

The extent of how financial determinants influence corporate use of derivatives

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Abstract

The goal of this study was to determine the extent of how financial determinants influence corporate use of derivatives for 473 firms in the US. Four hypotheses were developed for this study and to be researched on which include; there is no statistically significant influence of CFO experience in using derivatives on corporate use of derivatives, there is no statistically significant influence of current ratio on corporate use of derivatives, there is no statistically significant influence of leverage on corporate use of derivatives and there is no statistically significant influence of net profit ratio on corporate use of derivatives

Financial determinants on corporate use of derivatives in this study were CFO past experience in using derivatives, current ratio, leverage and net profit ratio. Data was collected using Compustat Execucomp, Compustat North America and Center for Research in Security Prices (CRSP). The data was merged in Stata, SPSS and Ms Excel platforms using fiscal year and several identifiers. The study period is from 1989 to 2018 and a total of 7931 CFOs from the 473 firms were selected. The study used a unique, manually collected dataset that was retrieved from Google and Bloomberg.

Analysis of data will comprise descriptive statistics, correlation matrices, analysis of variance and multivariate analysis. Presentation of the final output will be in form of frequency tables, measures of central tendencies, measures of variations and graphical expressions. The study used both descriptive and inferential statistics so that it can give an insight into the firm's characteristics in the sample and diverse statistical techniques like the Karl Pearson correlation. In multivariate analysis, multi linear regression model was used in explaining the relation that exists in derivatives usage and the financial determinants.

The study findings indicated that the independent variables; CFO past experience in using derivatives, current ratio, leverage and net profit ratio turned out to be statistically significant with the corporate use of derivatives. Additionally, this revealed there was a statistically positive significant relationship of CFO experience on corporate use of derivatives. It was also noted that CFO experience had moderate correlation with corporate use of derivatives. The current ratio and corporate use of derivatives had a negative correlation. The explanatory strength of leverage on corporate use of derivatives was significant with a negative relationship. It was also noted that leverage had negative correlation with corporate use of derivatives. Net profit ratio and corporate

use of derivatives had a positive relationship. This was slightly higher as compared to the other determinants as it accounted significantly the variability of change in corporate use of derivatives. Net profit ratio and corporate use of derivatives also had a positive moderate correlation.

Study findings still have to be further developed in future like the new financial determinants of corporate derivatives usage by conceptual investigations. The models for corporate risk management can be revamped to suit existential observations better. More companies can be included in future research to determine their financial determinants influence on corporate use of derivatives.

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Chapter one: Introduction

1.1 Background

Financial institutions are facing an increasingly volatile global economic environment, diversified market demand, progress in information technology, development of financial theory and financial engineering technology. This has led on the question of how the CFO experience and networking may potentially cultivate their optimistic behavior. Graham, Harvey and Puri (2013) indicated that the CFO career experience and their effect on corporate decision making is very important because the risk tolerant CFOs made more acquisitions and optimistic CFOs used more debt.

Based on finance theories, the managers act sensibly and they take into consideration the availability of information in making their decisions in investment (Vasile, Sebastian & Radu, 2012). A comparison was created by Jensen and Meckling (1976) which introduced the Agency Theory, between the traditional and conventional views of corporate finance by bringing out the conflict of interest among companies' management and stakeholders. Therefore this takes into account the role of managerial traits in terms of prior experiences in corporate policies and decision-making as some might make decisions in their favor and against the stakeholder's wishes.

Executive rewards are used to reduce most of the agency costs where the incentives of shareholders and executives vary from each other, especially the compensations plans which are laid out to give shareholders the same incentives as the executive. When executives are in charge then they create worth for shareholders, compensation and utility for themselves. However, the compensation schemes can be designed in a way that shareholders will anticipate their worth to be maximized. This will lead to crisis when an optimal contract is constructed which means that flow of cash will rely on the probability that the executive has to meet the required target by shareholders hence making it difficult to set the exact level of incentive compensation (Murphy,1999).

Corporate use of derivatives has become popular in the recent years which refer to diverse instruments like the futures, swaps and options as corporations are in search of modern and

contemporary ways that will control the financial and operating risks. (Kenneth A.Froot, David S.Scharfstein and Jeremy C.Stein) introduced a guide that will assist managers in coming up with a coherent risk management strategy.

Therefore the CFO's should ensure that daily decisions that comprises the use of derivatives continue to exist inside the sovereignty of corporate financial staff, how they should disclose their derivatives position, the kind of training and control systems required.

There has been an uptrend in derivatives securities among the corporations. Studies that were done depicted how firms engaged in managing risk. In accordance with insights of Modigliani and Miller (1958), is that the division value of the firm among shareholders is affected by financial policy decisions. However, recent studies cited that management of risk added profit to a firm if capital market flaws are there for instance the costs of financial distress, progressive tax rates and conflicts of interest.

1.2 Financial derivatives

The financial derivatives are financial instruments that comprise the fundamental assets whose worth lies on other more elementary variables. The target variable to which it is attached can be almost any variable. Various types of financial derivatives exist in the world, and dynamic financial innovation ventures are in progress to invent brand new derivatives. There are several stratification methods for financial derivatives.

According to product form, it can be divided into four categories: forward, futures, options and swaps. Forms of transactions; the forward contracts and futures contracts are what the parties consent to buy and sell given a specific quantity of asset at a particular price at a within a specified time in future. The futures exchange inaugurated the futures contract which is a systematized contract that specified the contract expiration date, type, quantity and quality of the assets it buys and sells. While a forward contract is signed between the buyer and the seller in accordance with the special needs. Therefore, future trading refers to highly liquid and forward trading is less liquid.

Contract that is signed between two parties in exchange for an asset at a certain time in the future is referred to a swap contract. Meticulously, a swap contract refers to parties making an

agreement to exchange cash flows of what they trust to be fair economic worth for duration of time in the future. We have the two most common swaps; interest rate swap contracts and currency swap contracts. If the exchange currency stipulated in the swap contract is of the same currency then it is the interest rate swap but if it is a foreign currency then that is a currency swap.

Trading of the right to buy and sell is referred to as option trading. This stipulates the right to buy or sell a given type, quantity, and quality of a particular asset at a given duration of time and price. Option contracts have regulated contracts which are itemized on the exchange, as well as non-regulated contracts which are traded over the counter.

As stated in the trading method, option trading can be divided into two; on board trading and off board trading. On board trading is also referred to as exchange trading which implies that the trading methods have the supply and demand sides focus on the exchange for bidding transactions. This means that the transaction has the attributes that the exchange collects the deposit from the trading participants and is accountable for liquidation and performance guarantee obligations. Additionally, each investor has varied needs which mean that the exchange has designed a regulated financial contract beforehand so that the investor can decide on which contract is closest to his or her needs for trade. Entirely the trader's focal point is the one place to trade which can magnify the density of the trade and predominantly form a market with higher liquidity.

Off board trading also referred to over-the-counter trading implies to the way the two parties become trading counterparties directly. We have several forms of this trading method and products with varied contents that can be blueprinted as per the different needs of each user. Although at the same time, financial institutions that sell derivative products ought to have higher-ranking financial technology and management of risk abilities in order to meet the particular requirements of customers. Therefore, transaction liquidation is reduplicated by both parties; the trading participants are restricted to customers with a high level of creditworthiness.

1.3 Disclaimer

Research was accomplished after approval and go ahead from the instructor. The information shared in this dissertation has been used with assurance that the copyright and plagiarism have been checked. The findings in this report is for the purpose of research and should not influence the formulation of business decisions. Distribution of the report is subject to conditions with the prior approval of both the instructor and the researcher.

Chapter two: Literature review

2.1 Introduction

This chapter entails the important literature with respect to topics discussed. First literature with respect to the aim of writing the article will be examined. Next, the research on motivation of corporate use of derivatives for hedging and CFO influence in using derivatives.

2.2 Aims of writing the article

This article tells the extent of how financial determinants influences corporate use of derivatives. However, derivatives usage is a common condition in most listed companies which means that derivatives have become an indispensable tool in financial transactions. In addition, CFO functions as a financial manager who controls a company's financial information and cash resources, their past experience or current decisions influence whether a company will use financial derivatives in some degree.

