



**UNIVERSITY OF GHANA BUSINESS SCHOOL**

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**DETERMINANTS OF COMPREHENSIVE MOTOR INSURANCE PRICING IN**

**GHANA**

**BY**

**JEDIDIAH NACHINAB**

**A THESIS SUBMITTED TO THE UNIVERSITY OF GHANA BUSINESS  
SCHOOL IN PARTIAL FULLFILMENT OF THE REQUIREMENT  
FOR THE AWRD OF MASTER OF PHILOSOPHY IN RISK  
MANAGEMENT AND INSURANCE DEGREE**

**INTEGRI PROCEDAMUS**

**DECEMBER 2021**

**DECLARATION**

I hereby affirm that this submission is my personal work towards the Masters of Philosophy in Risk Management and Insurance and that, to the best of my knowledge, it contains no significant formerly published work by another person or material which has been accepted for the award of any other degree of the University, except where due acknowledgement has been made in the text.



**JEDIDIAH NACHINAB**

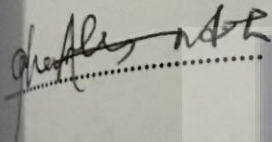
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### CERTIFICATION

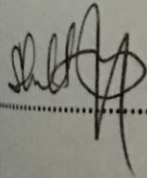
This is to certify that this thesis has been supervised with the laid down principles for thesis writing at the University.



**PROF. CHARLES ANDOH (SUPERVISOR)**

16/12/2021

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**DR. SAINT KUTTU (SUPERVISOR)**

17/12/2021

DATE



**DEDICATION**

I dedicate this work to my late mother, Sarah Nachinab, Rev. Samuel Nachinab, Jehoiada Nachinab, Jemima Nachinab and my good friend Daniel Osei-Agyemang (Head of claims, Prime Insurance).



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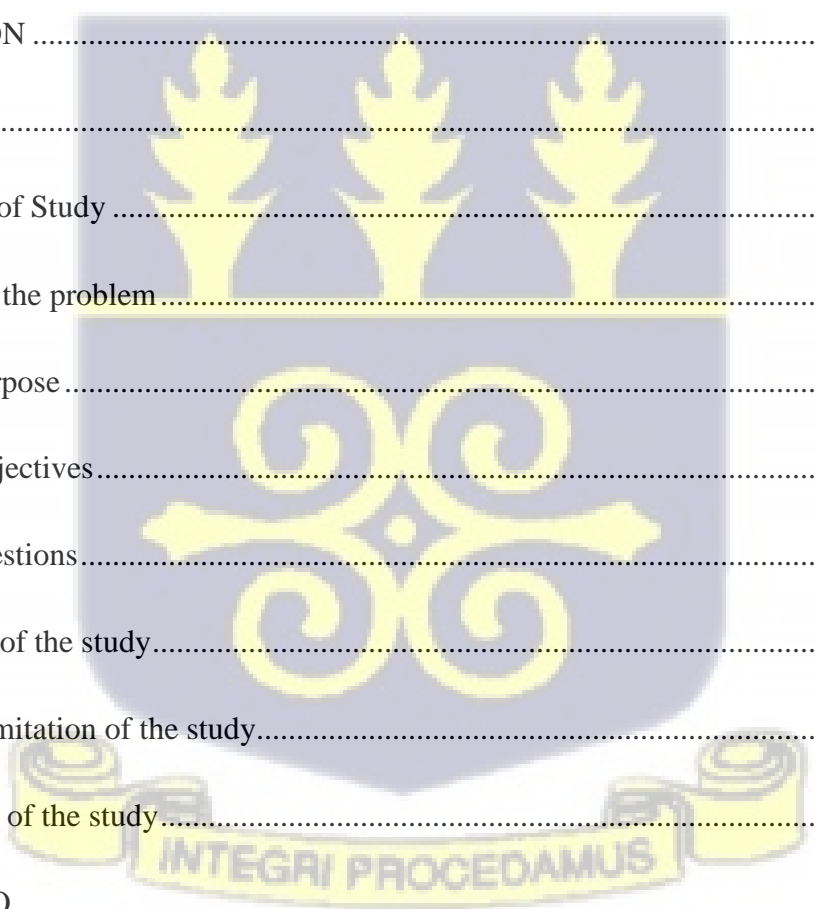
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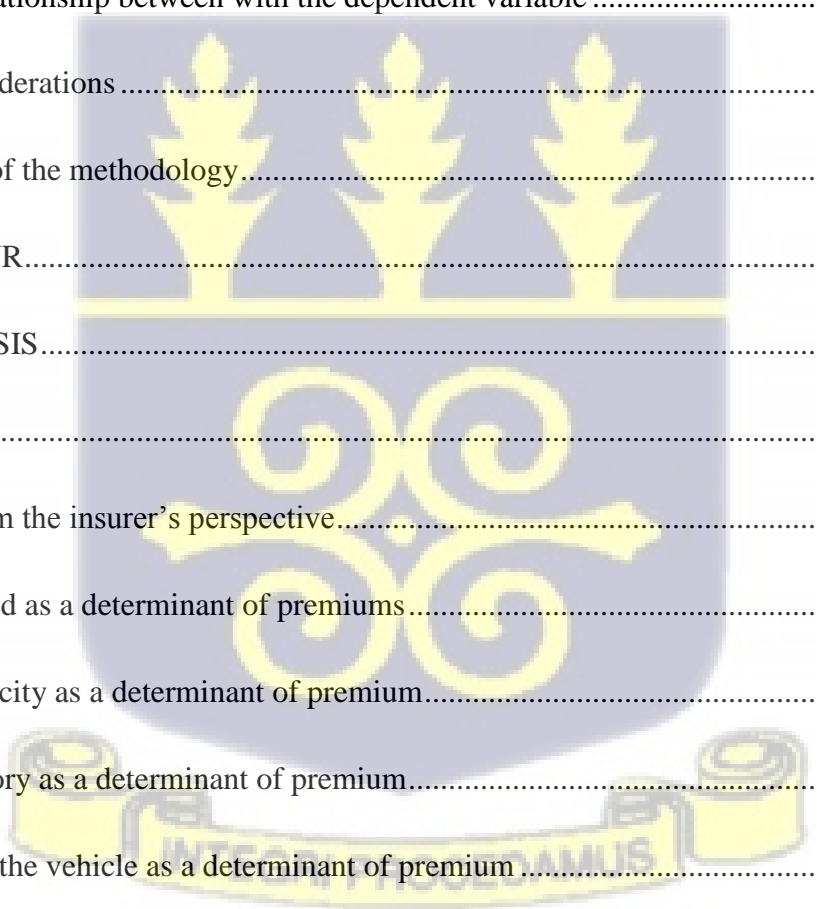
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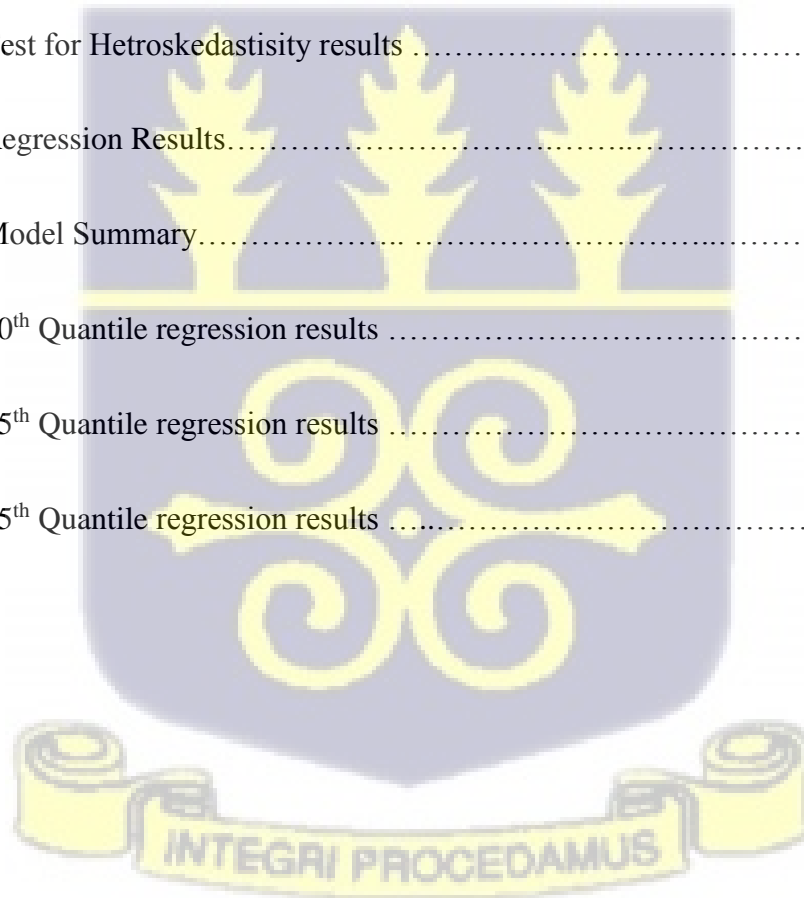


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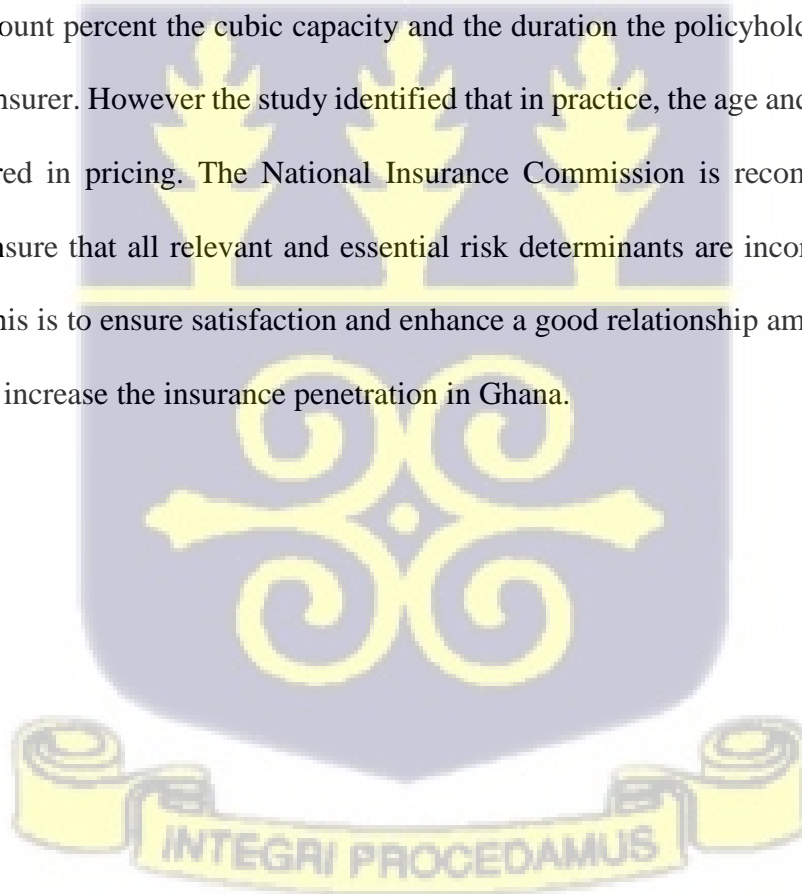
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## ABSTRACT

The purpose of this study is to identify relevant factors that influence comprehensive motor insurance pricing in Ghana. The study used primary data by way of issuing questionnaires to the underwriting department of 20 insurance companies out of the 29 insurance companies and a sample of 300 individual comprehensive motor insurance policy owners in Ghana. Multiple regression was used to show the impact of the various determinants of premium and how statistically significant they are in predicting premiums. The study further employed quantile regression to further explain the impact of the explanatory variables over different percentiles of the data set. The findings suggest that the relevant determinants of premium includes, the sum insured, the discount percent the cubic capacity and the duration the policyholder has kept of the policy with the insurer. However the study identified that in practice, the age and gender of drivers are not considered in pricing. The National Insurance Commission is recommended to enact regulations to ensure that all relevant and essential risk determinants are incorporated in risk to classification. This is to ensure satisfaction and enhance a good relationship among players in the industry so as to increase the insurance penetration in Ghana.



