1993) presented the concept of "corporate hedging". They defined it as the use of off-balance sheet instruments such as forwards, futures, swaps, and options to reduce and mitigate the volatility in the firm's value.

Many empirical studies and theoretical work supported the negative relationship between high-quality disclosure and COC, concentrating on the central information of disclosure, "earnings volatility". Beaver et al. (1970) were among the majority of earlier researchers who first examined whether earnings volatility can affect the degree of riskiness associated with the firm's stocks. Findings indicated that earnings volatility can increase the risk of the firm's stocks and raise the capital cost. Also, Hodder et al. (2006) supported those findings by documenting that earnings volatility is associated with the required rate of equity capital.

Furthermore, the establishment of a proper and sound risk management system in terms of perfect and effective hedging can result in enhancing the firm value by reducing cash flow and earnings volatility as documented by Minton and Schrand (1999) and Allayannis et al. (2005) and thus leading to reducing costs of financial distress, COC, taxes, and agency costs. So, this research can fill the gap in prior literature by providing empirical evidence on whether the adoption of an OHS can help financial institutions minimize the COC associated with the risk of earnings volatility resulting from measuring financial derivatives at fair value method. Findings of the study documented that the adoption of the OHS developed by Ebach et al. (2016) can effectively lead to reducing the cost of capital resulting from the high degree of earnings volatility risk.

II. LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

Derivatives hedging contributes to the business and its financial transactions by minimizing risks associated with it; this will reduce the risk premium charged by investors and thus reduce the COC. Stulz (1984) presented a model that introduced active hedging policies to firms seeking to maximize its value; the model also examined the role of managerial compensation, contracts, exchange rate dynamics, and hedging costs. Results of the model showed that the application of optimal hedging policy which was developed by the study aimed at maximizing the value of the firm and thus reducing the COC, findings also reported that the developed model derived optimal hedging policies for risk-averse agents in case of the uncertainty about future commodity prices and holding costs for hedging positions.

Besides, Ebach et al. (2016) developed an optimization model which accounts for the costs of earnings volatility when deciding the OHS, this study seeks to determine the OHS that aimed at lowering the COC resulting from the high degree of earnings volatility by presenting a quantitative model which represents the trade-off between the (utility of) costs of earnings volatility and the reduction of expected returns resulting from additional hedging based on a research project initiated by a large German bank. Results of the proposed model showed that adopting the OHS contributes to minimizing the COC related to the risk of earnings volatility induced by way of measuring derivatives at the fair value method.

Bhagawan and Lukose (2016) emphasized that firms with high currency risk and financial distress costs tend to use more derivatives by empirically examining the determinants of derivatives usage using a sample of 332 Indian firms from S&P CNX 500. Findings of the study indicated that Indian firms tend to use more currency derivatives to hedge against its higher currency risk and, therefore, reduce the financial distress costs. In the same vein, Mo et al. (2021) documented a significant negative relationship between the firm's financial distress and its hedging behavior by using a sample of 92 Canadian, publicly-traded oil extraction firms during the period from 2005- to 2015.

Moreover, Coutinho et al. (2012) stated that after the 2008 crisis in Brazil, large corporations tended to use currency derivatives as a risk management tool to reduce the COC by using a sample consisting of 47 nonfinancial Bovespa Listed Brazilian companies during the period from 2004- 2010. Similarly, Deng et al. (2017) confirmed that during the non-crisis period, banks tend to use derivatives hedging to allocate risks rather than reduce them, and this would result in higher cost of debt, but during the crisis period, banks used derivatives hedging to reduce risks and thus reducing the cost of debt. The study used a sample consisting of 5076 bond-quarter observations of 495 bonds issued by 70 bank holding companies.

Furthermore, Alam and Gupta (2018) compared firms engaged in hedging and non-hedgers and whether the adoption of hedging strategy could enhance the company value by using a sample consisting of 129 top non-financial Indian companies from 2008-2015. Additionally, Hadian and Adaoglu (2020) examined the effect of financial and operational hedging on company value by focusing on developed markets which depend on managed floating exchange rate regimes. The study used a sample of 109 Malaysian multinationals covering the period from 2004-2018. On the other hand, Aretz et al. (2007) outlined the main theories in literature, which suggested that corporate risk management and corporate hedging would reduce agency costs, reduce cost of debt, direct and indirect costs of bankruptcy, and thus enhancing shareholder value.

Chen and King (2014) provided strong evidence that hedging can reduce the cost of debt by minimizing bankruptcy risk, reducing agency costs, and reducing information asymmetry using a sample of 2612 USA firms and 13,066 bond issues over the period from 1994-2009. Ahmed et al. (2018) also documented that derivative hedging reduced the cost of equity capital and financial distress risk using a sample of 357 German non-financial firms with 1984 firm-year observations from 1999-2009.