Edward LiPuma figures out those derivatives started to become popular since 1973 and these kinds of derivatives soon formed a 100 trillion dollars' market Edward, L& Benjamin, L(2006). According to the knowledge gathered by predecessors, Fisher Black and Myron Scholars stated that on market equilibrium hypothesis and capital asset pricing models (Black, F & Scholars M., 1973, p.637-654) put forward the famous option pricing model in 1973. It gives a solid conceptual basis for the advancement of financial option revolution. Various derivatives loss events in the early 1990s have promoted the evolvement of various financial risk control theories to a palpable extent, primarily the measurement risk model, such as the VAR risk value

measurement model officially proposed by JP Morgan. Maurer figured out five aspects of the risk prevention mechanism of financial derivatives trading: market access supervision, establishing and perfecting risk management system, requiring commercial Banks or other financial groups to reinforce internal control and standardize operation, strengthening insightful information divulgence of derivatives trading, and congruously dealing with market withdrawal. (Maurer, B, 2006) In terms of corporate governance structure, Lodger Hentschel and Clifford W. Smith Jr. put forward concept of agency risk which was in 1996. They found in those famous risk events, the managers or traders of companies or Banks engaged in huge scale and positions of derivatives trading and did not act in accordance with the principle of maximizing corporate interests. (Hentschel, L. & Smith, C.W., 1995) In 1998, Fredric S. Mishkin first discussed the adverse selection of financial markets and moral hazard and the financial structural problems caused by it. (Mishkin, F. S., 1996) It indicates that there are many financial problems caused by different kinds of asymmetric information. In this condition, normal financial activities require a formal regulatory agency to regular the whole transaction process. Ludger Hentschel and S.P. Kothari believed formal regulatory rules and specialized regulation should be used to restore existing supervision by central bank and the Ministry of Finance which is non-professional. They think that this replacement can avoid the instability of the financial system caused by factors such as the lax regulation of derivatives, the sharp increase in the trading volume of financial derivative, or the incompleteness of information by government departments in charge of supervision. They advocated that laws should be applied to restrict the transaction of financial derivatives and proposed an effective regulatory mechanism should be established by the government so that a balance can be stroked between market development and constructive standardization. (Hentschel, L., & Kothari, S. P., 2001, p.93-118) However, the trading of financial derivatives within the company is difficult to regulate by the government, it is mostly controlled by the management of corporations, and in the management framework of a corporate, CFO plays an increasingly important role. CFO is a predetermined result of progress of corporate governance anatomy to a contemporary stage. Hady Farag thinks that CFO's function has changed from a financial manager of a company to a professional person with unconventional judgment, robust business sense, thorough comprehension of business, skillful running in capital market and strategic vision. (Farag, H., Plaschke, F., & Rodt, M., 2011) In another word, a qualified CFO not only needs to focus on the cooperation and integration of finance and business

management, but also needs to pay attention to the development of derivative using. Overall, this article uses 400 companies' CFO and CEO's experience on derivatives using as examples to build a logistic model.

2.3 Motivation of corporate to use financial derivatives for hedging

2.3.1 Maximize company value

This mainly includes reducing cost of financial distress, reducing expected taxation and avoiding the "insufficient investment". Empirical studies of most hedging motives for financial derivatives indicate that mainstream literature has expressed support for the theory of avoiding underinvestment and reducing the costs of financial distress. There is also a small part of literature supporting the hypothesis of reducing expected taxation. There is still some controversy due to the relatively small amount of evidence.

2.3.1.1 Reduce the cost of financial crisis and enhance the ability to borrow

Smith and Stulz (1985) proposed through a great amount of data analysis is that management of risk will reduce the expected cost of financial crisis by suppressing the variations in cash flow.

Nance, Smith and Rogers (1993) have shown that firms that preferred using financial derivatives for management of risk generally will have higher financial leverage, a view that is reduced by companies using hedging by financial derivatives. The views of financial crisis costs are complementary.

2.3.1.2 Reduce the expected taxation

Smith and Stulz (1985) argued when a company encounters a progressive tax system or a convexity, the company's ability to minimize the fluctuations in income and thus minimize the expected tax burden can be achieved through the using a risk management system. Therefore, if the cost of the company's hedging is acceptable, tax is highly gibbous then the expected tax cost to be reduced is very high.

Nance, Smith, and Smithson (1993) investigated that numbers of data between the use of risk management products and tax deductions to confirm a positive correlation. It is a strong proof that the company's tax function flexibility is large then the possibility of applying financial derivatives for risk management will be higher with the idea of saving tax incentives being clearer.

2.3.1.3 Avoid insufficient investment

Froot, Scharfstein and Stein (1993) have found the use of financial derivatives for risk management will alleviate or even solve the problem of lacking investment faced by the company to some extent. These scholars believe that if companies' have high external financing costs and internal cash flow are not stable, they may surrender related projects with net present worth, which leads to insufficient investment results. One of the ways to solve this problem is to conduct financial management. It is common for companies to obtain very abundant internal funds through hedging which can bring investment.

Nance, Smith, and Smithson (1993) have analyzed a large number of survey data to show that the use of hedging can produce more growth opportunities for the company, the relevant theories that using hedging to reduce the possible underinvestment is matched. They also found out that if the company is more productive, it is easier to have insufficient investment, so the possibility of losing the opportunity is higher. Possibility of using financial derivatives for risk management is usually greater.

Geczy, Minton, and Schrand (1997) have found a positive correlation between financial derivatives usage and research and development expenses. This implies that firms use hedging to reduce possible underinvestment problems is consistent with the theory.

2.3.2 Maximize the utility of managers

Smith and Stulz (1993) argued that corporate shareholders gain professional knowledge by hiring managers to increase company value. In order to maximize the wealth of shareholders, shareholders should give some appropriate encouragement to management to constrain managers to use professional knowledge to manage the company. The incentive contract of the manager should be designed as the behavior of the manager to the enterprise

The value of the personal desired utility that the value of the manager and the manager obtains through these actions must match.

Jensen (1976) argues that if the manager's purpose runs counter to the shareholder's risk, especially for the sake of his own risk, personal wealth will not be reduced by the price of products and raw materials, interest rates and exchange rate fluctuations, thus sacrificing The interests of shareholders apply to the company's use of financial derivatives for hedging.

Tufano's (1996) survey found that there is a lot of very favorable evidence about maximizing the manager's utility, that is, the number of stocks held by managers is consistent with the tendency to hedge.

2.3.3 Minimize market risk

In general, we divide risk into two categories, the first is systemic risk and the other is non-systemic risk. Systemic risk refers to risks outside the company, such as war, inflation, high interest rates, economic recession and other risks associated with the social environment. These risks cannot be dispersed by multiple investment channels, so this risk is also called For non-distributable risks or market risks. Non-systematic risks come from a variety of different economic activities within the company, such as the company's management level, advertising marketing behavior; changes in consumer tastes and research and development, etc., companies can diversify their investments to spread this risk, so It can be called a diversified risk or a company-specific risk. In fact, what companies in general care about is usually the systemic risk of the project, because non-systematic risks can be circumvented by a variety of investment methods. Project system risk and mandatory return rate.

In general, internal cause of market system risk is usually the market itself. External factors which cause system risk to appear on a large scale may come from economic, social, political and other parties.

Since the emergence and outbreak of systemic risks have a bad effect on the operation of the capital market itself, it is more important to resonate with other different market risks, leading to

a huge crisis. Therefore, the state's systemic risk to the market is not only highly valued, but also provides relevant risk prevention and governance.

2.4 General perspective on corporate hedging

Derivatives instruments In the last few years has led to an uptrend due to globalization. Thereafter they have been utilized by domestic and multinational companies as way to hedge the rise of flow of cash variation (Afza & Alam, 2016). Management of risk is not a case of removing risk but carefully choosing the risk which the organization can work with and reduce those that do not apply (Rao, 2012). In order for the companies to accomplish risk management objectives then they have to use financial derivatives by doing away with portions of risk exposures that are not necessary. Hedging refers to a technique of reducing the risk exposure through the use of derivatives. This process helps a lot in reducing firm risks like in projects where one or more transactions is involved in the financial market

Hedging which is a means of risk management strategy is applied when the company needs to restrict or offset probability of loss from the dynamic prices of products and currency (Mittal & Khakhar, 2015). When firms do not buy insurance policies then hedging becomes a transfer risk. This implies eliminating financial risk by transferring that risk to someone else which means that they will guarantee of cash flows, which assists in making budgets, motivates managerial personnel to handle investments and banish the viability of financial crisis.

The act of transferring any unexpected risk to other parties for a price and the parties involved are ready to assume the risk is a case of financial instruments whose returns have been extracted from other financial instruments or derivatives. (Haron, 2014) Other risk management commodities that have been developed include the futures, options and swap. We have three different categories of corporate hedging, these include the financial, commodity and operational hedging (Hankins, 2009). The main determinants of hedging that have been identified in various studies are; managerial experience, liquidity, leverage and foreign exchange (Aretz & Bartram, 2010). Hedging can strongly be attained the assistance of financial derivatives although majority of the corporations have developed other ways of ensuring that risk management strategies like commodity and operational capabilities for instance the choice of locations,, mergers and acquisitions or alternatively selecting a suitable capital structure (Ameer, 2010).

The major icon among management of risk utilization is the derivatives (Chaudhry & Mehmood, 2014). Market imperfections has led to firms payoff being a concave function of corporate hedging determinants (Spano, 2009) for as long as the corporate decision to hedge is worth enhancing for a risk neutral firm. This is in line with the theory of corporate finance. Liquidity which refers to firms current assets and current liabilities, managerial experience and leverage is among the cause of concavity of determinants of corporate hedging. These determinants of corporate hedging have been farther investigated through various studies, models and Tobin Q model for instance the logit model (Mseddi & Abid, 2010).