*Keywords and phrases: Comprehensive motor insurance, multiple linear regression, simultaneous quantile regression, sum insured.*

## CHAPTER ONE

### INTRODUCTION

#### 1.1 Overview

This is the introductory chapter. It consists of relevant background information on motor insurance pricing, research problem, the objectives and the research questions that arise out of it. This introductory chapter also makes available the critical importance of this study.

#### 1.2 Background of Study

Ratemaking is a fundamental role of insurers, regulated by the National Insurance Commission (NIC) and must be carried out properly in order to maintain insurer solvency and the insured satisfaction. Setting premiums are determined by the interplay of certain factors in flow relation to a specific risk. However, heated debates over which factors should be considered when pricing motor insurance products can be traced back to the 1970s and 1980s. From the actuarial point of view, important practical problems are in the choice of estimation method and or the rating variables for setting a pure premium (Chu, Chih, Chwen-Chi, & Emilio, 2010). It is therefore very difficult to settle on a particular approach to premium calculation. Premiums would be dependent on the insurer's perception of risk based on certain standards. So, what does the insurer consider before naming a premium for a particular prospect vehicle? What accounts for the differences in these premiums between various insured vehicles? Knowing what the insurer bases of pricing judgments will enable the insured estimate his or her risk considering these determinants and fairly predict the range of his or her premium. Do these general disagreements with the prices quoted suggest underwriting systems that need revision or variables that defy their purpose?

Traditionally the practice in premium determination is to define a base premium and apply a series of relatives to the base premium depending on the value of each rating factors. This is commonly known as a multiple rating structure (Nelson & Boo, 2009). However, how is the value of the ratings determined? Little research has gone into this aspect of rate making especially in the insurance industry of Ghana.

In July 2016, people took to the streets after a call for action by a group called Underground Ireland to protest against the rising motor insurance premiums in Dublin, Ireland (McNeice, 2016). The story is no different in Ghana. There are recurring threats by drivers to go on strike following a proposal to increase motor insurance premiums or the actual increment (Ansah, 2016). There seems to be this trend of unsatisfied motor insurance customers worldwide thus denting the relationship between insurers and the insured.

### **1.3 Statement of the problem**

The fairness of premiums on the side of both the insurer and the insured is critical to promote a smooth operation in the motor insurance industry and the economy at large. All related standards therefore have to be continually reviewed to ensure that the needs of both parties are adequately met. In 2016 the National Insurance Commission (NIC) projected that Insurance penetration rise from the reported 3% to 10% by 2021. In sharp contrast however, the NIC reports insurance penetration as 1% in 2021. In assessing the reasons for the low insurance patronage in Ghana, it was found out that one of the prevailing reasons for the low demand was the negative impact of price of comprehensive motor insurance (Awunyor-Vitor, 2012).

A number of factors have been identified by earlier studies to be determinants of risk; they include age, gender, driving record among many others. Kelly (2006) corroborates this viewpoint by

proposing that numbers of years licensed, driving record, safe driving rewards for young drivers, distance travelled and insurance scores be used either in place of or in conjunction with age and gender in risk classification. However, if really these factors matter at all, and then to what extent do they affect the rate that should be charged? This question has received less attention especially in our geographical region, Ghana.

Other than looking at the cost of the vehicle and other factors, some studies argue that the insurer should focus on predicting the frequency and severity of loss considering a particular observable risk and the pool of risks as a whole (Mihaela, 2015). Also, according to Bosari (2013), insurance companies use non-driving related risk factors in addition to the driving related factors to determine motor insurance rates on a daily basis. He added that in pricing motor insurance, women pay less than men on the average because men are seen as higher risk individuals than their female counterparts and likewise, young people are also considered high risk individuals. However, some have argued that using uncontrollable factors such as age and gender is highly unfair since they occur naturally beyond human influence (Mihaela, 2015).

The insurer's prices are sometimes received with much disapproval from the insured. Other insurers due to competition charge lower than average rates in order to attract customers; a trend termed as undercutting in the insurance system, which can result in the insurer's inability to service claims. This frustrates the actual purpose of comprehensive motor insurance. Some members of the public argue that factors such as gender, age and credit scores have no business predicting a driver's risk but a driver's record and accident record should be the determining factors (Awunyor-Vitor, 2012).

Comprehensive motor insurance policy owners should have the right to access or know how the premiums they are charged are calculated in order to maintain transparency and trust in the

industry. Some critics defend the insurance company on the secrecy with their underwriting standards or actuarial calculations that, it is their competitive advantage. The study compares trend to Coca-Cola's secret recipe suggesting that baring it all provides no advantage to the company but opens it up for attacks from competition. However, it should not be treated as such.

What factors should be considered in pricing Comprehensive motor insurance policies? Should the insurer focus on vehicle related factors such as the cost of vehicle, cubic capacity, seating capacity amongst others or the driver related factors such as age of driver, gender, driving history amongst others? If really these factors under contention matter at all, then, to what extent do they affect the premium that should be charged? This question has received less attention especially in our geographical region, Ghana.

#### **1.4 Research Purpose**

The general purpose of this research is to identify the relevant factors that are considered in the pricing of comprehensive motor insurance to improve the current underwriting system. This would ensure that policy owners are satisfied and insurers are in a better position to service claims.

#### **1.5 Research Objectives**

The general objective of this research is to identify the actual factors that determine the risk of a person under comprehensive motor insurance and develop an effective model for premium calculation. In specifics these are the objectives that this study seeks to address;

- I. To develop a model for premium calculation for Comprehensive motor insurance policies.
- II. Evaluate and determine the relevant factors that influence the risk of a vehicle under motor insurance pricing in Ghana.

III. To determine the predictive magnitude of the various factors on premium charged

### **1.6 Research questions**

The questions below form the very basis on which the research is founded. The answers to these will presumptively be the outcome of the research since they tackle the very core of the research topic. They are;

- I. What model can best predict the premium to be charged under comprehensive motor insurance?
- II. What are the relevant factors that influence the risk of a person under comprehensive motor insurance
- III. What is the impact of these premium determinants on premium

### **1.7 Significance of the study**

This study is aimed at arriving at certain factors that influences risk under motor insurance and to provide a model for premium determination. These findings would first of all be useful to insurance companies, the insured, the regulators and the general public.

The insurer can use this model to easily determine the rates that are to be charged for each comprehensive motor insurance applicant just by entering the values of the variables. This would be less time consuming and very cost effective, safe from the trouble of assessing each risk. The insured with this model can fairly predict the rate that is likely to be charged by the insurer. The regulators of the market may employ the findings of this study to update their database and ensure fairness in the market. The general public on the other hand can always use the model which

establishes transparency as in the banking sector where bank charges amongst others are known to all, both clients and the general public.

### **1.8 Scope and limitation of the study**

This study focused on identifying the factors that affects the risk of a person in motor insurance. For the purpose of this study, comprehensive motor insurance premiums was considered as the focus. This study does not include other forms of insurance aside comprehensive motor insurance. Hence Third Party Only and Third Party fire and theft are not the focus of this research. It also evaluated the value that should be placed on the factors hence its influence on premiums charged. The study looked at insurance companies and comprehensive motor insurance policy owners across Ghana as its geographic focus to arrive at its findings.

The study did not consider all the variables that were pointed out by the earlier studies as determinants of motor insurance premiums in the model that would be used to estimate motor insurance premium because they are not dominant in Ghana. However, these limitations are not sufficient to undermine the relevance of the study as further research would be required to test the relevance of these factors in our geographical region, Ghana.

### **1.9 Organization of the study**

The rest of this study is structured four additional chapters. The review of earlier conducted studies would be contained in chapter two. Chapter three describes the methods and procedure that was adopted in arriving at the findings. Chapter four was dedicated to the analysis of the collected data and the presentations and discussions of the findings of the study. The last chapter contains the summary and all relevant conclusions that were drawn from the study; it also includes recommendations to that effect.



## CHAPTER TWO

### LITERATURE REVIEW

#### 2.1 Overview

This section concentrates on the literature findings of existing literature on the motor insurance. The key concepts, definitions and aspects of the motor insurance are covered as is observed in the World. Further sections examine the theoretical and conceptual underpinnings of the motor insurance industry. The final section then captures the empirical reviews on the industry.

#### 2.2 The Motor insurance in Ghana

Ghana's motor insurance Act 1958 was set in force on the 1<sup>st</sup> of April 1959 to replace the Road Traffic Ordinance of 1952. Motor insurance, unlike other insurance policies is mandatory at least to have a third party cover. Motor insurance relates to providing cover for all motor vehicles; be it motor cycles, cars, jeeps, commercial vehicles, and trailers among others. The Act in certain instances allows for some exemptions. The exemptions according to the Act include; vehicles owned and used for the purposes of the government, owners of vehicles aside a passenger vehicle who have deposited an amount with the Accountant-General, vehicle used by the police, persons and vehicles so exempted by the Governor-General. The basic cover under motor insurance is compulsory for all. This basic cover is the third party only cover. The third party only component of the cover seeks to provide unlimited compensation for bodily injury and death for the third party involved in a motor accident. Policy owners can however extend the cover to cater for Third Party Fire and Theft or secure a Comprehensive motor insurance covers with each category or product with a much-added features and benefits and hence difference in premiums. In motor insurance underwriting, the insurance company (insurer) does an assessment of the risk exposed upon which

a decision to accept or reject the risk is made. A decision to accept a risk can be on the normal terms and conditions, standard premium, loaded premium, imposed excess, reduced cover or other modifications based on the nature or uniqueness of that risk. In assessing the risk, the insurer compares the risk presented in the light of certain standards such as drivers' record, nature of vehicle, type of coverage required, area of garage and loss or claim history with other insurers etc.

The making of the Third Party Insurance a mandatory requirement by The Motor Vehicles-Third Party Insurance, Act 42 resulted in a huge demand for this insurance product and subsequently created a market for motor insurance product in Ghana (Awunyor-Vitor, 2012). Insurance companies came up with more complex covers to cover certain needs of their policy owners. These special covers come at an extra cost hence an increase in premium as compared to the regular insurance covers. The study identified income, value of the car, age of the vehicle, and the perception of the premium and claim procedure as the main factors that influence the demand for comprehensive motor insurance in the Kumasi Metropolis for instance (Awunyor-Vitor, 2012). The study suggested that, in order for insurers to further increase demand, they should target wealthy people, individuals who used bank loans to purchase vehicles, improve their claim servicing, and set equitable premium (because premiums and demands are inversely related). Thus, the higher the premium charged, the lower the demand for motor insurance (not the compulsory third party only).

### **2.3 Overview of the motor insurance**

The Motor Insurance, also known as auto insurance, offers to pay for or compensate an insured party for any loss or damage to/ caused by the insured vehicle. It also covers any damage caused to another individual, vehicle or their property.

A motor insurance policy covers damages to the vehicle due to:

- I. Accidents/collisions
- II. Theft
- III. Fire
- IV. Vandalism or sabotage
- V. Riot and strike
- VI. Earthquake
- VII. Terrorism acts
- VIII. Flood, storm, cyclone, lightning
- IX. Landslide

### **2.3.1 Types of motor insurance covers**

There are many types of motor insurance policies available. Irrespective of the vehicle type, Motor insurance policies are mainly of two types, which depend on what kind of liabilities the insurance covers.

The two specified types are the Third-party policy and the Comprehensive Policy. The Third-Party Policy therefore covers damages caused to another person, their vehicle or property due to collision or accidents. It however leaves out damages to one's own vehicle or bodily injuries, which you may suffer. The Comprehensive policy as well covers damages caused to the individual, the vehicle, or a third party due to collisions, theft, sabotage, natural calamities, man-made calamities or even fire. The policy covers all kinds of damages, except for the loss suffered while drinking under the influence of alcohol or drugs or without a policy or license (Editorial Staff, 2017).

### **2.3.2 The costing of the motor insurance policy**

The costing of a motor insurance policy depends on a number of factors such as the type of insurance policy, the Insured Declared Value of the vehicle, manufacturing year of the vehicle among others. These costs come into the determination of the amount one pays as premium.