On the other hand, Sharfman and Fernando (2008) introduced a new strategy of developing the risk management system by improving the firm's environment using a sample of 267 largest publicly held firms in the United States. Amaya et al. (2015) also developed a dynamic risk management model to determine the optimal risk management strategy in terms of optimal leverage, which would maximize the firm value and minimize the COC using a sample of 854 industrial firms during the period from 1990-2009.

By reviewing and analyzing the literature which examined the relationship between hedging strategies and the COC, it can be concluded that there is a negative association between the adoption of hedging strategies and the COC. In other words, firms tend to use hedging strategies to mitigate the risks which contribute to improving the performance, enhancing the reputation of the firm, increasing the firm value, increasing the investors' confidence about the firm, and thus reducing the risk premium charged by investors and minimizing the COC. Also, firms that face financial distress or economic downturns tend to use hedging more to mitigate the degree of risks, leading to increasing the risk premium charged by investors to bear the tremendous amount of risks that may exist in these circumstances and thus increasing the COC. By following the optimization model developed by Ebach et al. (2016) to capture and eliminate the negative impacts of the risk of earnings volatility that appear in the income statement and lead to increasing COC. So, the hypothesis can be formulated and derived as follows:

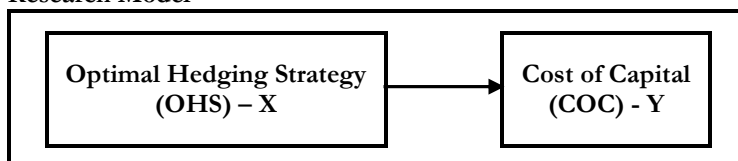
H_a: there is a negative relationship between the adoption of optimal hedging strategy and the cost of capital.

III. RESEARCH METHODOLOGY

3.1. Research Model

The following Figure 3.1 can clarify the relationship between the main variables of the study:

Figure 3.1
Research Model



3.2. Sample and Data Collection

This study used all the 13 Egyptian banks listed in the EGX 100 index to ensure that all the selected banks follow the central bank of Egypt rules in preparing and presenting financial statements. Furthermore, the study needs only market data to be analyzed according to each variable; so, only listed banks are selected. The final selected banks for the study cover the period 2015-2020 in Egypt. Accounting and market data related to banks of the study are collected from banks' annual reports available at Egypt for information dissemination company database, websites of banks, Thomson Reuters, and investing.com databases.

3.3. Research Design

3.3.1. Variables measurements

The dependent variable: the COC is the weighted sum of the cost of equity and the cost of debt for a firm (Modigliani & Miller, 1958). Soh (2011) argued that the firm's capital structure consists of debt and equity and the combination of these sources of finance constitutes the overall COC of the firm.

Following Coffie et al. (2018), the COC will be measured as:

$$WACC = (1-T) \times Kd \times (D/V) + Ke \times (E/V) \dots\dots\dots 1$$

Where:

T : tax rate

Kd : cost of debt = Interest rate \times (1 - Tax rate)

Ke : cost of equity (RRR) = Risk-free rate + (β \times Market risk premium)

D : the percentage of debt used by the firm.

E : the percentage of shareholders' equity in the firm.

V : value of the firm is the sum of total debt and equity finance used by the firm.

The independent variable: the OHS aimed at reducing costs associated with increasing the degree of earnings volatility. The research followed an optimization model developed by Ebach et al. (2016); it is a quantitative model representing the trade-off between (utility of) costs of earnings volatility and the reduction of expected returns that the organization sacrificed against the decrease in the costs of earnings volatility.

The OHS can be determined by maximizing the difference between the expected return $r(y)$ and the utility associated with costs $c(y)$:

$$\max(G) = \max \sum_{yt=0}^{tn} G(yt) = \max r(y) - c(y) = \sum_{yt=0}^{tn} r(yt) - c(yt) \dots\dots\dots 2$$

Where:

G(y): the objective function that represents the trade-off between the utility associated with costs of earnings volatility and expected returns.

r(y): the expected return that will be measured using the CAPM model (Risk-free rate + (β \times Market risk premium))

c(y): the utility associated with reduction of costs of earnings volatility COC.

So, the OHS which can be interpreted as the objective function G(y) can be determined by subtracting the utility function c(y) from the return function r(y). Nevertheless, the bank can achieve the maximum degree of the optimal additional hedging when the value of G(y) reached its maximum level when earning volatility is costly, which means that the additional OHS can successfully reduce the costs associated with the high degree of earnings volatility.

Insert Table 3.1 here.