The modern financial theory that has been evolving since the late 1950s implied that financial decisions do not have any impact on the firm's market worth in an ideal market (Monda, Giorgino and Modolin, 2013). As stated by Modigliani and Miller's propositions (1958) that a firm does not have the ability to boost firm worth by reducing its vulnerability to risks due to the fact that investors are able to transform these risks using their own personal accounts and this will bestow replicate of any hedging decision made by the firm. Although due to the existence of market imperfections and risk management, then ensuring stabilization of firm's gross can be strength the companies through the following measures: reducing transaction costs substantially on the expected costs of bankruptcy and reducing foreign exchange exposure. The theory of hedging was primarily restricted to the capability of derivative contracts usage (Klimczak, 2008) although since 1950s, risk has been incorporated into the theory of finance but only as a determinant in stock market risk-return calculations.

Recently, corporate hedging theory has foundation on financial economics and agency theory. This has been revealed further by the stakeholders' theory which concentrated on the relationship among stakeholders moderate classical assumptions. Klimczak (2008) argued that the financial economics theory gives reasons as to why corporate hedging is rational or worth enhancing as this relied majorly on other form of market imperfections. The study findings, for instance on (Chaudhry et al.2014) which indicated that the derivative users possess a highly competitive edge over those who do not use derivatives simply because they can assess economies of scale and genuine risk management through the utilization of financial instruments. Wang & Fang, (2011) stated that hedging can boost a firm's worth by concurrently reducing external claims like bankruptcy costs and putting in order the managerial interests with those of capital suppliers.

Corporate governance within firms has been improved through the implementation of agency theory in corporate hedging as a strategy for reducing conflicts between the shareholders, management and claimholders. Allayannis, Lal and Miller (2012) majored on keeping track of pressure that managers faced from shareholders and its effect on worth inference of financial instruments. They were able to identify that applying financial instruments led to an increase in firm worth in well governed companies with good structures in place and where managers have restricted powers to inflict financial instruments for conjecture or self interests.

Stakeholder theory supports the firm's hedge to minimize financial distress and maximize manager's utility. This has been utilized in corporate hedging which primarily was developed by Freeman (1984) so that it can serve as a managerial instrument. This has developed into theory of firm with high independent potential. The equilibrium of stakeholder's interests is considered as the main factor of corporate policy as stated explicitly in the stakeholder's theory. The anticipated costs of financial distress and bankruptcy are exceedingly sensitive to the worth of implicit claims. Company value increases if the corporate risk management practices will lead to the reduction of these expected costs.

If there is a series of bad turn of events which will end up affecting the companies profile in terms of the firm's capability to compete and operate then the customers, suppliers, employers and debt holders will become unwilling in dealing with the company as they cannot be guaranteed that their unsettled claims will be fulfilled and this will lead to worsening the situation and the impact of negative shock.

Therefore the more sensitive a firm's value is to financial distress then the higher the motivation for hedging. The availability of capital market imperfections which comprises other factors on hedging like bankruptcy, financial distress, managerial experience, liquidity, leverage constitutes a way of enhancing shareholders worth as stated by (Bartram, Brown and Hund, 2007). More specifically, hedging at the company level can lead to a decrease in agency conflicts among the shareholders and bondholders. This includes incentives that are invested below optimal levels or the incentives that will lead to a rise in the riskiness of the assets although corporate hedging may lead to an increase in firm worth by decreasing several kinds of transaction costs. Hence if a firm wants to ensure they encounter a low probability of default then they ought to have lowered

the flow of cash volatility which in turn will maintain the expected costs of bankruptcy and financial distress at minimal levels.

2.5 CFO influence in corporate use of derivatives

CFO (Chief Financial Officer) is one of the senior management personnel who are identified by the owner and who are in charge of overall supervision and management of the financial and accounting activities of the enterprise (Spanyi, A., 2011, p.20)

The emergence of the CFO system has its deep political origins. In order to overcome the moral hazard and adverse selection phenomenon caused by information asymmetry, the financial director's institutional arrangement representing the interests of the owner appears in corporate governance. After the appearance of the chief financial officer system, at the company's management level, there has been a pattern of “dual track” operation by the board of directors, general manager and chief financial officer. The supervisory responsibilities of the owners have been greatly enhanced and the information asymmetry will be improved

The recent theoretical studies indicated that CFOs have a great influence in earnings-smoothing and hence responsible for accounting measures, Chava and Purnanandam (2010). Based on accounting manipulations, Feng Ge ,Luo and Shevlin (2011) studied what motivates CFOs to become part of these influences. They indicated that although the CFOs execute fraud, it is due to the pressure of CEOs who have more power than them.

Height of leverage is one of the very important choice for firms because it affects the level of risk, Chava and Purnanandam (2010) although the CFOs determine the maturity of the debt. This statement is in accordance with the findings of an earlier paper by Chava and Purnanandam (2007), which indicated that the CFOs control the risk level by altering the volatility of debt.

Kim et al. (2011) determined whether the sensitivity of CFOs portfolios is related to cash risk, this was more evident in industries with financial leverage of high level. This suggested that the CFOs have an important share in total firm risk. This means that the CFO and incentives given to CFO are important when finding out the effects of incentives on firm volatility. Hence, the CFOs are in charge of making decisions on speculation, estimating whether use of derivatives is needed, treasury operations and risk management functions.

Therefore it is important to note that the CFOs possess a crucial role in several measures of risks at firms although they cannot determine the strategic management decisions due to the required knowledge.

2.6 Leverage

Leverage refers to the magnitude to which company's assets are financed by debt (Muchina et al., 2015). The lower the leverage the higher the control by shareholders and the converse is true. Empirical analysis supports the fact that corporate use of derivatives is negatively correlated with leverage. This implies that financial instruments of the individual firms have a very important role of lowering financial costs and increasing debt ability.

The firms that use derivatives more frequently tend to be high levered due to their large debt repayment. Majority of them opt to hedge so that the cash flow variability can be greatly reduced hence lowering the likelihood of encountering bankruptcy costs.

The CFOs have to be fair to the statement that firms with high level of debt are less likely able to accumulate cash because of the fact that there exists regulations that ensure keeping track of institutions and this can lead to firms holding cash as a way for borrowing more (Kariuki et al., 2015). Although the CFOs did not agree with the statement that the firms retain excess cash so that they can avoid the impact of doing so from the financial markets that accompanies the raising of funds. This means that the management is impassive to the declaration that high gearing towards keeping track of financial activities of the firms by lenders.

The study findings by (Ali, 2014) indicated that there is a statistically significant relationship between leverage and corporate use of financial instruments. This further revealed that profitable firms are using pecking order theory which implies that the more profitable a firm is the more the reduced debts.

The empirical analysis carried out by (Park and Kim, 2015) indicated that the effects of financial instruments usage on debt ability supported the fact that the financial instruments will lead to a rise in debt ability by passing risks and lowering financial cost. The firms that were using financial instruments turned out to have a good stock market results particularly during the time

when there is tight credit market. This implies that corporate use of financial derivatives possess an important role in increasing debt ability and ensuring stock results have improved.

Therefore, the long term financing of firms plays a key role in terms of growth in production and accumulation of capital. This further revealed that managers opt to use less debt due to the fact that it is risky and it would create higher chances of bankruptcy, debt and employment loss. Hence, keeping track effectively by management and shareholders would demoralize self serving managers from lowering financial leverage below its optimal level.

Firm worth is magnified by corporate risk management. Graham and Rogers (2002) this means that firms can be allowed to carry more debt which will add up the optimal debt to equity ratio that allows firms to have greater tax shields. Hence, for a company to encounter strenuous situations then it is likely that it has high leverage which is accompanied with higher payment obligations.

It was evident from several theoretical studies that there is high possibility of using debt as an beginning source of supplementary funding which means there is a high chance of financial risk. Therefore in order for firms to stabilize their internally generated flow of cash then they have to use corporate hedge so that various costs that are related with flow of cash variability can reduce. Hedging should lower the probability of financial distress with fixed leverage which will lead to higher debt capacity and this should be considered as a determinant of a firm's hedging policy (Magee, 2012).

2.7 Hypotheses

The goal of this dissertation was to determine if there if financial determinants have influence on the corporate use of derivatives during the period of 1989 – 2018. The following are the hypotheses to be tested:

Hypothesis 1

H_0 : There is no statistically significant influence of CFO experience in using derivatives on corporate use of derivatives

CFO influences greatly the use of derivatives as mentioned before. Hence the need to examine if there exists any relation linking the corporate use of derivatives and CFO experience

Hypothesis 2

H_0 : There is no statistically significant influence of current ratio on corporate use of derivatives

Hypothesis 3

H_0 : There is no statistically significant influence of leverage on corporate use of derivatives

Hypothesis 4

H_0 : There is no statistically significant influence of net profit ratio on corporate use of derivatives

Chapter three: Data

3.1 Introduction

This chapter outlines sample and data collection procedures used first then the variables used in regression. After that the dependent and independent variable will be examined. Data analysis on descriptive statistics, correlation matrices, analysis of variance and regression model will be displayed in the end.