### **2.3.2.1 The value of the vehicle (Sum insured)**

At the inception of insurance motor insurance policies, the proposal forms require the prospective policy owner to state the price or the value of the vehicle known to the insurer as sum insured. The premium calculation is based on the stated sum insured of the vehicle as at the time of the evaluation. This process is termed as Insured Declared Value (IDV). This IDV is the maximum amount an insurer pays in the event of an accident or occurrence of the insured circumstance. The sum insured is considered as the IDV charged on the car and this as well leads to higher premium costs (Editorial Staff, 2017).

### **2.3.2.2 The type of Insurance**

The insurance coverage options differ across different motor insurance policies. The greater the coverage, the higher the premium charged as well. Whereas, a third party insurance will cover only the damage made to another vehicle, person or property, the comprehensive insurance covers the third-party damage as well as own damage. On a pricing level, the third-party insurance is cheaper than the comprehensive insurance (Editorial Staff, 2017).

### **2.3.2.3 The age of the vehicle**

Vehicle life is an important part of valuing an insurance cover. The age of the vehicle is determined by subtracting the year of manufacture of the vehicle from the current year. The older the vehicle, the lower its market value is expected to be. On the other hand, the age of the vehicle could heighten its exposure to damages that may result in accidents and so increase its premium charge.

This is the case for the insurer examining the vehicle thoroughly before processing the policy application.

#### **2.3.2.4 The claim history of the insured**

Most times, regular claims reported increases premium payments in subsequent insurance covers. The number of times you make a claim in a year affects the premium amount charged. Some insurance providers reward policyholders for a no claim made in any active policy year. This is called a No Claim Bonus (NCB). Frequent claims represent a higher tendency to be involved in more accidents hence a greater risk to the insurer.

#### **2.3.2.5 The additional covers on the policy.**

In a given insurance cover, the more services and coverage offered add-on to premium costs. This increases the cost of the cover and so insurers charge higher premium to underwrite such losses should they occur.

#### **2.3.2.6 Added security on vehicle**

There are cases where some vehicles have some embedded security features. These security features may be trackers, anti-theft systems and sensors among others. These lowers the risk of loss due to theft among others. In such cases, the risk valuation reduces and so a lower premium is charged (Editorial Staff, 2017).



## **2.4 History of motor insurance pricing (premium)**

The inverse relationship between premiums and demand imposes on insurers the imperative to equitably set premiums that will cover claim settlements, pay for technical services, cover acquisition costs or commissions, pay salaries and overheads, ensure profits and still maintain competition in the market. Thus insurers price the product to commensurate with the risk it is exposed to. In the earlier years of auto insurance in the USA, it was in two forms- those written by casualty and liability companies and those written by fire and marine insurance companies according to Riegel (1917). During that era, the country was divided into 11 sections and automobiles divided into four groups (private pleasure cars, public vehicles, commercial motors, and manufacturers' and dealers' cars) for the purpose of rate making. That era further considered some three factors as necessary in rate making of each individual automobile and they included; motive power (electric cars that bore lower premiums and gasoline cars which attracted higher premiums), territory or geographic location and horse power of the vehicle. For insurance against theft and fire the rating was based on the territory, list price or value of the car, model, vehicle's age (new and second-hand), and the motive power. This method of rating had their own defects as some people regarded them as quite discriminatory and hence moving forward, individual researchers have tested and explored new factors to incorporate into the rate making process to ensure equity and fairness for both the insured and the insurance company.

## **2.5 The concepts of insurance pricing**

The pricing of insurance products is as critical as the insurance products itself. Abbott, Wallace and Beck (2006) propounds that we live in a society that fears events which are uncertain and are considered as risk-taking. People are therefore ready to pay a token to transfer that risk, but to what amount would they be ready to pay to transfer the risk is worthy of note. Again, a research made

by Mihaela (2013), numerous studies on the principle of precaution shows that individuals want to live in a safe society and hence this feeling of uncertainty and fear leads individuals to show special attention to the advantages of safety. According to a research made by Lagadec (1981), the request for insurance has increased as a result of having in exchange the guarantee of financial security against losses that may occur. This has led to the development and growth of insurance, which seeks to solve the issue of uncertainty by providing protection for man and his assets against any possible risk. A study by Mihaela (2013) reveals that, the main role of insurance is to provide a means for transferring the economic impact that is involved by uncertain events to an insurer by payments of an insurance premium by the insured. According to Denuit (2003), the pricing process outlines a procedure for determining a fair premium relating to the insured's individual risk profile. Furthermore, the pricing process in insurance can be considered as a unit of methods that determines the price paid by the insured to the insurers in exchange for the transfer of their risk. In determining the prices, there has to be a free flow of information from both the insured and the insurer and when it is not so, it creates a problem, which may lead to difficulties in evaluating the risk level of the insured. The economics literature by Mihaela (2013) presents two aspects of asymmetrical information, which includes moral hazard and adverse selection. Denuit, Marechal, and Walhin (2007) assert that, adverse selection occurs when the policyholders have a better knowledge of their claim behavior than the insurer does and uses it to the disadvantage of the insurer. Also, Chiappori, Jullien and Salanie (2006) proclaimed that, moral hazards arises only when the probability of risk occurrence depends on the insured's behavior and his decisions. These two phenomena were differentiated in a study by Dionne, Michaud, and Pinquet (2013) who is argued that adverse selection is the effect of unobserved differences among individuals which affects the optimality of insurance contracts whereas moral hazard is the effect of contracts on

individuals unobserved behavior. This means that, with the information problem, risk that are not favorable are covered at a standard rate and this makes it cheaper when it is compare with its real cost and this discourages insurers from insuring medium risks.

## **2.6 The modified auto insurance rating**

That previous era of auto insurance rating was quite regulated and there existed less information and data to help rates accurately predict and determine rates for each risk. This therefore called for a massive investment in information and a lot of researches were carried out in that direction. The era after 1917, generally saw a change in cars in terms of speed, horsepower, models and general features and hence this generally affected the automobile insurance industry in terms of its operations as reported by (Loman, 1932). This therefore saw an increase in motor vehicle accidents, new liability legislations were enacted which led to insurers instituting merit rating mechanisms to induce responsible and safe driving and facilitate equity. Therefore, in order to ensure equity, actuaries were employed to ensure this objective is upheld in determining auto insurance rates. In (Coutts, 1984), a detailed breakdown of data, which combines practical and technical judgment in pricing motor insurance products, was proposed. The paper also reviewed claim cost and economic conditions in ratemaking.

## **2.7 Some factors that affect motor insurance ratings**

The basic Automobile Insurance rating factors are age and sex of the driver, use of the automobile, and drivers' record (Vaughan & Vaughan, 2007). Actuaries sometimes consider other factors such as location of the garage, value of the vehicle, deductibles selected etc. Also, Rejda and McNamara (2014) outlined several factors that go into motor insurance rating to include; territory or location of the garage, age gender and marital status, use of automobile, level of drivers' education, good student

discount, number and types of vehicles (fleet and value), individual driving record and claim history. Holding the above factors in check, a general increase in medical bills, cost of vehicles repairs, the legal liability hazard, fraudulent and padded claims have recently caused a hike in the cost of auto insurance.

Researches in other jurisdictions sought to consider how insurers incorporate the above rating factors and others in arriving at a premium for automobile users who need this type of insurance product. A study by Bernstein (1994), aimed at using database from government sources and insurance companies to develop a model that was tested on a pay at a pump automobile insurance system. The study focused on factors such as; driver's safety records, annual miles driven, years of driving experience, location, type of car, travel patterns, coverage and tort rules. The paper reported that individuals who were not price conscious tend to pay more premiums for auto insurance but do not realize so because their agents compensate them by providing a higher service standard for them. The reason is that; a higher premium means a juicier commission for that agent of the client. These services rendered by these agents at the pump station affected how each individual insured decided if it were better or worse under this auto insurance system.

A study in the regulated Taiwanese insurance market by Li, Lin, Liu, and Venezian (2010) examined the role of age and gender as used as rating factors in the face of ethical concerns, actuarial fairness, constitutional rights and other objections. They mentioned driving experience as another rating factor in rate making. The study also made an interesting observation that, rating based on age can cause young people to register vehicles in the names of older people in order to enjoy low premiums and females registering on behalf of males. The result is an adverse selection if stringent underwriting standards are not in place.

The two main rating factors of age and gender have been viewed by some as been discriminatory, unethical, and unfair. However, Brown, Charters, Gunz, and Haddow (2007) argued that age, as rating variable is an acceptable discrimination under the principle of actuarial equity and the related concept of risk classification. Bernstein (1994) found that age, as a rating was not used in six of the ten provinces of Canada because it led to moral hazards and other unfair pricing methods such as cross subsidization. Their study approached from a theoretical perspective by examining concepts relevant to this topic namely, discrimination and fairness and then reviewed wider purposes of insurance, adding both actuarial equity and risk classification. They went ahead to evaluate and defend the application of these principles in the current context of ratemaking. Their study was based on an earlier stance by Wieger (1989) which found that though age, sex and marital status are not entirely acceptable variables for rating, they are necessary because they are not arbitrary and non-redundant and therefore relevant in that current condition in auto insurance rating. The salient reason is that, the auto insurance industry has not reached the point where age can be eliminated from insurance rating processes without creating market disruptions and increases in moral hazards that are themselves undesirable.

The use of age in particular continues to attract a lot of debate regarding its acceptability as a relevant discriminatory and fair actuarial practice. In a study by Nielson and Kelly (2006), it was realized that age was practically reliable and implementable variable that lends itself to no intuitive causal relationship. It further suggested high correlation between age on one hand and the frequency and severity of motor accident on the other in a U-shaped curve when accident history was plotted against the age variable.

## 2.8 Adjusting some of these factors in determining premium

Having identified and reviewed some factors that go into motor insurance rating particularly age, gender and marital status, we consider how these factors are incorporated to arrive at a premium. In a related survey in Australia presented to the Australian Institute of Actuaries, Henwood and Wang (2009) sought to explore some motor insurance rating approaches based on certain primary rating factors as driver rating, vehicle rating, and location rating as well as other rating factors such as vehicle usage, multiple policies, voluntary excesses and no claim and family discounts. Their study generated a regression model for the various factors and established a correlation between these factors and premiums.

A similar study conducted by Dionne and Vanasse (1992) in which they presented a statistical model that incorporates a priori and a posteriori model into a single proposed model which will eliminate the inconsistencies with the two stage bonus-malus procedure. Their study was done in the presence of asymmetric information to produce a negative binomial model with a regression component in order to truly estimate an accurate distribution of accidents to determine premiums. Their study also sought to help rates build a system that adds severity as a rating factor and also increase incentives to ensure safety under asymmetrical information. They however suggested for future research to steer towards incorporating individual's actions and characteristics in a model that simultaneously explains the occurrence and severity of accidents.

In their quest to outline alternatives to the basic rate classification factors such as territory, age, sex marital status, years of driving experience, and use of vehicle, Hoffer and Miller (1979) offered an alternative rating factors to solve the problem of affordability and accessibility to motor insurance. They suggested a pricing system where premiums were rather linked to the mileage driven by the user and the driving record of the insured. The vehicle usage/mileage factor was based on *ex ante* or

predictable premiums whilst that of ex-post pricing system regarded the frequency and severity of road traffic violations and convictions. Their approach also came with its own defects as being discriminatory, created room for the insured to evade premiums, unemployment, and general overhaul in the structure of the automobile insurance industry. In their subsequent study, Hoffer and Miller (1983) extended their departure from the primary factors such as age of a driver, sex and marital status, territory, use of the automobile, driving experience which according to them only predicted accident frequency not its severity. Their new and alternative factor was based on vehicle mileage measured by fuel consumption, the location and the driving record of the insured to help improve the current premium system by reducing marketing expenses, premium collection and claim adjustment. According to them, their study will help reduce the number of uninsured motorists and eliminate the present residual markets. They also identified poor service delivery, absence of consumer choice, layoff of marketing and collection staff as some of the defects with the implementation their plan.

## **2.9 Theoretical framework**

This section considered the theoretical backing supporting the data on motor insurance. The study on insurance bothers around assessment of risks, the perceptions of the insured and conditionality in the discharge of the insured risks. In this study, two major theories are considered for the assessment of motor insurance determinants. These are the prospect utility theory and the state-dependent utility theory.

