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Risk Assessment by Insurance Firms: Calculation of Various Types of Insurance

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ABSTRACT

This paper assesses insurance firms by examining the key characteristics of four principal insurance types: life, marine, vehicle, and health/medical. It emphasizes the distinctions among these types in terms of risk coverage, premium structures, claim settlement processes, and regulatory oversight. The study evaluates how these factors influence the operational efficiency and financial performance of insurance companies, considering the specific risk profiles and challenges inherent to each category. By comparing these insurance forms, the paper aims to clarify how product-specific attributes inform firm strategies and affect consumer trust. The findings provide a basis for more precise evaluation of insurance firms according to the nature of the insurance products offered, thereby contributing to a better understanding of the diverse operational dynamics within the insurance sector.

KEYWORDS: *Premium, Underwriting, Claim Cost, Risk Factor, Loss Distribution, Contract, Insurer, Insured, Commission, Profit Loading.*

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1. INTRODUCTION

Insurance is one of the most essential pillars of financial security in today's world as it protects individual's businesses and communities from unexpected losses and uncertainties. Whether it is life insurance that provides peace of mind to families, marine insurance that covers risks in global trade, automobile insurance that safeguards vehicles and drivers, or medical insurance that ensures access to healthcare, each type operates on the fundamental principle of risk pooling and cost sharing. At the heart of this system lies the calculation of premiums, especially the base premium, which forms the starting point for what policyholders pay. This paper explores how base premiums are calculated across different forms of insurance, highlighting the unique factors that influence each—such as the unpredictability of death in life insurance, the impact of route and cargo risks in marine insurance, the dependence on driver history and vehicle type in automobile insurance, and the role of healthcare costs and individual medical profiles in medical insurance—and examining how insurers adapt to emerging risks and new technologies. By comparing the structure of premium calculations in life, marine, automobile and medical insurance, the research sheds light on the diverse yet interconnected nature of underwriting practices and offers a deeper understanding of how insurance functions as both a business and a social safety net in a rapidly changing world.

2. DEFINITIONS AND NUMERICAL EXAMPLES

2.1. AUTOMOBILE INSURANCE

Automobile insurance is a contractual agreement in which an insurer provides financial protection against losses arising from the ownership or operation of a motor vehicle. It typically covers damages from accidents, liability for injuries, and other related risks, offering compensation in exchange for a predetermined premium paid by the policyholder.

Formula for fair premium:

+Present value of expected claim cost
+Present value of underwriting cost
+Expected claim processing cost

+Present value of marketing expenses
+Commission
+Profit Loading

Policy Details:

1. year insurance policy on a car
2. Not more than 1 accident allowed under this policy
3. Policy provides fuel coverage
4. All genuine claims are paid at the end of the year

Data and Assumptions:

1. Underwriting costs= 15% of pure premium incurred at the beginning of the year
2. Interest Rate=5% per annum
3. Claim processing costs paid at the end of the year=Rs 5,000
4. Marketing cost paid in the Middle of the year=Rs5,000
5. Fixed commission paid to the agent at the beginning of the year=Rs 500
6. Profit Loading=5% of pure premium

Loss Distribution:

1,00,000	0.07
50,000	0.03
0	Otherwise

Solution:

Pure Premium= 1,100,000 x 0.07 + 50,000 x 0.03=7000+1500 = Rs 8,500

Present value of expected claims= 8,500/1.05 =Rs 8,095.23

Present value of underwriting costs= 0.15 x 8,500 = Rs 1,275

Expected claim processing costs= 5,000/1.05=Rs 4,761.90

Present value of marketing expenses=5,000/1.05^0.5 = Rs 4,879.63

Present value of commission = Rs 500

Profit Loading= 8500 x 0.05 = Rs 425

Fair Premium: 8,093.25+ 1,275 + 4,761.90 + 4,879.9 + 500 + 425 = Rs 18,936.77

2.2. MARINE INSURANCE

Marine insurance is a risk management contract that provides financial coverage for goods in transit over sea, protecting against losses such as damage, theft, or piracy during shipment. In the

context of a marine cargo policy, the insurer agrees to compensate the insured for genuine claims arising during the policy period, typically settled at the end of the term.