3.2 Sample and data collection

The study focused on CFOs from 473 firms in the US. The study period is from 1989 to 2018 and a total of 7931 CFOs in the sample. This period was important because the financial derivatives were first introduced in the 1980s. The sample was formed from the retrieved list of selected firms. The earlier researchers confirmed that the CFO takes responsibility as the main corporate decision maker. The study used a unique, manually collected dataset that was retrieved from Google and Bloomberg. The derivatives usage aligns with theoretical models of corporate risk management.

Data was collected using Compustat Execucomp, Compustat North America and Center for Research in Security Prices (CRSP). Data was merged in Stata and Ms Excel platforms using fiscal year and several identifiers.

3.3 Variables

There were two types of variables that were used to investigate the existence of relationship. That is the response variable which is the corporate use of derivatives against four main independent variables which include: CFO experience in using derivatives, current ratio, leverage and net profit ratio.

3.4 Multi linear regression model

In multivariate analysis, multi linear regression model was used in explaining further on the corporate use of derivatives and other determinant factors like the CFO experience, current ratio, leverage and net profit ratio.

Regression analysis was used to examine the causal relationship between one dependent and independent variable. The measure of effects of multiple independent variables on one dependent variable (Okello et al. 2015) was determined using multiple regression analysis. The model that will be formed will be as follows:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon$$

Where:

Y = Corporate use of derivatives

β_0 = Coefficient of the constant variable

$\beta_1 - \beta_4$ = Regression coefficients of the independent variable

X_1 = CFO experience in using derivatives

X_2 = Current ratio

X_3 = Leverage

$X_4 =$ Net profit ratio

$\varepsilon =$ Error term

The model was used to investigate the hypotheses to conclude whether there is relation between corporate use of derivative and the other predictor variables. Some variables were log-transformed so as to improve normality across variables and the residuals of the model and to reduce the effect of outliers; the data has been winsorized as presented in Table 3.4 below.

Table 3.4: Overview of variables used in the model

Variable name	Description
Derivatives: der	Corporate use of derivatives
pexp	CFO experience in using derivatives
curratio	Log(Current assets/Current liabilities)
lev	1 – (Capital/Total assets)
npratio	$\text{Log}\left(\frac{\text{Net profit after tax}}{\text{Net sales}} \times 100\right)$

3.7 Data analysis

3.7.1 Data normality test

Normality test is a very crucial statistical analysis for the purpose of the assumption and technicality for the application of the right statistical techniques. Data that has been verified gives confidence and reliable inferences for policy making (Ali & Akayuure, 2016). Therefore we used the Kolmogrov-Smirnov test and, skewness and kurtosis statistic.

3.7.1.1 Kolmogrov-Smirnov test

Null hypothesis states that data comes from a specified distribution. Kolmogorov-Smirnov test is used to investigate if a sample with specified continuous contribution comes from a population as stated by Baghban et al (2013). Table 3.7.1.1 below shows that all the data on the variables did not deviate significantly from the normal distribution hence it was okay to use the required statistical tests and procedures that assume normality.

Table 3.7.1.1 : Normality test

	Kolmogorov-Smirnov		
	Statistic	df	Sig.
der	.484	7924	.000
pexp	.392	7886	.000
curatio	.057	7926	.000
lev	.057	7930	.000
npratio	.058	7927	.000

3.7.1.2 Skewness and Kurtosis test

The symmetric and peakness of the distribution was determined using Skewness and Kurtosis respectively (Mbui et al, 2016). The values presented in Table 3.7.1.2 below indicated that all the Skewness and Kurtosis coefficients are within the acceptable range of -2 and +2. This means that the distribution has no significant Skewness and Kurtosis problem.

Table 3.7.1.2: Test on Skewness and Kurtosis

	N	Skewness		Kurtosis	
	Statistic	Statistic	Std. Error	Statistic	Std. Error
der	7931	-1.377	.028	-.103	.055
pexp	7931	-.403	.028	-1.838	.055
curatio	7931	.001	.028	-1.197	.055
Lev	7931	.002	.028	-1.201	.055
npratio	7931	-.004	.028	-1.204	.055

3.7.2 Descriptive statistics

The means and standard deviations determined from the responses are presented in Table 3.7.2 below. In general, the responses indicated low levels of agreement. The highest score from the findings was on the current ratio which implies the current assets and liabilities with mean of

2.319 and standard deviation of 1.974. This implies that the firms' liquidity is the most important financial derivative as cited by Nguyen (2015). The current ratio had a minimum of 0 and maximum of 44.66 which implies that the distribution is large. The current ratio was followed by leverage with mean of 0.441 and standard deviation of 0.237 and then CFO experience in using derivatives followed closely with mean of 0.400 and standard deviation of 0.49.

Table 3.7.2: Descriptive statistics of variables

Variable	N	Mean	Median	SD	p50	Min	Max
der	7931	0.218	0.00	0.413	0.000	0.000	1.000
pexp	7931	0.400	0.00	0.490	0.000	0.000	1.000
curatio	7931	2.319	1.90	1.974	1.900	0.000	44.656
lev	7931	0.441	0.458	0.237	0.457	-0.548	0.880
npratio	7931	0.239	0.278	0.635	0.278	-3.672	1.767

3.7.3 Correlation matrix

Analysis of relationship was assessed using Pearson correlation at 5% significance level and correlation matrix used. Maina et al. (2016) stated that Karl Pearson Correlation Coefficient is the most widely used method of measuring the degree of relationship between two variables. Table 3.7.3 below shows a correlation matrix with a varied degree of interrelationship between the variables.

The coefficients range between -1 to +1, where -1 shows a perfect negative correlation, 0 shows no correlation and +1 a perfect positive correlation. The findings depicted show that majority of the correlation coefficients turned out to be statistically significant in Table below. Corporate use of derivatives and CFO experience in using derivatives had a moderate positive relationship which means that the corporate use of derivatives increases with an increase in CFO experience.

Corporate use of derivatives and the current ratio had a negative relationship and statistically significant which means that the corporate use of derivatives increases in magnitude with decrease in the current ratio and vice versa. The relationship between corporate use of derivatives and leverage was established and the result indicated that there was a moderate negative relationship. This means that the corporate use of derivatives increases with decrease in magnitude of leverage and vice versa. This disagreed with findings by Ali (2014 from the Tobin's Q model which indicated that large firms have a positive significant relationship between financial

影响美国473家公司对衍生品的公司使用。

为这项研究提出了四个假设，将要研究的包括：

CFO使用衍生工具的经验对衍生工具的公司使用没有统计上的显著影响，流动比率对衍生工具的公司使用没有统计上的显著影响，杠杆对衍生工具的公司使用没有统计上的显著影响，也没有净利润比率对衍生品公司使用的统计显著影响

这项研究中企业使用衍生工具的财务决定因素是首席财务官过去使用衍生工具，流动比率，杠杆和净利润比率的经验。使用Compustat

Execucomp，北美Compustat和证券价格研究中心（CRSP）收集数据。

数据使用会计年度和几个标识符在Stata，SPSS和Ms Excel平台中合并。

研究期间为1989年至2018年，从473家公司中选出了7931名首席财务官。

该研究使用了一个独特的，手动收集的数据集，该数据集是从Google和彭博社检索到的。

数据分析将包括描述性统计，相关矩阵，方差分析和多元分析。

最终输出将以频率表，中心趋势量度，变化量和图形表达形式呈现。

该研究同时使用了描述性统计和推论统计，以便可以洞察样本中公司的特征以及诸如卡尔

·皮尔森相关性之类的多种统计技术。

在多元分析中，使用多元线性回归模型来解释衍生工具使用与财务决定因素之间的关系。

研究结果表明，自变量。

首席财务官过去在使用衍生工具，流动比率，杠杆和净利润比率方面的经验在企业使用衍生工具方面具有统计学意义。

此外，这表明首席财务官经验与企业使用衍生工具之间存在统计学上的正相关关系。

还应指出的是，首席财务官的经验与公司对衍生工具的使用具有中等相关性。

流动比率与衍生品的公司用途呈负相关。

杠杆对公司使用衍生工具的解释力是显著的，具有负相关关系。那也是leverage and firm performance.

The relationship between corporate use of derivatives and net profit ratio was established and the output indicated that there was a positive moderate relationship. This means an increase in corporate use of derivatives will lead to an increase in magnitude of the net profit ratio and vice versa.

Table 3.7.3: Pearson correlation analysis

	der	pexp	curatio	lev	npratio
der	1.0000				
pexp	0.112**	1.0000			
curatio	-0.080**	0.040**	1.0000		
lev	-0.118**	-0.017	0.729**	1.0000	
npratio	0.1832**	0.065**	0.192**	0.312**	1.0000

** . Correlation is significant at 0.05 level (2-tailed).

Chapter four: ANOVA and Regression results

This chapter outlines the analysis of variance and multivariate analysis. Several checks will be conducted to confirm if the findings are not affected by model misspecifications. The study findings will help in determining if the hypotheses are true. Robustness will also be performed to confirm if the results of the data are consistent.