### **2.9.1 The prospect utility theory**

The prospect utility theory is solely concerned about how an individual or prospect views an insurance offer not just on the amount of uncertainty, but also in terms of profits and losses uncertainty as may be concluded by an expected utility index. Here, the individual is more

interested in what he or she would gain in taking up the policy and not because of the cover against the injury or risk. Thus, the individual assumes some optimal level of risk conditioning his choice for which insurance cover. To address this in the insurance context is to say that the insured is always looking at a gain perspective and not on the industry basis that insurance reduces uncertainty about tomorrow. In the case of the motor insurance cover, the individual would first determine the level of threat and to what extent a deviance may occur even before taking a decision to purchase a policy cover. This is also same for one who sees gain in getting a refurbished vehicle or a higher financing in terms of injury or accidents and so opts for the insurance offer of a higher benefit, be it in the comprehensive cover or third-party cover. So then, customers insure when the certainty of loss is clear to them as they seek to gain from the situation when it does happen. This is totally different from being risk averse and for many of such, they are risk preferring, looking on to the gains than to the losses that may occur (Kahnemann & Tversky, 1979).

### **2.9.2 The state-dependent utility theory**

The theory states that the utility levels and risk-tolerance levels of consumers are hinged on their specific states, such as their socio-economic situation. That is, in a case where the individual deems him or herself as being capable of surviving a loss in the not so distant future, it makes them hesitant in getting a comprehensive cover. To them, they are in a no loss state where the risks and its associated costs would be minimal as compared to getting insured. Here, perceptions are really influential and individuals get to a state of different degrees of risk aversion affecting their decision to sign up or even the pay-offs they attribute to their decision of being insured. Individuals in referring to the no loss state have a lower intent to an insurance decision and so a lower than full loss coverage may be done if they anticipate a lower cost than is proposed in the event occurring. Thus, according to Phelps (1973), holding on to a person's current situation and the size of

insurance pay-off envisioned should the loss occur, the effect on the demand for a motor insurance cover may differ.

## **2.10 Empirical review**

This section is an overview of studies relating to the pricing of motor vehicle insurance and its associated relations across various sectors. The observations look at how the insurer and the insured come together to cover the intended asset.

### **2.10.1 Motor insurance in developed countries**

In the developed countries, relatively few studies have been conducted. Among these studies, income, location and education were the primary factors that influence the need for automobile insurance.

In California, an assessment of auto insurance in some underserved areas was done by Stith and Hoyt (2012). In their study, motor insurance demand was being hindered by the income levels of persons living in the stated jurisdiction. Location was highly significant as motor insurance demand was fairly in demand in the urban areas than in the rural and underserved communities. This condition informed the assertion by Cummins and Tennyson (1996) adding that the urbanization driving was rather negatively impacting the demand for automobile insurance since less people given their incomes were residing in the urban communities where accidents were more likely. Cummins and Tennyson (1996) adds that automobile insurance behavior is different in the large cities than in the rural areas. On the flip side, Hoyt, Mustard and Powell (2006) further added that the fraction of injuries and motor claims were higher in urban areas leading to higher premium charges in the urban areas as a result of the high claim costs. Again, the spillover effect of this is the resultant decline in motor insurance (Harrington & Niehaus, 1998).

Still in California, Stith and Hoyt (2012) mentioned that in the rural or underserved communities, individuals may have public transit available to them and so probably would not require insurance. Even in cases where they ride their own cars, usage is minimal and so the individuals are hesitant to take up the motor insurance cover. Additionally, vehicles in these vicinities may be of poor quality and so insurers charge higher premiums, further deterring individuals from signing up to the insurance. These findings coincide with that of Harrington and Niehaus (1998). The general California perspective posits that the greater the level of income of residents, the lower insurance is purchased in the given place. Insurance therefore is considered an inferior good, favoring the rich than the poor. This is consistent with Brown and Hoyt (2000) who looked into flooding and its insurance demand factors in the United States of America.

However, Harrington and Niehaus, (1998) added that consumers with higher incomes were also more likely to better understand the relevance of purchasing insurance and why they should protect themselves and the property. Again, with more wealth as their disposal, they were more likely to ward off any chance of a lawsuit by being insured against the liability of a loss due to car accidents among others.

Lastly, Stith and Hoyt (2012) observed some relation between insurance demand and education of individual. In their findings, the highest level of education attained was in direct relation to the insurance demand. That is, the higher the level of education attained, the more susceptible the individual was to demand for motor insurance. Same findings were found in a homeowners' policy assessment in Texas where homeowners with higher education were insuring their properties unlike those with lower education (Klein & Grace, 2001).

### 2.10.2 Motor insurance in developing countries

Again, few studies on motor insurance have been undertaken in third world nations. A research by Hamadu and Yusuf (2012) investigated the motor insurance demand components in Nigeria focusing on corporate and private buyers. Among the bulk of reasons found, gender, employment type, ownership status of the insurance, the reason behind procuring the insurance and the expectations on service delivery were most significant in predicting motor insurance demand. The gender perspective saw more females preferring a comprehensive motor insurance unlike their male counterparts who were more risk tolerant and opted for the third party insurance.

In an earlier study by Cummins and Doherty (2006), customers opted out of insurance covers when trust was broken or they had a reason to mistrust the system. This was because the sector had witnessed some levels of misrepresentation of some insurers' representatives and so clients were not convinced as to if they were receiving partial or professional advice. Beloucif, Donaldson and Kazanci (2004) also found that trust, dedication, and customer satisfaction were proven to have a favorable impact on the results of the insured-insurer relationship.. The impacts of each were however different in magnitude.

Hamadu and Yusuf (2012) was also concerned with the legalities of the motor insurance cover. This, the authors mentioned was seen in individuals opting for the minimum policy coverage of their country in order to satisfy the requirements of driving their vehicles. The only time customers indicated opting for the comprehensive motor insurance was when they had established trust in the existing relationship with their insurer.

The purchasing decisions of the insured was also interogated by Hamadu and Yusif (2012) realizing that the marital status, existence of more policies and its mode of access were significant

in influencing private buyers decision for motor insurance. Others who felt they would be financial burdened should they go in for a motor insurance, were likely to have a negative perception of the institution of insurance. Such persons seem to turn down offers of motor insurance most times (Tennyson, 1997).

In Ghana, the story has been no different. Kumaga (2016) in an assessment of the comprehensive motor insurance in Ghana considered the factors influencing the purchasing decision of policy holders in Ghana. The author as well considered the effect of the recent third party motor insurance premiums on the demand for the comprehensive motor insurance. In the study, key factors relating to the demand for the policy included the premium charged, the vehicle's year of manufacture, the make of the vehicle, the ownership, the policy status and even the location in which the vehicle runs. Again, changes to the third party insurance had a direct impact on the comprehensive motor insurance. The author additionally raised some concerns about some changes in the comprehensive motor insurance adding that a lot of underlying factors may affect its premium pricing.

Awunyo-Vitor (2012) also looked into the numerous variables of comprehensive automobile insurance in Ghana by gathering precise data from private car owners across the country. The study results showed that the decision to be insured was mainly influenced by the earnings of the insured, the sum cover of the vehicle, the age or vehicle life as well as the perceptions the insured did have about the premium charge. This time around, the study showed more males suscribing to the comprehensive insurance policy unlike their female counterparts. This evidence was contrary that of Hamadu and Yusuf (2012) in Nigeria. The Ghanaian Motor insurance covers thus combines the vehicle specific as well as the insured specific factors in determining the demand for the motor insurance policies (Kumaga, 2016).



## CHAPTER THREE

### RESEARCH METHODOLOGY

#### 3.1 Overview

This research is a diagnostic research. The paper would utilize quantitative and qualitative approaches to identify the prevalent factors that influence and impact motor insurance premiums. The responses would be used to generate a regression model to be used to predict comprehensive motor insurance premium.

#### 3.2 Population

The target population to respond to the data collection instrument would be the various insurance companies in Ghana and the general public who have motor insurance policy. Currently, there are about twenty-nine (29) non-life insurance companies. Information would be gathered from different insurance companies so as to get a sufficient representation of the population of the study. On the side of the insured (Comprehensive Motor Insurance Policy holders), both males and females would be considered for a fair view.

The population, which is made up of insureds across the country would be divided into three belts. The northern belt consists of Upper East, Upper West, Northern, North East and Savannah Regions. The middle belt consists of Bono, Ahafo, Bono East, Ashanti, Oti and Volta Regions. The southern belt includes the Central, Greater Accra, Western, Eastern, and Western North Regions. This is to get a fair representation of the population of comprehensive motor insurance policy owners in Ghana.

### **3.3 Sample and sampling technique**

A sample underwriters from twenty (20) insurance companies out of the twenty-nine would be used for this study. The list of companies that responded to the questionnaire are listed in the appendix. In addition, the study used a sample 300 comprehensive motor insurance policy owners. The sample will consist of comprehensive motor insurance policy owners across the country and a cross section of insureds of different ages and gender so as to obtain a more comprehensive and fair results. The participants of the sample may fall in any social status, religion or age. The participants of the study would be selected using the stratified random sampling technique. Stratified random sampling is dividing the population into regions and then selecting the research participants so as to get a fair representation of the population of the study

### **3.4 Study design**

This research was conducted using both the quantitative and qualitative approach in arriving at our findings hence mixed method approach. The first question of this research, which is concerned with finding, the working model for motor insurance premium prediction and would be tackled with a quantitative approach. This consequently arrived at quantitative results. The second objectives bother on arriving at the quantitative weight for each of those factors identified. A quantitative technique was therefore be employed to attain the second research objective. This research employed questionnaires as the major tool of data collection to arrive at its findings. We also used standardized questionnaires, which is efficient in obtaining information that gives facts about existing conditions and practices. In this survey, questionnaires were administered to respondents on a one- to – one basis to ensure effectiveness. All the questions to be asked will be closed ended questions. Moreover, the answer options given will take the format of the likert scale for easier analysis. The likert scale kind of response options is where weights are given to

qualitative data to enable researchers perform quantitative analysis with the selected responses, (Dawes, 2008).

### 3.5 The regression model

The main tools for data analysis for this study was SPSS and STATA software. The responses obtained in the questionnaire were coded and entered into the statistical software, SPSS and STATA software. The SPSS was used to generate the quantitative results, which was then organized into charts and tables with the aid of MS Excel. This is to provide pictorial views of what is being explained or described from the results obtained. Subsequently, this research will employ the use of a multiple regression model to establish and predict the change that will occur in premium charges (dependent) as a result of changes in the independent variables. The independent variables includes; sum insured, discount, cubic capacity, seating capacity, the age of a vehicle, the use of the vehicle, age of the driver, the duration of the insurance policy, the number of claims, the age of the driver.

The estimated regression model would take this form;

$$P_i = \beta_0 + \beta_1 SI_i + \beta_2 DP_i + \beta_3 NC_i + \beta_4 AV_i + \beta_5 U_i + \beta_6 SC_i + \beta_7 CC_i + \beta_8 G_i + \beta_9 AD_i + \beta_{10} D_i + \epsilon_i$$

- I. P is Premium
- II. SI is the Sum insured (Value of the vehicle)
- III. DP is Discount percent
- IV. NC is Number of claims
- V. AV is Age of vehicle
- VI. U is Usage (Commercial)

- VII. SC is Seating capacity
- VIII. CC is Cubic capacity
- IX. G is Gender
- X. AD is Age of driver
- XI. D is Duration

where  $i = 1, 2, 3, \dots, 300$  representing the responses of the respondents and  $\beta_0, \beta_1, \beta_2, \dots, \beta_{10}$  represents the regression coefficients.

The various constants would be determined to show how premiums are influenced by all the independent variable.

### **3.6 Expected relationship between with the dependent variable**

The sum insured is likely to have a positive impact on premium. It is expected that cars of higher values would attract higher premiums. one of the reasons for this assumption is that in the event of a loss, much money would be needed to service the claim

Discounts are given to clients for not claiming in an insurance year No Claim Discount (NCD), how loyal they are to the insurer. The discount reduces the premium that policy owners pay and is therefore expected to have a negative impact on premiums.