3.3.2. Regression model

The relationship between OHS and COC will be estimated using the following basic multiple regression model:

$$WACC_{it} = \alpha + \beta_1 OHS_{it} + \beta_2 XixXt + \beta_3 SIZE_{it} + \beta_4 ROA_{it} + \beta_5 LEV_{it} + \epsilon_{it} \dots\dots\dots 3$$

Where:

$WACC_{it}$: the proxy of COC in the bank (i) during year (t).

OHS_{it} : the proxy of optimal hedging strategies in the bank (i) during year (t).

$X_i * X_t$: year fixed effect and firm fixed effects.

$SIZE_{it}$: it is a control variable which refers to the bank size during year (t).

ROA_{it} : it is a control variable which refers to the return on assets related to bank (i) during year (t).

LEV_{it} : it is a control variable which refers to leverage related to bank (i) during year (t).

ϵ_{it} : the error term.

Table 3.1

Variables Definitions and Measurements

Variables	Abbreviation	Proxies Measures	Data Source
Independent Variable	Optimal Hedging Strategy (OHS)	It is measured by the optimization model developed by Ebach et al. (2016) by subtracting the costs of earning volatility from the expected return: $\max(G) = \max \sum_{tj=0}^{tn} G(yt) = \max r(y) - c(y) = \sum_{tj}^{tn} r(yti) - c(yti)$.	✓ Investing.com ✓ EGID database ✓ Thomson Reuters database ✓ Financial Statements
	Dependent Variable	Cost of Capital (COC)	It is measured by the WACC formula: $WACC = (1-T) \times Kd \times (D/V) + Ke \times (E/V)$
Control Variables	Bank Size	Natural logarithm of total assets	Financial Statements
	Lev	Total debt/total debt+ total equity	
	ROA	Net income/total assets	

IV. RESULTS AND DISCUSSION

4.1. Empirical Results

Table 4.1 shows the descriptive statistics of WACC, OHS, and control variables which are bank size, lev, and ROA, this table comprises the mean, standard deviation, minimum and maximum values of each variable used in the analysis

Table 4.1

Descriptive Statistics for the Annual Data for the Period 2015–2020

Variable	Obs.	Mean	Std. Dev.	Min.	Max.
WACC	78	-0.789	2.168	-10.081	0.449
OHS	78	10.144	24.379	-0.073	117.269
Bank size	78	17.939	0.738	16.379	19.870
Lev	78	0.911	0.027	0.854	0.954
ROA	78	0.018	0.010	0	0.047

The mean of WACC is -0.7898818 with a standard deviation equal to 2.168, the maximum value of WACC is 0.449 while the minimum value equals to -10.081 which indicates that there are great differences related to WACC between the banks of the study. According to OHS, the mean is 10.144 with a standard deviation equal to 24.379, the maximum value of OHS is 117.269 while the minimum value equals -0.073 which indicates also there are great differences related to OHS between the banks of the study.

Furthermore, the mean of bank size is 17.939 with a standard deviation equal 0.738, the maximum value of bank size is 19.870 while the minimum value equals to 16.379. This refers to that there are no great differences in the bank size between the

banks of the study. According to lev, the mean is 0.911 with a standard deviation equal 0.027, the maximum value of lev is 0.954 while the minimum value equals 0.854 which indicates that there are no great differences in the lev between the banks of the study. Additionally, the mean of ROA is 0.018 with a standard deviation equal to 0.010, the maximum value of ROA is 0.047 while the minimum value equals zero and this indicates also that there are no great differences related to ROA between the banks of the study.

Table 4.2

Pearson Correlation Analysis for the Period 2015-2020

Variables	WACC	OHS	Bank Size	LEV	ROA
WACC	1	-0.953***	-0.148	0.246	-0.250
OHS	-0.953***	1	0.114	-0.116	0.141
Bank Size	-0.148	0.114	1	-0.333	0.358
LEV	0.246	-0.116	-0.333	1	-0.705
ROA	-0.250	0.141	0.358	-0.705	1

Note: *** significant at a level less than (5%).

Table 4.2 displays the Person's (Spearman) correlation coefficient between the dependent variable (WACC) and the independent variable (OHS). The correlation analysis shows that there is a strong negative correlation (-95.3%) between OHS and WACC with a p-value equals 0.000, which indicates a highly significant strong negative correlation between OHS and WACC even after controlling for bank size, leverage and Return on Assets (ROA), which means that the adoption of the optimal additional hedging leads to reducing the COC resulting from the earning volatility risk associated with using of financial derivatives by banks.