4.1 Analysis of variance (ANOVA)

The ANOVA technique was used to determine whether the regression analysis model used is fit or the relationship of the variables just occurred. The significance of F ratio was used to investigate whether the model was fit or not. If it turned out significant then the model is considered fit (Weeks & Namusonge, 2016). The standard P value of 0.05 will be used and if the output turns out to be less than 0.05, then the F statistic is considered high hence the null hypothesis is rejected since it is false.

4.1.1 Hypothesis 1

H₀: There is no statistically significant influence of CFO experience in using derivatives on corporate use of derivatives

The findings shows that the significance level is less than 0.05 which means that we rejected the null hypothesis and conclude that the CFO experience in using derivatives has an influence on corporate use of derivatives.

Table 4.1.1 : ANOVA table for CFO experience on using derivatives

Model	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	16.936	1	16.936	100.702	.000
Within Groups	1324.764	7877	.168		
Total	1341.701	7878			

4.1.2 Hypothesis 2

H_0 : There is no statistically significant influence of current ratio on corporate use of derivatives

The findings in the Table below shows that the P value is less than 0.05 which means that the null hypothesis is rejected hence the current ratio has influence on corporate use of derivatives.

Table 4.1.2 : ANOVA table for the current ratio

Model	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1327.420	7764	.171	1.629	.000
Within Groups	16.167	154	.105		
Total	1343.586	7918			

4.1.3 Hypothesis 3

H_0 : There is no statistically significant influence of leverage on corporate use of derivatives

The P value is less than 0.05, hence the null hypothesis is rejected and this means that leverage has influence on corporate use of derivatives.

Table 4.1.3 : ANOVA table for leverage

Model	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1342.274	7880	.170	4.770	.000
Within Groups	1.500	42	.036		
Total	1343.774	7922			

4.1.4 Hypothesis 4

H_0 : There is no statistically significant influence of net profit ratio on corporate use of derivatives

The output in the Table below shows that the P value is less than 0.05 which means that the null hypothesis is rejected. Therefore this shows that the net profit ratio has an influence on the corporate use of derivatives.

Table 4.1.4 : ANOVA table for net profit ratio

Model	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	1336.566	7830	.171	2.337	.000
Within Groups	6.500	89	.073		
Total	1343.066	7919			

4.2 Model checks

The requisite tests were carried out to investigate if there was violation of regression assumptions. This included tests on multicollinearity where the tolerance and VIF scores were used to confirm this assumption using the coefficients table. Next, the residuals were checked if they are constant using Durbin-watson test from the model summary then the test on whether the variance of the residuals is constant that is homoscedasticity and was determined using the scatterplot of dependent variable against the predictor variables and finally the values of the residuals are normally distributed was determined using the normal probability plot (P-P plot). The following tests are shown below:

4.2.1 Test on multicollinearity

VIF and Tolerance statistics was used to assess this assumption. For the assumption to be met we want VIF scores to be well below 10, and tolerance scores to be above 0.2. This means that there is no multicollinearity in the data.

Table 4.2.1 : Test on multicollinearity

Model	Collinearity Statistics
-------	-------------------------

	B	Tolerance	VIF
(Constant)	1.456		
Pexp	.079	.993	1.007
Curatio	.034	.463	2.161
Lev	-.208	.436	2.295
Npratio	.232	.898	1.113

4.2.2 Test on independence of the values of the residuals

Durbin-Watson statistic was used to test the assumption that our residuals are independent (or uncorrelated). This statistic can vary from 0 to 4. For this assumption to be met, the Durbin-Watson value should be close to 2. Since the value is 0.323, this mean that the residuals are not independent hence correlated.

Table 4.2.2 : Model Summary

Model	R	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson	
				R Square	F	df1	df2	Sig. F Change		
1	.642 ^a	.580	.629	.396	.580	170.136	4	7866	.000	0.323

4.2.3 Test on the variance of the residuals is constant

This tests the assumption of homoscedasticity, this refers to the assumption that the variation in the residuals is similar at each point of the model. This graph plots the standardized values that the model predicts against the standardized residuals obtained. As the predicted values increase along X-axis then the variation in the residuals should be roughly similar.

Since the data points appear not to be at random then we conclude that the assumption has not been met hence the variance of the residuals is not constant which is referred to as heteroscedasticity as shown in the scatter plot in Figure 4.2.3 below

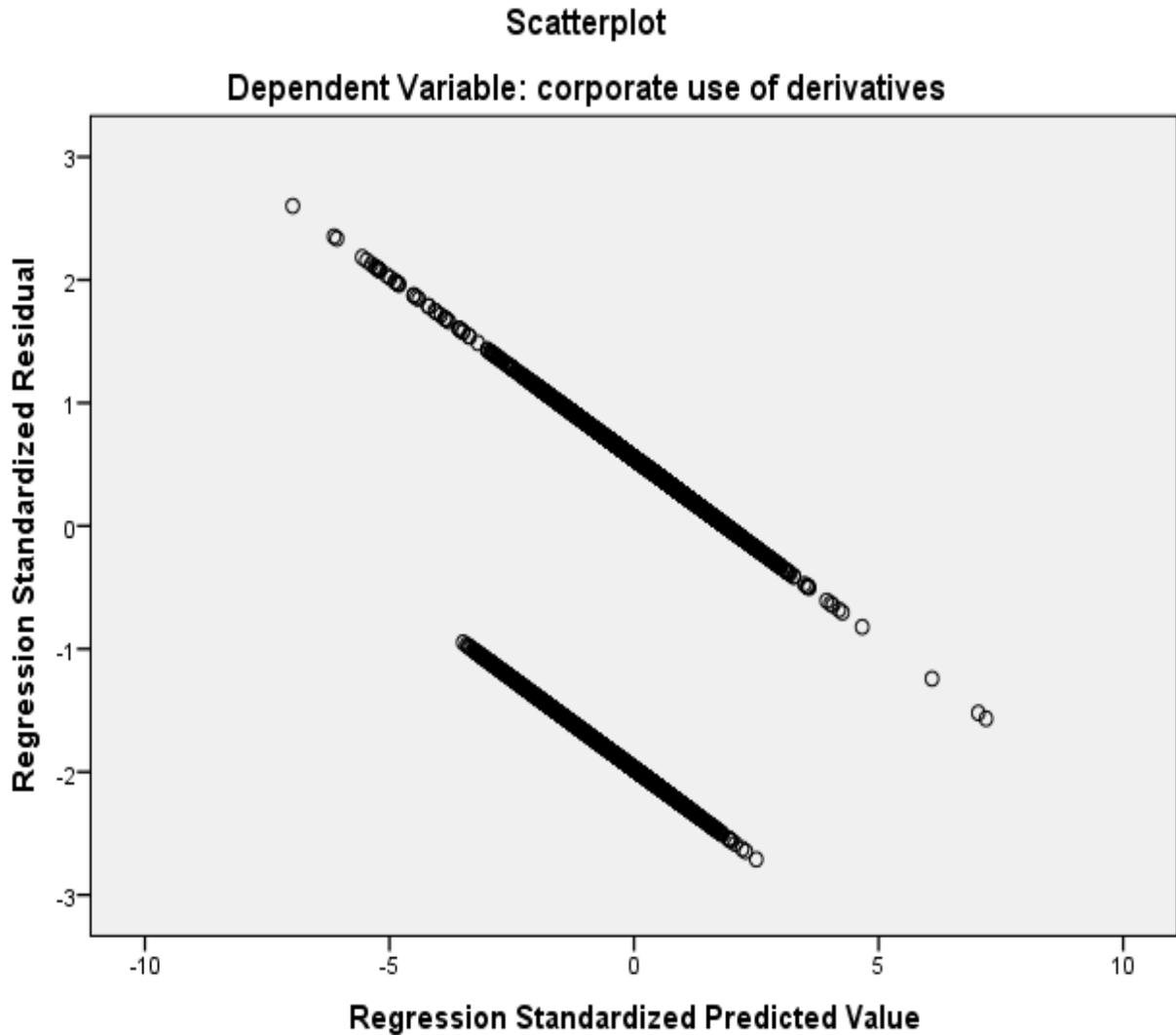


Figure 4.2.3: Test on the variance of the residuals is constant

4.2.4 Test on whether the values of the residuals are normally distributed

This assumption can be tested by looking at the normal **P-P plot** for the model. The closer the dots lie to the diagonal line, the closer to normal the residuals are distributed. Therefore the

findings in Figure below show that the data points did not touch the line which indicates that the residuals are not normally distributed.