Generally commercial vehicles are seen to be more risky are compared to privately used vehicles.

This is because it carries a lot more people. The liabilities that can arise from commercial vehicles is higher and so, commercial use of a vehicle is expected to have a positive impact on premiums.

Comprehensive premiums is expected to go high as the number of seats go high, this is because if a vehicle carries more people, the expected loss should an accident occur is higher. However, the value of the vehicle might influence this to turn out to be negative. Some heavy duty trucks have

only two seats but pay higher premiums due to their high sum insureds, just as some commercial vehicles with more seats pay less premium because of their low value.

As a vehicle gets older, the more risky the vehicle is and is therefore more likely to attract a higher premium. This would imply a positive impact on premium. However, older vehicles might be insured at a reduced value resulting in lower premiums other than the expected higher premium.

The cubic capacity of a vehicle shows the power of the engine. Vehicles with higher cubic capacities are likely to move faster. Fast moving vehicles are more prone to accidents. The cubic capacity therefore is expected to have a positive impact on premium.

Most insurance companies reward their customers for loyalty by giving discounts. These discounts reduce the premium. Therefore, the duration spent with a particular insurer is likely to have a negative impact on premium.

The number of claims made under a policy is expected to have a positive impact on premium. Frequent claims increase the premium that is paid in the next insurance period.

Again, young drivers are considered to be more risky. Young drivers are most often than not less careful and take too much risk when driving which sometimes results in accidents. The younger a driver is the more risky the driver is hence higher premiums.

Generally male drivers are considered to be more risky while female drivers are careful. Male drivers are therefore expected to attract higher premiums hence a positive impact.

A summary of this is shown in table 3.1.

**Table 3.1: Expected impact on premium**

<b>Independent variable</b>	<b>Impact on premium</b>
Sum Insured	+
Discount	-

Usage (Commercial)	+
Seating Capacity	+
Age of Vehicle	+
Cubic Capacity	+
Duration	-
Number of claims	+
Driver's Age	-
Gender(Male)	+

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### **3.7 Ethical considerations**

Informed consent would be sought from the insurance companies and policy holders before they partake in this study, they will not be coerced but they would be entreated to partake in this research based on their free will. The objectives and the aims of this research would be carefully explained to the participants to enable them to understand what this research is about and what is required of them to do before they partake in this study. Also the data collected from the various companies would be treated with confidentiality. Their names and identities would not be used in this research and the data that is collected from the participants would be used for the sole purpose of this study.

### **3.8 Limitations of the methodology**

The findings of this study have to be seen in the light of some limitations to in the methodology. A larger sample size might be needed to check if the findings of this research still holds. These limitations however do not undermine the findings of the research.

## CHAPTER FOUR

### DATA ANALYSIS

#### 4.1 Introduction

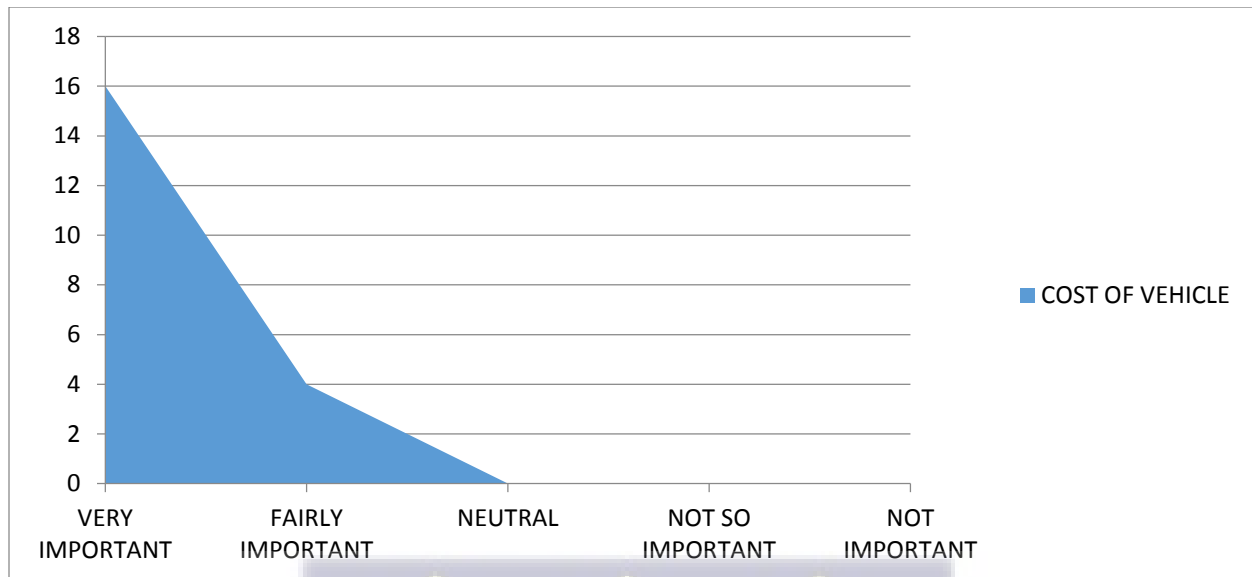
This chapter is divided into two main sections. The first section provides results as gathered from the insurance companies, hence the insurer's perspective of comprehensive motor insurance pricing. The second section of this chapter of the work presents the various results based on the linear regression for testing the relationship between comprehensive motor insurance premiums and the dependent variables (sum insured, discount, cubic capacity, age of the vehicle, duration the insured with a particular insurance company, seating capacity, gender of the driver, and age of the driver). The issue above would be addressed by the analysis of data collected and its interpretation. The second section would be broken down into five sub sections. In the first section would present the descriptive statistics of the variables that were employed in this study. The second section would provide a thorough analysis of results. The third section would look at the analysis and interpretation of the correlation matrix. While the fourth section focuses on testing the hypothesis, the fifth section would show the OLS and quantile regression results and its interpretation, which is the focus of the study.

#### 4.2 Analysis from the insurer's perspective

##### 4.2.1 Sum insured as a determinant of premiums

The cost of vehicle as stated by the insured on the proposal form is the Sum insured. It is seen to be one of the most important factors affecting the risk that a particular vehicle presents to the insurer as displayed by Figure 4.1. The sum insured is therefore an important determinant of comprehensive motor insurance premiums in Ghana.

Figure 4.1: Sum Insured as a determinant of premium



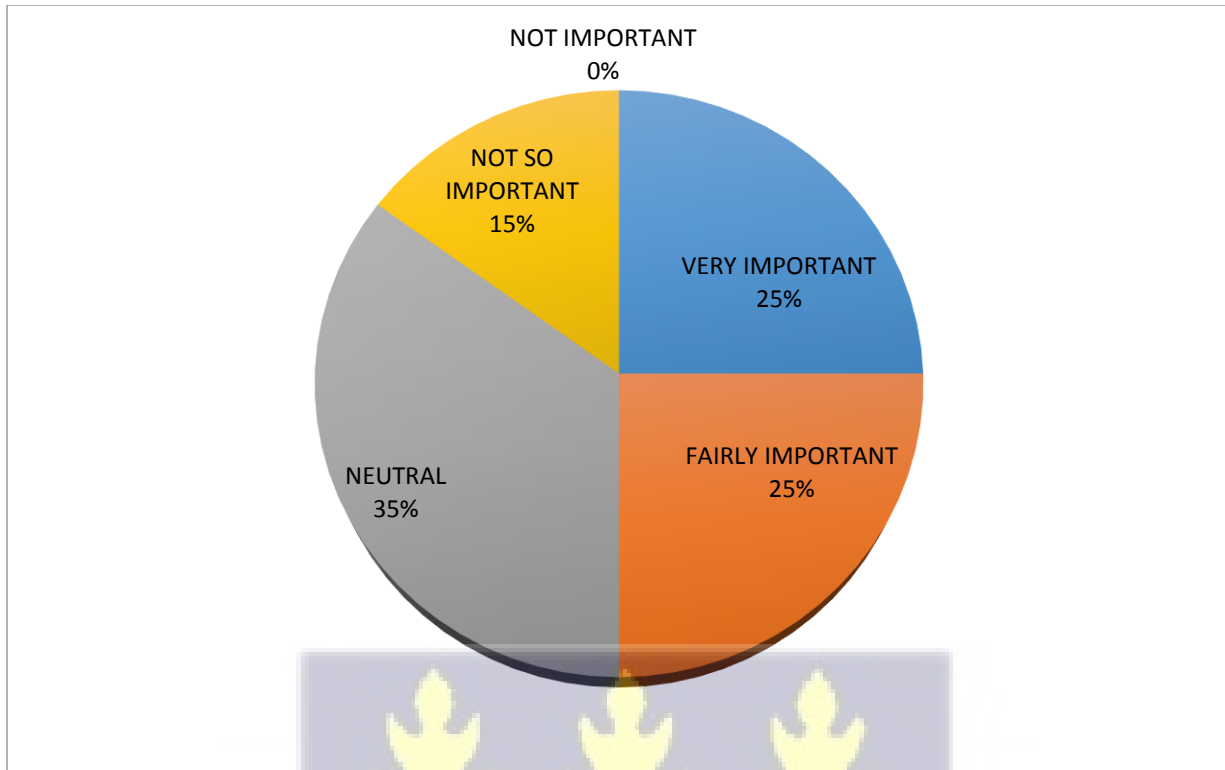
**Source: Researcher's Results, 2021**

The responses gathered from the insurance companies indicate that 16 out of 20 representing 80% of the sample size report that the cost of a vehicle is very important in determining the premium under comprehensive motor insurance. Also, 20% of the respondents consider the cost of vehicle to be fairly important. The responses gathered propose that the cost of a vehicle is a relevant determinant of premiums.

#### **4.2.3 Cubic capacity as a determinant of premium**

The cubic capacity of a vehicle determines the engine capacity of the vehicle. It can be inferred that the higher the cubic capacity of the vehicle the faster the vehicle can move. The faster the vehicle can move all things equal, the more likely it is for the vehicle to be involved in an accident. Hence a higher cubic capacity represents a higher risk. However, it is worthy of note that modern technology allows some cars with smaller cubic capacities move equally faster.

Figure 4.2: Cubic Capacity as a determinant of premium



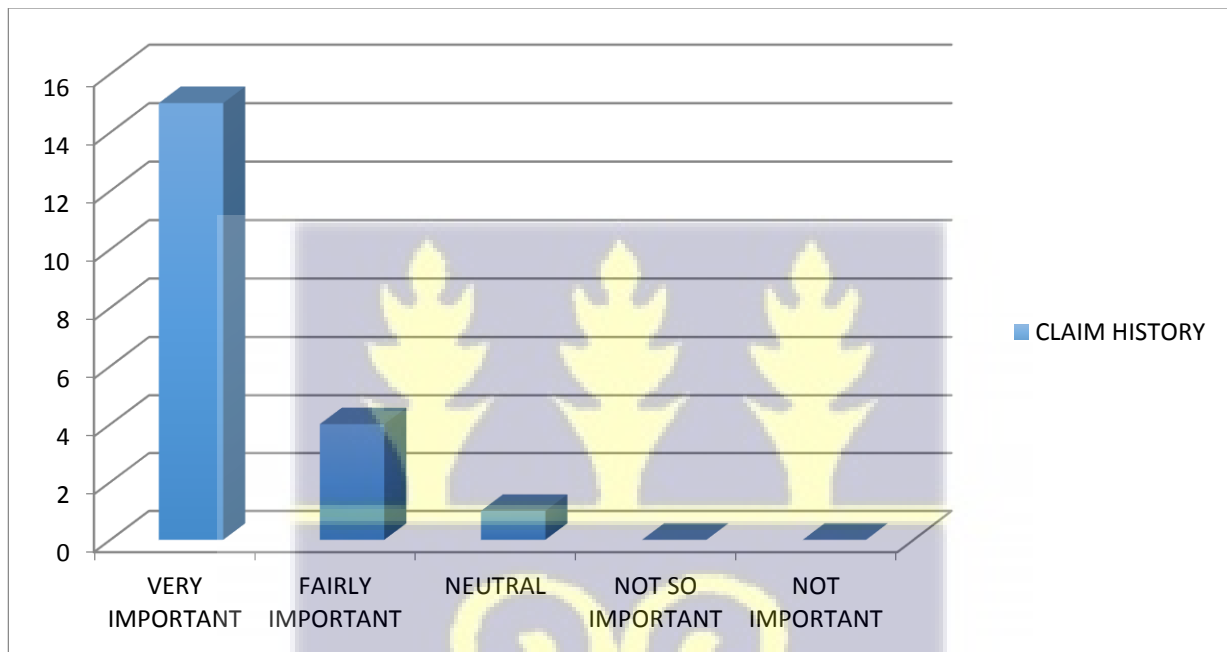
**Source: Researcher's Results, 2021**

Respondents to this question expressed divergent views on the relevance of cubic capacity in the pricing of comprehensive motor insurance policies. Figure 4.2 shows that 50% of the respondents are of the view that the cubic capacity of a vehicle is a good determinant of premium, 15% of the respondents claim the cubic capacity is not so important in premium determination. The respondents claimed further that the vehicles with bigger cubic capacities are likely to have a bigger sum insured; therefore the focus should be on the sum insured rather than the cubic capacity. The remaining 35% remained neutral about the importance of Cubic capacity in premium determination.