Table 4.3 shows the regression results, according to the first column, which shows the value of R that displays the parameter of the OHS because of its importance in predicting the COC (WACC), the value of R demonstrates that the OHS affects strongly and negatively the COC (WACC) ($r = -96.3\%$) after controlling for bank size, leverage, and ROA which means that the additional practice of the OHS can contribute to minimizing the COC resulting from the earnings volatility. The second column displays the coefficient of determination which implies the Independent Variable which is OHS is accepted in the model, the value of adjusted R square, which appears in the third column, equals 92.8%, which means that OHS explains (92.8%) from a total variation of the dependent variable, COC (WACC).

Regarding the t-test which appears in the fourth column, this test is useful in determining the significant level of each of the coefficients of the independent variable in the regression model. The independent variable, the OHS, has the most significant value equals 000000.

Additionally, the F test, which appears in the fifth column, is a test to determine the degree of linearity between the dependent variable (y) and a subset of the independent variables. Since the value of the "F test" is (233.847) with significance at the (.000) level, then the researcher concludes that the independent variable which is OHS is accepted in the model and this also indicates the validity of the model in the interpretation of the association between the variables of the research.

Finally, the last column which shows the value of VIF, stands for variance inflation factors that are useful measures of multicollinearity, the larger value of VIF indicates that there is a higher degree of multicollinearity between some independent variables. Moreover, some authors have suggested that if the value of VIF exceeds 10, it means that there is a multicollinearity problem between some independent variables. Other authors consider this value too liberal and suggest that the value of VIF should not exceed

4 or 5. As shown in Table 4.3, the value of VIP is less than 4, therefore the model has not suffered from the multicollinearity problem.

Table 4.3

Regression Results of the Relationship between Optimal Hedging Strategy (OHS) and Cost of Capital (COC)

No.	Independent Variables	R-value (%)S	Estimated Coefficient	Adjusted R square (%)	t-test		F test		VIF
					Value	Sig.	Value	Sig.	
1	Constant		-8.210		-2.073	0.042	233.847	.000	
2	OHS	96.3%	-0.083	92.8%	-29.32	0.000			1.025
3	Bank size		0.032		0.324	0.747			1.170
4	Lev		8.622		2.438	0.017			2.021
5	ROA		-9.539		-0.993	0.324			2.071

It can be concluded from the above regression model results that there is a highly strong negative significant association between OHS and COC. This is consistent with the results of Bhagawan and Lukose (2016), Ahmed et al. (2018) and Mo et al. (2021). Therefore, it implies that the adoption of the optimal hedging strategy suggested by Ebach et al. (2016) leads to reducing the cost of capital associated with the high degree of earnings volatility risk which results in supporting and accepting the research hypothesis.

V. CONCLUSION

This paper investigates the impact of the adoption of an optimal additional hedging strategy developed through an optimization model by Ebach et al. (2016) on the COC arising from the risk of earnings volatility induced by measuring financial derivatives at the fair value method. The research data belongs to all 13 Egyptian listed banks in EGX 100 from 2015-2020. Moreover, multiple regression analysis is used to test the research hypothesis, results of the regression analysis demonstrated that the application of the additional OHS leads to successfully eliminating the negative impacts of earnings volatility which appear in the income statement and therefore reducing the COC which indicates that the empirical evidence of the research supports and accepts the research hypothesis.

However, this research is subject to some limitations that should be taken into consideration in order to develop and suggest some recommendations and opportunities for future research. First, this research focused its investigation on the Egyptian environment only especially on the banking sector. Future research can extend the study by examining the association between variables in other countries especially developed ones with more stable economic conditions using different sectors.

Additionally, the research measured the cost of capital using WACC, however, the cost of capital can be measured using various measurement tools and models such as Ohlson and residual income models. Future research can test the relationships between variables and compare results using different measures of the cost of capital.

Besides, the findings of the research are important for bank regulators not only in Egypt but also in the emerging markets in order to effectively adopt hedging strategies which help to successfully mitigate business risks and reduce the cost of capital resulting from those risks and therefore contribute to enhancing the performance, reputation, and efficiency of the banking sector.

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Appendix A

The 13 Egyptian Listed Banks Which Are Used in the Analysis and Testing of the Research Hypothesis

No.	Bank
1.	Commercial International Bank (CIB)
2.	Credit Agricole Egypt
3.	AlBaraka Bank Egypt
4.	Egyptian Gulf Bank
5.	National Bank of Kuwait-Egypt
6.	Export Development Bank of Egypt
7.	Faisel Islamic Bank of Egypt
8.	Housing and Development Bank
9.	Qatar National Bank AlAhly
10.	Abu-Dhabi Islamic Bank-Egypt
11.	Union National Bank-Egypt
12.	Société ArabeInternationale de
13.	Suez Canal Bank