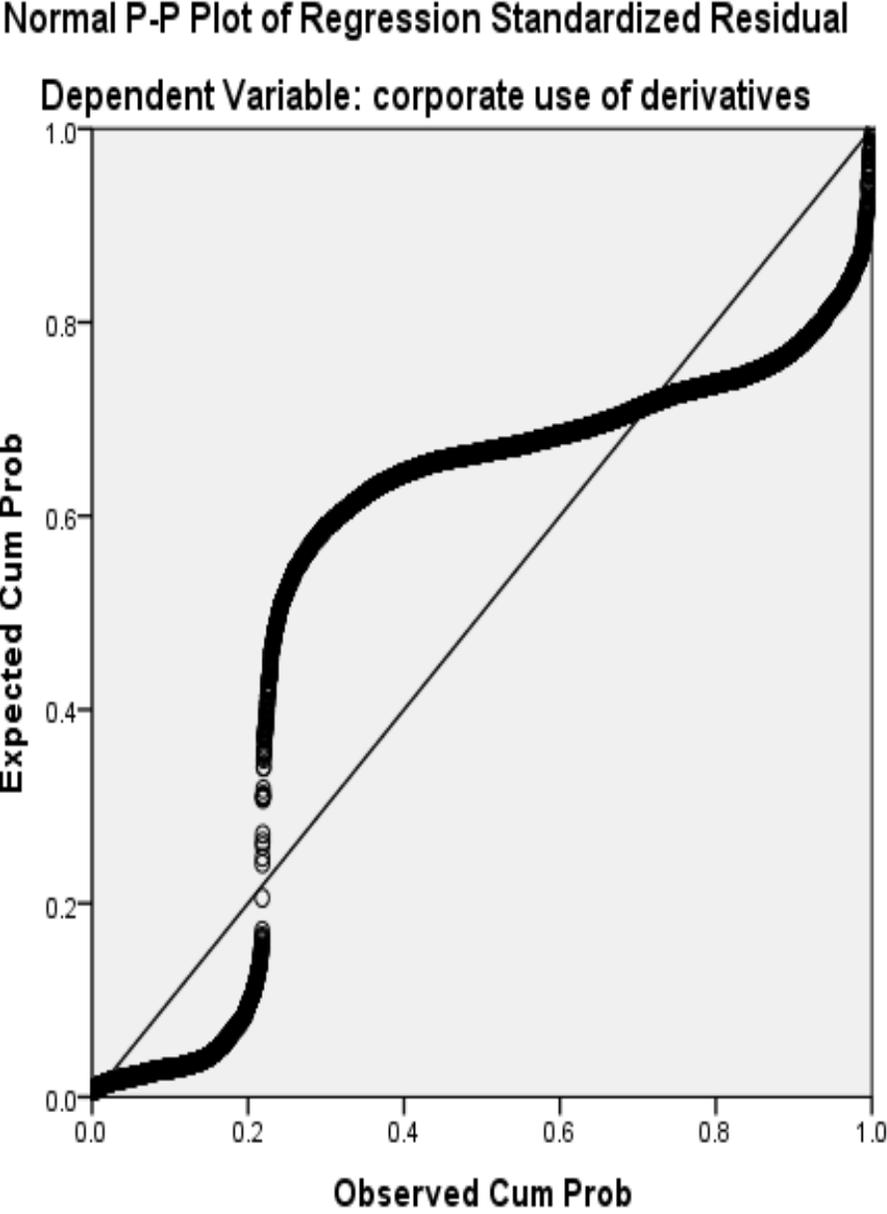


Figure 4.2.4: Test on whether the values of the residuals are normally distributed

4.3 Regression results

The four hypotheses were all tested using the multiple regression model. This was achieved using SPSS version 20 and it included all the independent variables; CFO experience on using derivatives, current ratio, leverage and net profit ratio. The assessment was utilized using 5% significance level.

The findings in Table 4.3 below showed that CFO experience, current ratio, leverage and net profit ratio had significant P values as 0.000, 0.027, 0.000 and 0.000 respectively. Therefore our linear equation for the model will be as follows:

$$Y = 1.456 + 0.079X_1 + 0.034X_2 - 0.208X_3 + 0.232X_4$$

The output depicted that a unit change in CFO experience in using derivatives will led to 7.9% increase in corporate use of derivatives. A unit change in current ratio led to 3.4% increase in corporate use of derivatives and a unit change in net profit ratio led to 2.3% increase in corporate use of derivatives. Although a unit change in leverage led to 2.1% decrease in corporate use of derivatives as shown in Table 4.3 below

Table 4.3 : Regression coefficients

Model	Unstandardized		t	Sig.	Collinearity	
	Coefficients				Statistics	
	B	Std. Error			Tolerance	VIF
(Constant)	1.456	.049	29.776	.000		
pexp	.079	.009	8.678	.000	.993	1.007
curatio	.034	.015	2.214	.027	.463	2.161
lev	-.208	.016	-13.224	.000	.436	2.295
npratio	.232	.011	21.377	.000	.898	1.113

4.4 Summary of hypotheses

Table 4.4 below gives a summary of the study hypotheses as laid out. All the stated hypotheses were rejected and it was concluded that there is significance between the variables; CFO experience, current ratio, leverage, net profit ratio on the use of corporate derivatives.

Table 4.4 : Summary of hypotheses

Hypotheses	Accept/Reject
There is no significance influence of CFO experience on corporate use of derivatives	Rejected
There is no significant influence of current ratio on corporate use of derivatives	Rejected
There is no significant influence of leverage on corporate use of derivatives	Rejected
There is no significant influence of net profit ratio on corporate use of derivatives	Rejected

Chapter five: Summary, conclusion and limitation

5.1 Introduction

This chapter outlines the summary of the discussions of the results and conclusions made from the study findings and suggested areas for further research.

5.2 Summary results

This section summarizes the study findings as per the research hypotheses.

5.2.1 The influence of CFO experience on corporate use of derivatives

The findings showed that there is a positive influence of CFO past experience on corporate use of derivatives. This is in order with Zhang et al. (2016) who used managerial risk preferences of 308 state owned enterprises management personnel in China.

The findings further established that the CFO appreciates the role played by derivatives in their firms as it increases the shareholders' value. This means that they have to embrace the use of corporate derivatives in key areas like reduction of costs. A study on determinants of corporate hedging in Malaysia stated that there was a positive and significant influence of CFO managerial experience on derivatives usage. Therefore, the findings have indicated that managerial experience aligns the interests of the managers with those of shareholders.

5.2.2 The influence of current ratio on corporate use of derivatives

The findings showed that the current ratio which is the firm liquidity has a positive and significant influence on corporate use of derivatives (Liu, 2014). This means that firms hold lump sum of cash as a precautionary motive which serves as a substitute of derivative usage.

The research found out that there was a significant association between current ratio and corporate use of derivatives. This agreed with the study on establishing factors contributing to the use of letter credit by Malikanzia & Gekara(2013). Hence the findings were consistent with a

research study of Chaudhry et al.,(2014) who stated that there exist a strong relationship between corporate use of derivatives and the current ratio.

5.2.3 The influence of leverage on corporate use of derivatives

The study findings indicated that leverage had a significant and negative influence on corporate use of derivatives. The correlation analysis supported that leverage is negatively associated with corporate use of derivatives. This disagreed with the study by Daka and Basu (2016) who determined the relation between leverage and use of derivatives which turned out to be positively correlated. The firms that use derivatives tend to have a better stock market especially when there is tight credit market.

Use of financial derivative plays an important role in increasing debt capability and achieving better stock performance. The regression analysis indicated there was a significant relationship between leverage and corporate use of derivatives. This was further validated by ANOVA results which means that the results were consistent with Kariuki et al. (2015) study which stated that CFOs of private manufacturing firms feel that the leverage have a significant influence on corporate use of derivatives.

5.2.4 The influence of net profit ratio on corporate use of derivatives

The study findings indicated that net profit ratio had a significant and positive influence on corporate use of derivatives. Correlation analysis supported that net profit ratio was positively correlated with corporate use of derivatives. This means that the higher the levels of net profit margin the higher the probability of a firm being nonuser.

The regression analysis indicated there was a significant relationship between net profit ratio and corporate use of derivatives. This was further validated by ANOVA results which turned out to be significant. This means that the profit that remains after all deductions like cost of production, administration and financing is directly affected by the usage of derivatives like hedging.

5.3 Conclusion

5.3.1 CFO experience and corporate use of derivatives

The overall regression output revealed that there was a statistically significant positive relationship between CFO experience and corporate use of derivatives. This means that the CFOs

experience from the selected firms for the study greatly influence the corporate use of derivatives. It was also noted that CFO experience had moderate correlation with corporate use of derivatives hence a significant relationship exists.

5.3.2 Current ratio and corporate use of derivatives

The study findings concluded that there is a significant influence of current ratio on corporate use of derivatives. Regression analysis showed that there was a significant influence and a positive relationship between current ratio and corporate use of derivatives. There was also a negative correlation between the current ratio and corporate use of derivatives which implied that there was a statistically significant influence of current ratio on corporate use of derivatives.

5.3.3 Leverage and corporate use of derivatives

The study findings indicated that the explanatory strength of leverage on corporate use of derivatives was significant with a negative relationship. It was also noted that leverage had negative correlation with corporate use of derivatives. Therefore it was concluded that leverage has a significant influence on corporate use of derivatives.