#### 4.2.4 Claim history as a determinant of premium

The table below represents the responses of the Insurance Companies who responded to the questionnaire. On the average 95% of the insurance companies consider the claim history of the vehicle an important in determining the premium under comprehensive motor insurance.

Figure 4.3: Claim History as a determinant of premium



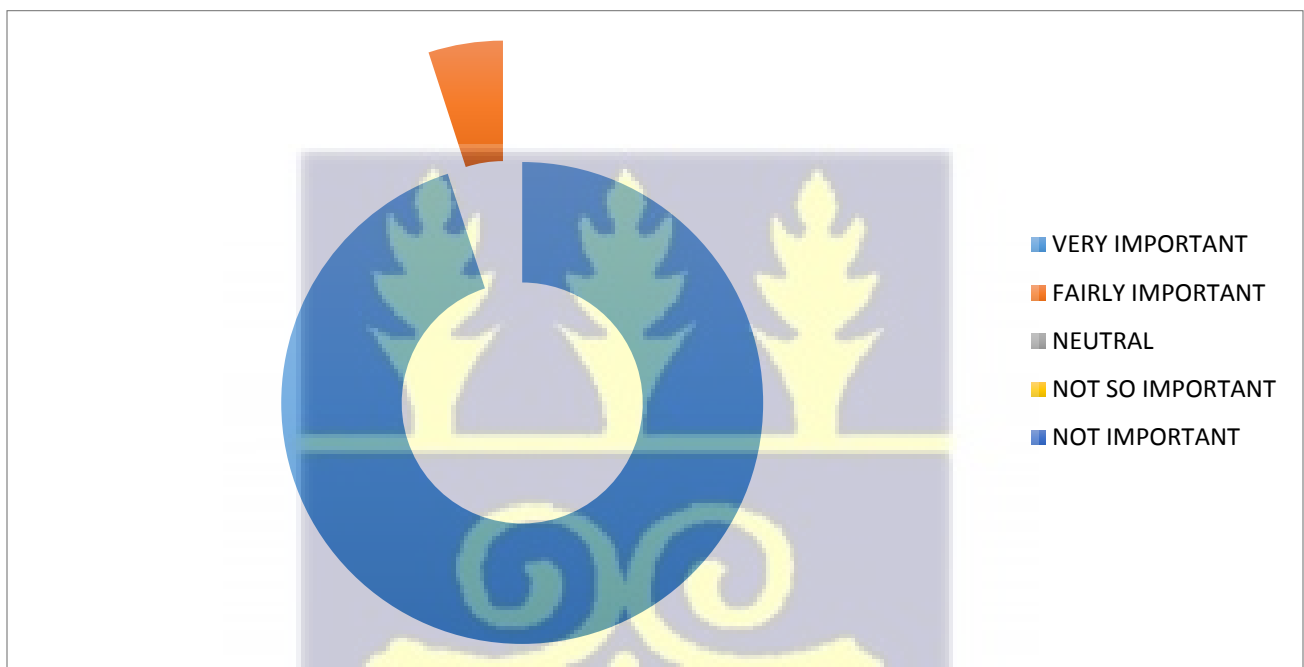
**Source: Researcher's Results, 2021**

The comprehensive motor insurance policy owner is entitled to enjoy a discount if after the insurance period there is no claim on the policy called No Claim Discount (NCD). The no claim discount reduces the premium as the years go by depending of the claim history of the policy owner. Therefore, as shown by Figure 4.3 above, the claim history is a good determinant of comprehensive motor insurance premiums.

#### 4.2.5 The use of the vehicle as a determinant of premium

The use of the vehicle was categorized into two; private use and commercial use. Figure 4.4 below indicates that, almost unanimously, 95% and 5% of the respondents indicated the use of the vehicle had an influence on the risk the vehicle comes with and is therefore very important and fairly important respectively in the comprehensive motor insurance pricing.

Figure 4.4: Use of vehicle as a determinant of premium



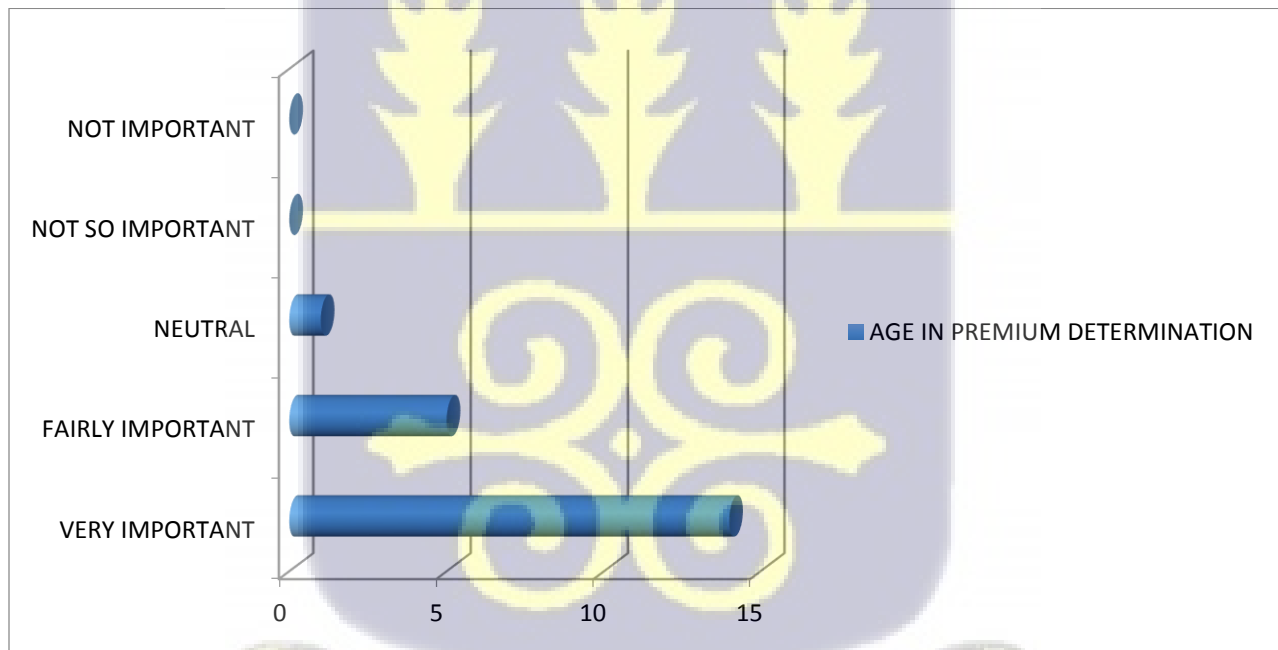
**Source: Researcher's Results, 2021**

All respondents, representing 100% of insurance companies indicated that commercially used vehicles represent a greater risk than privately used vehicles, hence is one of the determining factors of motor insurance pricing in Ghana.

#### 4.2.6 The age of a driver as a determinant of premium

The insurance companies were asked on how relevant the age of the driver of a vehicle is in assessing the risk a vehicle comes with and consequently the pricing under comprehensive motor insurance. As displayed in Figure 4.5, while 1 and 5 insurance companies representing 5% and 25% of the respondents stated the relevance of age of the driver to be neutral and fairly relevant respectively in premium determination, 70% of are of the stance that the age of a driver influences the risk of the driver and should be used in premium determination. They further expressed that the younger a driver the more risky the driver is.

Figure 4.5: Age of driver as a determinant of premium



Source: Researcher's Results, 2021

### 4.3 Analysis of Data gathered from comprehensive motor insurance policy owners

#### 4.3.1 Descriptive statistics

In this section of the work, the attributes of the variables employed in the model are explicitly provided. Table 4.1, which shows the descriptive analysis' outputs, may be found below. The table 4.1 shows a total number of 300 respondents who responded to the questionnaire.

**Table 4.1: Descriptive statistics**

Variable	Obs. (N)	Mean	Std. Dev.	Min	Max
Premium	300	2,571	2,229.367	740	18,819
Gender (Male)	300	0.55	0.49	0	1
Age Group	300	1.9	1.109	1	5
Duration	300	3.49	1.914	1	9
Number of claims	300	1.48	1.184	0	7
Discount	300	32.93	21.301	0	50
Sum Insured	300	63,541.02	64,816.968	6,750	500,000
Usage (Commercial)	300	0.19	0.396	0	1
Age of Vehicle	300	9.39	4.97	1	31
Seating Capacity	300	4.971	1.2	2	15
Cubic Capacity	300	2,504.09	2,146.299	220	15,250

Source: Researcher's Results, 2021

The descriptive statistics are in the terms of mean, standard deviation minimum and maximum. From the table 4.1, the average premium paid by comprehensive motor insurance policy owners is GHC2,571.00. The maximum premium paid was GHC18,819.00, while the minimum is

GHC740.00 with a standard deviation of GHC2,229.367 which shows how skewed premium payment over the data set.

The mean value for the standard deviation is 0.55, this indicates that 55% of the respondent drivers who have a comprehensive motor insurance are males, which is the majority, 45% of the drivers are found out to be females.

On the average the drivers fall within the upper limit of the driver's age group, which is 30 to 40 years. Hence the average driver is between 35 and 40 years. The driver with the least year is below 30 years while the driver with the highest age lies above 60 years.

The variable duration, which explains how long the policy owner has had that insurance cover, has an average of 3.59 with a standard deviation of 1.914. This implies that on the average a policy owner has had the comprehensive motor insurance policy with a particular insurer for over 3 years.

The minimum number of years is 1 year while the maximum lies at 9 years.

On the average, a comprehensive motor insurance policy owner has claimed at least once the descriptive shows a mean of 1.48 with a standard deviation of 1.184. Some comprehensive motor insurance policy owners have never claimed, however the highest number of claims by a single policy is 7.

From the table 4.1, the average discount enjoyed by a policy owner is 32.93% with a standard deviation of 21.301. This shows the level of variation of discounts that is given to the policy owners. Some of the policies have no discount at all while the maximum discount given by the insurance companies is 50%.

With a standard deviation of 64,816.968, the average car is comprehensively insured at GHC63541.02. This indicates skewness in the sum insured over the vehicles in the sample. The

maximum and minimum sum insured according to Table 4.1 are GHC6,750.00 and GHC500,000.00

From the Table 4.1, averagely 19% of the vehicles are commercially used vehicles while the greater percentage of 81% are privately used vehicle. This is a representation of reality as it is expected that more private vehicles are likely to take a comprehensive motor insurance policies as compared to commercially used vehicles.

The youngest vehicle amongst the respondents is 1 year old, the oldest age was 31 years, and however, the average vehicle is a little over 9 years with a standard deviation of 4.97 according to table 4.1. Again, the average vehicle has 5 seats and all vehicles from the table 4.1 lie between a minimum of two seats and a maximum of 15 seats. Lastly the table 4.1 presents an average cubic capacity of 2500 with a standard deviation of 2100. The vehicle with the least cubic capacity is 220 and the one with the highest cubic capacity had a cubic capacity of 15,250.

#### 4.3.2.1 Correlation analysis

The correlation coefficient of the variables is able to communicate the level of strength or in some cases the weakness of the predictor variables on the dependent variable. The coefficient is also able to tell whether the relationship between the independent variables and the dependent variables is a positive or negative. The correlation coefficient  $\rho \in [-1, 1]$ . The table 4.2 shows the strength of the independent variables.

Table 4.2: Correlation coefficient values and their level of strength

Correlation Coef.	Strength
1.0	Perfect
0.8 – 0.99	Very Strong
0.50 – 0.79	Strong

0.30 – 0.49	Weak
0.01 – 0.29	Very Weak
0.00	No relationship

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Source: Researcher’s Calculation, 2021

#### 4.3.2.2 Analysis of correlation between premium and independent variables

Comprehensive motor insurance premiums are dependent on the independent variables. The independent variable might have a positive or negative influence on the premium charged. The table 4.3 shows the relationship between premium and the various independent variables as depicted by the signs. The table 4.4 also shows the correlation matrix, which combines the strength and the relationship of the independent variables on the premium

**Table 4.3: Correlation signs**

Independent Variable	Dependent (Premium)
Sum Insured	+
Discount	-
Usage (Commercial)	-
Seating Capacity	+
Age of Vehicle	-
Cubic Capacity	+
Duration	-
Number of claims	+
Driver’s Age	-
Gender	+

Source: Researcher’s Results, 2021



is expected that premiums too increase and vice versa. The cubic capacity is next to sum insured in terms of correlation with premium. The cubic capacity has a correlation coefficient of 0.346; this is positive and weak, meaning if the cubic capacity increases, Premiums are expected to increase. The number of claims and the seating capacity has a very weak and positive correlation with premiums with coefficients of 0.002 and 0.038 respectively according to table 4.4. This informs us that when any of these factors increase, premium is likely to increase.

Also, there is a very weak and negative correlation between premiums and discount percent Usage of vehicle (commercial) age of vehicle and duration of insurance policy, drivers age and gender of the driver with correlation coefficients of -0.70, -0.153, -0.089, -0.1 and -0.035 respectively.

#### 4.3.2.3 Analysis of correlation among independent variables

**Table 4.5: Correlation matrix for independent variables**

Premium	SI	DP	U	SC	AV	CC	D	NC	DA	G
SI	1									
DP	0.229	1								
U	-0.277	-0.504	1							
SC	0.111	0.157	-0.138	1						
AV	-0.226	-0.155	0.232	-0.161	1					
CC	0.277	0.103	-0.039	-0.244	0.131	1				
D	-0.020	0.094	-0.006	-0.060	0.087	0.003	1			
NC	-0.002	-0.490	0.351	0.091	0.103	0.103	0.002	1		
DA	-0.100	0.136	-0.168	0.008	-0.074	0.001	0.015	0.101	1	
G	-0.035	0.074	-0.029	0.005	0.034	0.03	0.131	0.003	-0.012	1

**Source: Researcher's Results, 2021**

The table 4.5 above shows a negative relationship between the age of the vehicle and the sum insured. Older vehicles are likely to insure at a lower sum insured and subsequently a lower

premium. Again, Table 4.5 shows a weak positive correlation between age of vehicle and number of claims. This implies that on the average, the older the car the less likely it is for the vehicle to be involved in an accident and claim.

There is a good negative relationship between number of claims and discount percent. This indicates that the less number of times a person claims the higher discounts the policy would enjoy.

#### 4.4 Test for heteroskedasticity

One of the assumptions of the ordinary least square is that the variance in the error term is constant. I employed the Breusch-Pagan / Cook-Weisberg test for heteroskedasticity to test the data. Below are the results of the test;

**Table 4.6 Breusch-Pagan / Cook-Weisberg test for heteroskedasticity results**

Test	Chi <sup>2</sup> Value	Probability
	549.56	0.000***

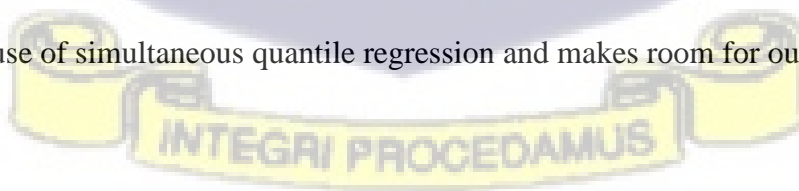
**Source: Researcher's Results, 2021**

*Ho: Constant variance*

*Decision: Reject the Ho*

*Conclusion: The variance is not constant*

The results from table 4.6 indicate that the data exhibits heteroskedasticity. We would therefore be necessary to examine the impact of the independent variables over different quintiles. This necessitates the use of simultaneous quantile regression and makes room for out layers.



#### 4.5 Test for cross sectional autocorrelation

The study further employed the Durbin-Watson test for autocorrelation to test the data for auto correlation. The cross sectional auto correlation is necessary to check whether observations are dependent due to some other reasons other than time.

The Durbin-Watson test indicates a DW statistic of 2.025. This statistic indicates that there is no autocorrelation in the data set.

#### 4.6.1 OLS Regression results analysis

Ordinary Least squares regression is used to show the relationship between dependent and one or more explanatory variables. It is very effective when used for prediction and explanation when the assumptions are satisfied. This part of the study examines results from the linear regression model for comprehensive motor insurance premium measurement and the variables; sum insured, discount, cubic capacity, seating capacity, the age of a vehicle, the use of the vehicle, age of the driver, the duration of the insurance policy, the number of claims, the age of the driver.

The estimated linear regression model is given by

$$P = 1324.285 + .029SI - 11.665DP + 17.332NC + -13.269AV + 144.008U - 18.084SC + 0.126CC - 29.688G - 73.970AD - 62.549D$$

The details of the regression results are stated below in table 4.7.

**Table 4.7 Regression results**

Variable	Coef. (B)	Coef Std Error	Sig
Constant	1324.285	410.876	0.001***
Sum Insured	0.029	0.001	0.000***

Discount percent	-11.665	3.824	0.002***
Number of claims	17.332	61.875	0.780
Age of vehicle	-13.269	13.795	0.337
Usage (Commercial)	144.008	13.795	0.455
Seating capacity	-18.084	55.741	0.746
Cubic capacity	0.186	0.033	0.000***
Gender (Male)	-29.688	126.703	0.815
Age of driver	-73.790	58.439	0.207
Duration	-62.549	33.524	0.063*

\* - 90% reliability, \*\* - 95% reliability, \*\*\* - 99% reliability

The table 4.7 shows a variance inflation factor (VIF) of less than 10 for all independent variables, this indicates that there is no problem of multi-collinearity hence all independent variables predict premium in different ways. The table 4.6 shows that independent variables such as sum insured, discount and cubic capacity are statistically significant at a confidence interval of 95%. At 90% level of significance, the duration also becomes statistically significant. Also from table 4.6, independent variables such as sum insured, number of claims, commercial usage of vehicle and cubic capacity have a positive relationship with premiums, also discount, age, seating capacity, male gender, and duration have a negative impact on premium.

**Source: Researcher's Results, 2021**

The adjusted R Square as shown in Table 4.8 is 0.764. The coefficient of determination is therefore

76.4%. This informs that 76.4% of the variation in premium can be explained by the combined effect of the independent variables that were used in the model. The remaining 23.6% can be explained by some other factors, which were not included in this study. However, the variables considered in this study together contribute for 76.4% of the variation in comprehensive motor insurance premiums.

**Table 4.8: Model Summary**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.878 <sup>a</sup>	0.771	0.764	1082.188

a. Predictors: (Constant), Sum insured, Usage of Vehicle, Cubic Capacity, Age of vehicle, Seating Capacity, Number of claims, age of driver, Discount Percent, Gender of driver and Duration with insurer.

b. Dependent Variable: Premium

#### 4.6.2 Discussion of regression results

A 1% increase in the sum insured of a vehicle would cause premium to increase by 2.9% holding all other variables; given usage of vehicle, cubic capacity, age of vehicle, seating capacity, number of claims, age of driver, discount percent, gender of driver and duration with insurer constant. As indicated by the regression results in table 4.7, likewise a 1% reduction in the sum insured would result in a 2.9% reduction in the premium to be paid.

Correspondingly, from table 4.7, an upsurge in the discount percent by 1 unit would induce an reduce premium by 11.665 units holding all other independent variables constant and a decrease in premium by 1 unit would increase premium by 11.665.

On the average, premium would increase by 0.186 units if cubic capacity is increased by one unit holding all other variables constant. Similarly, a unit reduction in the cubic capacity would result in a 0.186 reduction in premium.

From the 4.7, a unit upsurge in the duration would result in the a reduction in premium by 62.549 holding all other variables constant and a down surge of a unit would cause premium to increase by 62.549 holding all variables constant.

#### 4.7 Simultaneous quantile regression

This section goes further to examine the relationship between the explained variable and the explanatory variables using quantile regression. Quantile regression allows for understanding relationships between variables outside the mean of the data. Quantile regression is vastly more robust to outliers than ordinary least squares regression because observations far from the mean may have high leverage and may cause significant bias of the mean.

The tables 4.9, 4.10 and 4.11 above show the relationship between the independent variables and premium over the 10<sup>th</sup>, 25<sup>th</sup> and 75<sup>th</sup> quantile of the data set respectively.

**Table 4.9 10<sup>th</sup> Quantile Regression results**

Variable	Coef. (B)	Coef Std Error	Sig
Constant	1425.08	433.9853	0.001***
Sum Insured	0.012969	0.002813	0.000***
Discount percent	-0.216253	25.04533	0.924
Number of claims	76.43554	51.89114	0.142
Age of vehicle	8.880515	10.32585	0.390

Usage (Commercial)	-96.9764	132.9940	0.466
Seating capacity	-151.2674	79.3618	0.058*
Cubic capacity	0.0028599	0.016088	0.859
Gender (Male)	-108.5883	94.0438	0.249
Age of driver	-62.410	42.139	0.194
Duration	-9.99746	25.04533	0.690

\* - 90% reliability, \*\* - 95% reliability, \*\*\* - 99% reliability

**Source: Researcher's Results, 2021**

From the table 4.9, which represents the results from the 10<sup>th</sup> quantile of the data, a 1% increase in the sum insured of a vehicle would cause premium to increase by 1.3% holding all other variables; given usage of vehicle, cubic capacity, age of vehicle, seating capacity, number of claims, age of driver, discount percent, gender of driver and duration with insurer constant.

Again, a unit increase in the seating capacity of a vehicle would result in a reduction in premium by 151.2674 holding all other variables constant and a unit reduction in the seating capacity would increase premium by 151.2674 holding all other variables constant.

**Table 4.10**

**25<sup>th</sup> Quantile regression results**

Variable	Coef. (B)	Coef Std Error	Sig
Constant	1013.485	472.872	0.033*
Sum Insured	0.019696	0.0034265	0.000***

Discount percent	-0.2911949	3.299102	0.930
Number of claims	110.4339	32.94875	0.001***
Age of vehicle	12.29531	7.633883	0.108
Usage (Commercial)	-23.7983	151.2315	0.875
Seating capacity	-91.5709	65.42214	0.163
Cubic capacity	0.018798	0.013501	0.165
Gender (Male)	-103.703	98.55402	0.294
Age of driver	71.20313	43.12991	0.109
Duration	-33.33314	23.44908	0.156

\* - 90% reliability, \*\* - 95% reliability, \*\*\* - 99% reliability

**Source: Researcher's Results, 2021**

From the table 4.10, which represents the results from the 25<sup>th</sup> quantile of the data, a 1% increase in the sum insured of a vehicle would cause premium to increase by 2.0% holding all other variables; given usage of vehicle, cubic capacity, age of vehicle, seating capacity, number of claims, age of driver, discount percent, gender of driver and duration with insurer constant.

Again, a unit increase in the number of claims would result in an increase in premium by 110.4339 holding all other variables constant and a unit reduction in the seating capacity would reduce premium by 110.4339 holding all other variables constant.