5.3.4 Net profit ratio and corporate use of derivatives

The findings depicted that there is significant influence of net profit ratio on corporate use of derivatives. Regression analysis showed that there was a positive relationship between net profit ratio and corporate use of derivatives. This was slightly higher as compared to the other determinants as it accounted significantly the variability of change in corporate use of derivatives. Net profit ratio also had a positive moderate correlation with corporate use of derivatives. The study concluded that there was a significant influence of net profit ratio on corporate use of derivatives.

5.4 Suggestions for further research

The research will help intellectuals and act as a reference for future studies on the influence of financial determinants on corporate use of derivatives. Findings from the study are important on derivatives usage and it will add to the theoretical literature.

The study findings still have to be further developed in future like the new financial determinants of corporate derivatives usage by conceptual investigations. The risk management models can be

modified to fit empirical observations better. More companies can be included in future research to determine their financial determinants influence on corporate use of derivatives.

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Chapter 7: Appendices

7.1 Data sources

Table 7.1: Data sources

Data	Description	Source
CUSIP	Security identifier	CRSP
Company name	Name of the company	Execucomp
Annual title	Executives title description	Execucomp
Stock awards	Worth of stock awards	Execucomp
Option awards	Worth of option awards	Execucomp
TDC1	Total compensation	Execucomp
Company id number	Gvkey identifier	Execucomp
Fiscal year	Fiscal year	Execucomp
der	Measure of derivatives use	Compustat North America
pexp	CFO past experience	Compustat North America
Leverage	$1 - (\text{Capital} / \text{Total assets})$	Compustat North America
PRCCF	Stock price in USD	Execucomp
curatio	Current assets/Current liabilities	Compustat North America
npratio	Net profit/net sales	Compustat North America
Shares owned	Number of shares held by executive	Execucomp
Assets/liabilities	Return on assets/liabilities	Compustat North America
Loans	Loans /total assets	Compustat North America
Retail sales	Retail sales/total sales	Compustat North America
Total assets	Total company's assets	Compustat North America

7.2 List of firms

ABBOTT LABORATORIES
ABITIBI CONSOLIDATED INC
ABM INDUSTRIES INC
ACETO CORP
ACME UNITED CORP
ACS INDUSTRIES INC
ACTERNA CORP
ACTUANT CORP -CL A
ACUSON CORP
ADAPTIVE BROADBAND CORP.
ADDMASTER CORP
ADOBE SYSTEMS INC
ADVANCED MICRO DEVICES
AEL INDUSTRIES -CL A
AEROFLEX INC
ALARMGUARD HOLDINGS INC
ALCOA INC
ALGOREX CORP
ALZA CORP
AMATI COMMUNICATIONS CORP
AMCAST INDUSTRIAL CORP
AMDAHL CORP
AMERICAN AIRLINES GROUP INC
AMERICAN BILTRITE INC
AMERICAN MAIZE-PRODS -CL A
AMERICAN MONITOR CORP
AMERICAN PACIFIC CORP
AMERICAN PRECISION INDS
AMERICAN SCIENCE ENGINEERING
AMERISTEEL CORP
AMETEK INC
AMGEN INC
AMP INC
AMPCO-PITTSBURGH CORP
AMREP CORP
ANACOMP INC
ANAREN INC
APOGEE ENTERPRISES INC
APPLIED BIOSYSTEMS INC
APPLIED MATERIALS INC
AQUA ALLIANCE INC -CL A
ARTS WAY MFG INC
KEANE INC
KEARNEY NATIONAL INC
KERR-MCGEE CORP
KIT MANUFACTURING
KNOGO CORP
KOMAG INC
KOSS CORP
KRAFT HEINZ CO
KREISLER MANUFACTURING CORP
KRELITZ INDUSTRIES INC
KUSTOM ELECTRONICS INC
KYSOR INDUSTRIAL CORP
LAM RESEARCH CORP
LANCER ORTHODONTICS INC
LA-Z-BOY INC
LEARONAL INC
LILLY (ELI) & CO
LILLY INDS INC -CL A
LINCOLN ELECTRIC HLDGS INC
LIQUID AIR CORP
LOCKHEED MARTIN CORP
LOCTITE CORP
LONGVIEW FIBRE CO
LORAL CORP
LSI CORP
LTV CORP
LUKENS INC
MACK TRUCKS INC
MAGNETEK INC
MARION MERRELL DOW INC
MARK IV INDUSTRIES INC
MATTEL INC
MCKESSON CORP
MEASUREX CORP
MEDUSA CORP
MENTOR CORP
MENTOR GRAPHICS CORP
MERCK & CO
MESA INC
METROMEDIA INTERNATIONAL GRP
MILACRON INC
MILLER (HERMAN) INC

ASARCO INC
 ASCENT MEDIA GROUP INC
 ASTRONICS CORP
 AT&T CORP
 AT&T INC
 ATLANTIC RICHFIELD CO
 ATLANTIS PLASTICS INC
 AVERY DENNISON CORP
 AVON PRODUCTS
 AVX CORP
 AZZ INC
 BADGER METER INC
 BADGER PAPER MILLS INC
 BAE SYSTEMS CANADA INC
 BAIRNCO CORP
 BALDOR ELECTRIC CO
 BALKORE INDUSTRIES INC
 BALL CORP
 BANDAG INC
 BARD (C.R.) INC
 BARRINGER TECHNOLOGIES
 BASE TEN SYSTEMS -CL A
 BASTIAN INDUSTRIES
 BAUSCH & LOMB HLDGS -REDH
 BAXTER INTERNATIONAL INC
 BECKMAN COULTER INC
 BECTON DICKINSON & CO
 BEMIS CO INC
 BESTFOODS
 BIC CORP
 BIO-RAD LABORATORIES INC
 BLOCK DRUG -CL A
 BLOUNT INTL INC
 BMC INDUSTRIES INC
 BONTEX INC
 BRISTOL-MYERS SQUIBB CO
 BROCKWAY INC
 BULOVA CORP
 CABOT CORP
 CALGON CARBON CORP
 CALYPSO WIRELESS INC
 CANRAD INC
 CARTER-WALLACE INC
 CBI INDUSTRIES INC
 CBS CORP
 CBS CORP -OLD
 MILLIPORE CORP
 MOLEX INC
 MOOG INC -CL A
 MOSCOW CABLECOM CORP
 MOTOROLA SOLUTIONS INC
 MOYCO TECHNOLOGIES INC
 MSI DATA CORP
 MTS SYSTEMS CORP
 MULTIGRAPHICS INC
 NABI BIOPHARMACEUTICALS-OLD
 NABISCO GROUP HOLDINGS CORP
 NACCO INDUSTRIES -CL A
 NALCO CHEMICAL CO
 NATIONAL COMPUTER SYS INC
 NATIONAL CONVENIENCE STORES
 NATIONAL GYPSUM CO
 NATIONAL SEMICONDUCTOR CORP
 NATIONAL-STANDARD CO
 NATURES SUNSHINE PRODS INC
 NCH CORP
 NEUTROGENA CORP
 NEWELL BRANDS INC
 NEWMARKET CORP
 NEWPORT CORP
 NEXEN INC
 NORD RESOURCES CORP
 NORTEL NETWORKS CORP
 NORTHWEST AIRLINES CORP
 NUCOR CORP
 O I CORP
 OCEANEERING INTERNATIONAL
 OFFICEMAX INC
 OHIO ART CO
 OPTELECOM-NKF INC
 OPTICAL COATING LAB INC
 ORACLE CORP
 OSMONICS INC
 OUTBOARD MARINE CORP
 P & F INDUSTRIES -CL A
 PACIFIC SCIENTIFIC CO
 PALL CORP
 PALM BEACH INC
 PARKER DRILLING CO
 PENNSYLVANIA ENGINEERING
 PEPSICO INC
 PERKINELMER INC