**Table 4.11 75<sup>th</sup> Quantile regression results**

Variable	Coef. (B)	Coef Std Error	Sig
Constant	1168.989	293.841	0.000***
Sum Insured	0.0306357	0.0015834	0.000***
Discount percent	-12.87086	3.341854	0.000***
Number of claims	-0.4748003	36.1141	0.990
Age of vehicle	18.39911	10.93049	0.093*
Usage (Commercial)	-184.9047	97.39252	0.059*
Seating capacity	13.73938	36.10424	0.704
Cubic capacity	0.0558202	0.029465	0.059*
Gender (Male)	28.98649	98.47546	0.294
Age of driver	31.6098	24.18512	0.091*
Duration	-36.19756	17.63807	0.1041**

\* - 90% reliability, \*\* - 95% reliability, \*\*\* - 99% reliability

Source: Researcher's Results, 2021

From the table 4.11, which represents the results from the 75<sup>th</sup> quantile of the data, a 1% increase in the sum insured of a vehicle would cause premium to increase by 3.1% holding all other

variables; given usage of vehicle, cubic capacity, age of vehicle, seating capacity, number of claims, age of driver, discount percent, gender of driver and duration with insurer constant.

A unit increase in the discount percent would result in a reduction in premiums by 12.87 units and a unit decrease would result in a 12.87 increase in premiums holding all other variables constant.

According to table 4.11, if the age of a vehicle increases by a unit, premiums would increase by 18.34 units and if the age of a vehicle reduces by one unit, it would cause premiums to fall by 18.34 units holding all other variables constant.

Holding all other variables constant, premiums would be 184.90 higher if the usage of the vehicle is commercial other than private use.

Again, a unit increase in the cubic capacity of a vehicle would result in an increase in premium by 0.056 holding all other variables constant and a unit reduction in the cubic capacity would reduce premium by 0.056 holding all other variables constant.

The age of a driver is a significant determinant of premium according to table 4.11. a unit increase in the age of a driver of a vehicle results in an increase in premium by 31.61 units and a reduction in the age of a driver causes the premium charged to fall by 31.61 units holding all other variables constant.

The duration, in the 75<sup>th</sup> quantile is a significant determinant of premium. A unit increase in the duration reduces premium charged by 36.20 units, similarly, a reduction in the duration tends to increase premium by 36.20 units holding all other variables constant.

The Sum insured of a vehicle is significant at 99% across all quantiles and has a positive impact across the data set. The 75<sup>th</sup> percentile of the data indicates that a good number of the independent variables to be statistically significant. Sum insured, discount, number of claims, age of vehicle,

usage of vehicle, cubic capacity, age of driver and duration with insurance company were all significant at various levels of confidence as shown by table 4.11.

The signs of the coefficient remains same with the signs in the OLS regression about the mean. This shows that the relationship of the explained variables and the explanatory variables are in no question according to both regression approaches. However, the magnitude of the explanatory variables differ across data sets. Further research is required to test the possibility of a nonlinear relationship amongst the explanatory variables and the between the explained variable and the explanatory variable.



## CHAPTER FIVE

### SUMMARY, CONCLUSION AND RECOMMENDATIONS

#### 5.1 Introduction

The chapter five presents a summary of the study, the key findings and the conclusions that were drawn from analyzed results in chapter 4. The chapter also suggests some recommendations for future study concerning the pricing of motor insurance products as. Recommendations were also made to improve the current pricing system of motor insurance.

#### 5.2 Summary of study

Motor insurance premium is the most essential aspect of the motor insurance contract. Premium validates the contract between the insured and the insurer. The payment of premium therefore makes the insurer liable for the occurrence of the insured contingencies.

Several factors are considered by the insurer in determining the premium to be paid by every policy. This critical role is carried out by underwriters and should be done with care so as to ensure fairness and keep the policy owner satisfied and the insurer solvent.

There is no clear awareness in literature concerning the factors that are used in pricing comprehensive motor insurance policy owners. The objective of this research was to identify the relevant factors that determine the premium a policy owner pays for a comprehensive motor insurance cover. The research was also to determine the quantitative impact of the various independent variables on premium and to develop a model that can be used to predict comprehensive motor insurance premium.

To achieve these objectives, primary data, by way of questionnaires and interview were administered to a sample 20 insurance companies out of a population of 29 non-life insurance

companies in Ghana listed by the National Insurance Commission. Also 300 comprehensive motor insurance policy owners were sampled using stratified sampling technique. The data collected were then analyzed using SPSS software, STATA and Microsoft Excel.

The study revealed a very strong and positive correlation between premium and sum insured of a vehicle, seating capacity, cubic capacity and number of claims as shown in table 4.4. Indicating that they move in the same direction with premium. The Sum insured of the vehicle has the highest correlation with premium. Again, Discount, use of vehicle, age of vehicle, Duration with insurance company, the age of a driver and the gender being female has a negative correlation on premium.

The result of the multiple linear regression shows that sum insured have a positive statistically significant relationship with premium. The coefficient signifies that an increase in sum insured would result in an increase in premium. The model also shows that discount has a statistically significant negative relationship with premium thus, as the discount percent appreciates, the premium comes down. The coefficient of number of claims, the cubic capacity and commercial usage of vehicles indicates a positive impact on premiums hence an increase in the number of claims and the cubic capacity holding all other factors constant is likely to result in an increase in premium. The commercial use of a vehicle attracts higher premiums. Age of vehicle, seating capacity and duration have negative coefficients indicating a negative relationship with premium.

### **5.3 Findings**

The adjusted R squared value indicates that premium depends largely on the combined effect of the independent variables that were considered in this study. Therefore sum insured, discount, cubic capacity, seating capacity, the age of a vehicle, the use of the vehicle, age of the driver, the duration of the insurance policy, the number of claims and the age of the driver are very relevant in predicting comprehensive motor insurance premiums. On the average, seventy-seven percent

(77%) of the variation in premium can be explained by the combined effect of the above listed independent variables used in the study.

The coefficient of sum insured from the results is positive. This relationship is statistically significant. Insurance industry regulators and companies should therefore ensure that a higher sum insured should attract a higher premium.

The results show that the discount is a statistically significant determinant of comprehensive motor insurance premiums. The negative coefficient suggests that a higher discount percent reduces the sum insured. The discount given however should have a justification such as no claim discount or increased security features to reduce the risk of a loss.

At the confidence level of 99% the cubic capacity is a statistically significant predictor of comprehensive motor insurance premiums of a vehicle. The positive coefficient shows that higher cubic capacities attracts higher premium. Motor insurance underwriters should take due note of the cubic capacity of a vehicle as it is very relevant in premium determination. The impact of the cubic capacity of the vehicle is significant. It is therefore worthwhile to ensure that the right cubic capacity is what is stated in the proposal forms.

The number of years a policyholder insures with a particular insurance company is statistically significant in predicting comprehensive motor insurance premiums at 90% confidence interval.

The results show a negative relationship between premium and the number of years a policyholder stays with one insurance company. This findings shows that, on average, a policyholder pays lesser premium as the policy stays longer with a particular insurance company. Comprehensive motor insurance policyholders can decide to stay with one insurer for a longer period to enjoy lesser premiums.

#### **5.4 Conclusion**

From the study it can be concluded that the relevant determinants of premium includes, the sum insured, the discount percent, cubic capacity and the duration the policyholder has kept of the policy with the insurer.

There are however, factors such as the age of a driver and the gender of a driver are good determinants of premium but in practice, the industry does not consider these factors in pricing comprehensive motor insurance products.

#### **5.5 Recommendations and future studies**

The findings of this research clearly points out that, the age of the driver influences the risk of a driver and therefore is relevant in the determination of comprehensive motor insurance premium. To this effect, there is a need for the revision of the underwriting standards to accommodate information on the driver of a vehicle. Most insurance companies do not include that information on the proposal forms and therefore do not consider it in pricing.

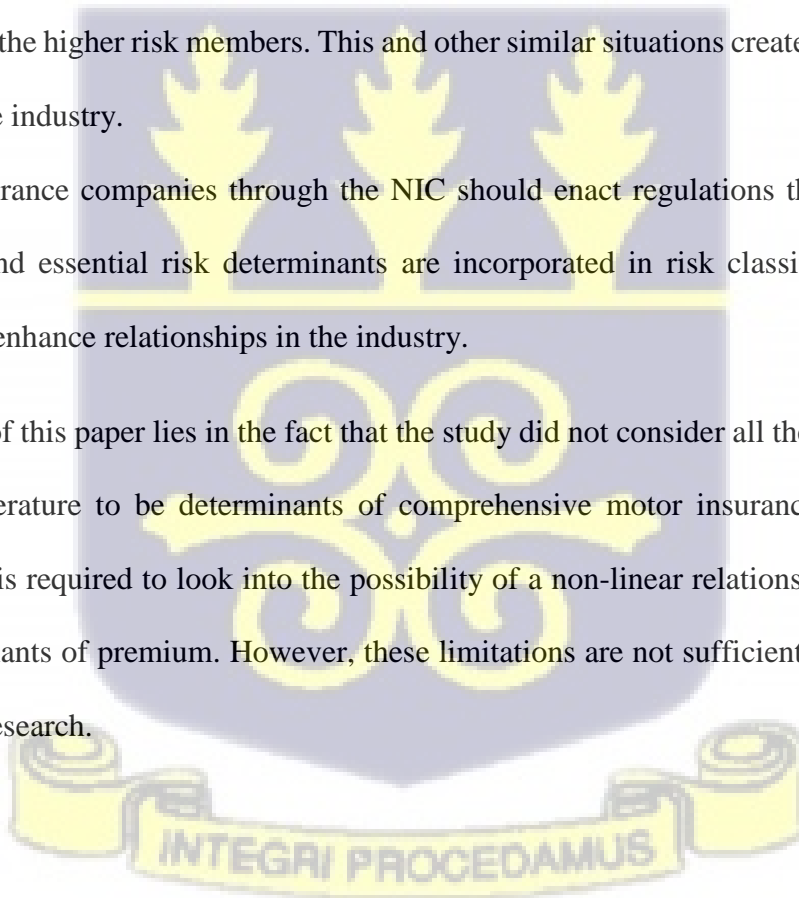
The recording of the cubic capacity should be a critical requirement because it is a relevant determinant of premium. The cubic capacity gives an indication of how fast the vehicle can move. The faster a vehicle can move all things being equal the more riskier the vehicle is as speed is closely associated with accidents. The higher tendency of an accident occurring translates to higher premiums.

The research identified major discrepancies between theory and what is practiced. Insurance is a risk management technique and as such depends heavily on risk determining factors in every branch. There are statistically proven and generally accepted factors that determine the risk of an

individual in relation to motor insurance. These risk determinants are the basis for premium classification. Throughout the research, there seems to be a general knowledge and understanding of these factors as related to motor insurance especially in relation to the insurer. There was an almost unanimous agreement on the relevance of certain factors and how they impact an individual's risk. Despite this widespread knowledge, these factors are not incorporated in the final premium decisions of the insurers. For example, although insurers agree that females are less risky than males and hence are involved in fewer accidents with its associated lower claims cost, female drivers in Ghana pay as much as their male counterparts without any consideration to the lesser risk they present. This presents a situation of the lower risk members of the pool subsidizing the premiums of the higher risk members. This and other similar situations create tensions between the players in the industry.

As a result, insurance companies through the NIC should enact regulations that ensure that all these relevant and essential risk determinants are incorporated in risk classification to ensure satisfaction and enhance relationships in the industry.

The limitations of this paper lies in the fact that the study did not consider all the factors that were identified by literature to be determinants of comprehensive motor insurance pricing. Again, further research is required to look into the possibility of a non-linear relationship between price and the determinants of premium. However, these limitations are not sufficient to undermine the findings of the research.



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**APPENDIX**

List of Insurance companies used for the study

- I. Hollard Insurance
- II. Star Insurance
- III. Vanguard Insurance
- IV. Prime Insurance
- V. Donewell insurance
- VI. Unique Insurance
- VII. Glico Insurance
- VIII. Enterprise Insurance
- IX. Provident Insurance
- X. Quality Insurance
- XI. SIC Insurance
- XII. Loyalty Insurance
- XIII. Priority Insurance
- XIV. Equity Insurance
- XV. Unique Insurance
- XVI. Activa Insurance
- XVII. Best Assurance
- XVIII. Coronation Insurance Ghana
- XIX. Ghana Union Assurance
- XX. Imperial Insurance