CHAMPION INTERNATIONAL CORP
 CHATHAM MFG CO
 CHECKPOINT SYSTEMS INC
 CHEVRON CORP
 CHRIS-CRAFT INDS
 CHURCH & DWIGHT INC
 CLARCOR INC
 CLARK EQUIPMENT CO
 CLEVELAND-CLIFFS INC
 CLOROX CO/DE
 CMX CORP
 CNW CORP
 COCA-COLA CO
 COEUR MINING INC
 COHERENT INC
 COLEMAN CO INC -OLD
 COLGATE-PALMOLIVE CO
 COLTEC INDUSTRIES
 COMINCO LTD
 COMMERCIAL INTERTECH
 COMMERCIAL METALS
 COMPUTERVISION CORP
 COMSHARE INC
 CONCEPT INC
 CONNELLY CONTAINERS INC
 CONTINENTAL CAN/DE
 CORDANT TECHNOLOGIES INC
 CORDIS CORP
 CORE INDUSTRIES INC
 CRANE CO
 CRESTEK INC
 CROWN CENTRAL PETROL -CL B
 CTS CORP
 CUBIC CORP
 CYBEX INTERNATIONAL INC
 DATAMETRICS CORP
 DATASCOPE CORP
 DAVIS WATER & WASTE
 DAXOR CORP
 DAY INTERNATIONAL INC
 DETECTION SYSTEMS INC
 DETREX CORP
 DEWEY ELECTRONICS CORP
 DEXTER CORP
 DIALYSIS CORP OF AMERICA
 DIEBOLD NIXDORF INC
 PFIZER INC
 PHARMACIA & UPJOHN INC
 PHARMACIA CORP
 PHILIPS INDUSTRIES INC
 PHONE-MATE INC
 PHOTO CONTROL CORP
 PITNEY BOWES INC
 PITTWAY CORP/DE -CL A
 POTLATCHDELTA CORP
 PRATT & LAMBERT UNITED INC
 PRIMARY PDC INC
 PRINCETON HOLDINGS INC
 PRODUCTS RESEARCH & CHEMICAL
 PULSE ELECTRONICS CORP
 PURITAN-BENNETT CORP
 PVH CORP
 QUANTRONIX CORP
 QUANTUM CORP
 RADIATION SYSTEMS INC
 RALSTON PURINA CO
 RANSBURG CORP
 RAYCHEM CORP
 RAYMOND CORP
 RAYTHEON CO
 RECOTON CORP
 REDKEN LABORATORIES
 REFLECTONE INC
 REGAL BELOIT CORP
 REVLON INC -OLD
 REYNOLDS METALS CO
 RHONE-POULENC RORER
 RIPLEY CO INC
 ROBBINS & MYERS INC
 ROBINS (A.H.) CO
 ROHM AND HAAS CO
 ROHR INC
 SALEM CORP
 SAVANNAH FOODS & INDS
 SBE INC
 SCHERER (R P)/DE
 SCHERER HEALTHCARE INC
 SCHERING-PLOUGH
 SCHULMAN (A.) INC
 SCOTT PAPER CO
 SCOTT'S LIQUID GOLD
 SEAGATE TECHNOLOGY-OLD

DIODES INC
 DISNEY (WALT) CO
 DIXIE GROUP INC
 DIXON TICONDEROGA CO
 DOMTAR INC
 DONALDSON CO INC
 DOW JONES & CO INC
 DOWDUPONT INC
 DREWRY PHOTOCOLOR CORP
 DRIVER-HARRIS CO
 DU PONT (E I) DE NEMOURS
 DUN & BRADSTREET CORP
 DYNAMICS CORP OF AMER
 DYNCORP INC
 EAGLE-PICHER INC
 ECOLAB INC
 ELECTRONIC CONTROL SYS INC
 ELECTRONIC DATA SYSTEMS CORP
 ELKCORP
 EMERSON ELECTRIC CO
 EMEX CORP
 EMS TECHNOLOGIES INC
 ENERCO INC
 ENGRAPH INC
 ENVIRONMENTAL TECTONICS CORP
 ENVIRONMENT-ONE CORP
 EPSCO INC
 EQUIPMENT CO OF AMERICA
 ERO INDUSTRIES INC
 ESCALADE INC
 EVEREST&JENNINGS INTL
 EXX INC -CL A
 EXXON MOBIL CORP
 FAB INDUSTRIES INC
 FACET ENTERPRISES
 FAIRCHILD CORP -CL A
 FARAH INC
 FARR CO
 FEDERAL PAPER BOARD CO
 FERRO CORP
 FINNIGAN CORP
 FLAMEMASTER CORP
 FLEETWOOD ENTERPRISES INC
 FLUKE CORP
 FMC CORP
 FORT JAMES CORP
 SEAGRAM CO LTD
 SENSORMATIC ELECTRONICS
 SENSYTECH INC
 SFE TECHNOLOGIES
 SHAW INDUSTRIES INC
 SIERRACIN CORP
 SIGMA-ALDRICH CORP
 SIMPSON INDUSTRIES
 SL INDUSTRIES INC
 SMURFIT-STONE CONTAINER CORP
 SNAP-ON INC
 SOLITRON DEVICES INC
 SOUTHDOWN INC
 SPECIALTY COMPOSITES CORP
 SPECTRA-PHYSICS
 SPHERIX INC -OLD
 SPRINT CORP
 SPX CORP
 ST JUDE MEDICAL INC
 STANDARD COMMERCIAL CORP
 STANDARD HAVENS -CL A
 STANDARD MICROSYSTEMS CORP
 STANDARD PRODUCTS CO
 STONE & WEBSTER INC
 STONE CONTAINER CORP
 STORAGE TECHNOLOGY CP
 SUNLINK HEALTH SYSTEMS INC
 SUPERIOR UNIFORM GROUP INC
 SYRACUSE SUPPLY CO
 TAMBRANDS INC
 TANDEM COMPUTERS INC
 TEKTRONIX INC
 TELEFLEX INC
 TERADYNE INC
 TEREX CORP
 TERMINAL DATA CORP
 TEXACO INC
 TEXAS INDUSTRIES INC
 TEXAS INSTRUMENTS INC
 TEXFI INDUSTRIES INC
 THERMO FISHER SCIENTIFIC INC
 THOMAS & BETTS CORP
 THORN APPLE VALLEY INC
 TIANRONG INTERNET PRDS & SRV
 TIME WARNER INC-OLD
 TIMEPLEX INC

FORTTRAN CORP
 FULLER (H. B.) CO
 FURON CO
 GALEN HEALTH CARE INC
 GALVESTON HOUSTON
 GAP INC
 GENERAL DYNAMICS CORP
 GENERAL KINETICS INC
 GENERAL MICROWAVE CORP
 GENERAL MILLS INC
 GENERAL MOTORS CO
 GENESEE CORP -CL B
 GENRAD INC
 GOODRICH CORP
 GORMAN-RUPP CO
 GREAT LAKES CHEMICAL CORP
 GT BIOPHARMA INC
 GTE CORP
 GUARDSMAN PRODUCTS INC
 HANOVER DIRECT INC
 HARLAND (JOHN H.) CO
 HARSCO CORP
 HARTMARX CORP
 HASBRO INC
 HASTINGS MANUFACTURING CO
 HEICO CORP
 HEIN-WERNER CORP
 HELEN OF TROY LTD
 HELENE CURTIS INDS
 HERCULES INC
 HERSHEY CO
 HESS CORP
 HIPOTRONICS INC
 HI-SHEAR INDUSTRIES
 HOMESTAKE MINING
 HOWELL CORP
 HP INC
 HYDRO FLAME CORP
 INCO LTD
 INFORMATION INTERNATIONAL
 INTEL CORP
 INTERNATIONAL ALUMINUM CORP
 INTL BUSINESS MACHINES CORP
 INTL FLAVORS & FRAGRANCES
 INTL PAPER CO
 INTL RECTIFIER CORP
 TINSLEY LABORATORIES INC
 TJ INTERNATIONAL INC
 TODD SHIPYARDS CORP
 TONKA CORP
 TORO CO
 TOTAL PETROLEUM OF N AMERICA
 TRANSTECH INDUSTRIES INC
 TRANZONIC COS
 TRC COS INC
 TRION INC
 TULTEX CORP
 TYLER TECHNOLOGIES INC
 TYSON FOODS INC -CL A
 U S SURGICAL CORP
 UNIFI INC
 UNIFLEX INC
 UNION CAMP CORP
 UNION PACIFIC CORP
 UNITED CONTINENTAL HLDGS INC
 UNITED-GUARDIAN INC
 UNOCAL CORP
 URS CORP
 USG CORP
 VALSPAR CORP
 VARCO INTERNATIONAL-OLD
 VARIAN MEDICAL SYSTEMS INC
 VARO INC
 VEECO INSTRUMENTS INC
 VERMONT AMERICAN -CL A
 VGC CORP -CL B
 VICON INDUSTRIES INC
 VIPONT PHARMACEUTICAL INC
 VISKASE COMPANIES INC
 VLSI TECHNOLOGY INC
 VOICE IT WORLDWIDE INC
 WARNER-LAMBERT CO
 WATKINS-JOHNSON
 WATSCO INC
 WAUSAU PAPER CORP
 WESTERN CO OF NO AMER
 WESTERN DIGITAL CORP
 WETTERAU INC
 WILLAMETTE INDUSTRIES
 WINNEBAGO INDUSTRIES
 WITCO CORP
 WOLVERINE TECHNOLOGIES INC

INTRICON CORP
INVACARE CORP
ISOMET CORP
ITT INC
JACLYN INC
JOHNSON & JOHNSON
JOHNSON OUTDOORS INC -CL A
JOSLYN CORP
K2 INC
KATE SPADE & CO
HANOVER DIRECT INC

WOODSTREAM CORP
WOODWARD INC
WYETH
XEROX CORP
YORK INTERNATIONAL CORP
ZARLINK SEMICONDUCTOR INC
ZENITH ELECTRONICS CORP