Formula for fair premium:

+Present value of expected claim cost
+Present value of underwriting cost
+Expected claim processing cost
+Present value of marketing expenses
+Commission
+Profit Loading

Policy Details:

1. year marine cargo insurance policy
2. Covers damage or loss during transit by sea
3. Policy includes protection against piracy
4. All genuine claims are paid at the end of the year

Data and Assumptions:

Underwriting costs = 10% of pure premium incurred at the beginning of the year

Interest rate = 6% per annum

Claim processing costs paid at the end of the year = Rs 8000

Marketing cost paid in the middle of the year = Rs 6000

Fixed commission paid to the agent at the beginning of the year = Rs 1000

Profit loading = 7% of pure premium

Loss Distribution:

2,00,000	0.05
1,00,000	0.10
0	Otherwise

Solution:

Pure Premium = 2,00,000 × 0.05 + 1,00,000 × 0.10 = 10,000 + 10,000 =Rs 20,000

Present value of expected claims = 20,000 / 1.06 = Rs 18,867.92

Present value of underwriting costs = 0.10 × 20,000 = Rs 2000

Present value of claim processing cost = 8000 / 1.06 = Rs 7547.17

Present value of marketing expenses = 6000 / (1.06)^0.5 = 6000 / 1.0296 = Rs 5827.52

Present value of commission = Rs 1000
Profit Loading = 0.07 × 20,000 = Rs 1400

Fair Premium = 18,867.92 + 2000 + 7547.17 + 5827.52 + 1000 + 1400 = Rs **36,642.61**

2.3. LIFE INSURANCE

Life insurance is a financial contract between an insurer and an individual that provides a monetary benefit to designated beneficiaries upon the insured's

death, in exchange for periodic premium payments. The premium is determined through actuarial analysis of mortality risk and reflects various demographic and behavioral attributes, including age, gender, occupation, geographic location, and lifestyle factors such as smoking. These characteristics are assigned numerical risk multipliers, which are applied to a standard base premium representing the cost for a healthy individual. The resulting risk-adjusted premium ensures that pricing is equitable, financially sound, and reflective of the insured's unique risk profile over the term of the policy.

CASE 1

FACTORS	VALUES	RISK FACTOR
AGE	30	1.2
GENDER	MALE	1.1
BLUE/WHITE-COLLAR	BLUE-COLLAR	1.4
GEOGRAPHY	RISKY AREA	1.3
SMOKER	YES	1.8

Base Premium for a 30-Year-Old Man-Rs 1500

Multiplying all risk factors-1.2 x 1.1 x 1.4 x 1.3 x 1.8= 4.82

Adjusted Premium = Base Premium x Risk Factor = 1500 X 4.82 = Rs 7230

CASE 2

FACTORS	VALUES	RISK FACTOR
AGE	58	2.5
GENDER	FEMALE	0.9
BLUE/WHITE-COLLAR	WHITE-COLLAR	1.0
GEOGRAPHY	SAFE AREA	1.0
SMOKER	NO	1.0

Base Premium for a 58-Year-Old Woman-Rs 5000

Multiplying all risk factors- 2.5 x 0.9 x 1.0 x 1.0 x 1.0=2.25

Adjusted Premium = Base Premium x Risk Factor =Rs 11250

CASE 3

FACTORS	VALUES	RISK FACTOR
AGE	25	1.0
GENDER	MALE	1.1
BLUE/WHITE-COLLAR	BLUE/COLLAR	1.4
GEOGRAPHY	VERY HIGH RISK	1.6
SMOKER	YES	1.8

Base Premium for a 25-Year-Old Man – Rs 1000

Multiplying all risk factors= 1.0 x 1.1 x 1.4 x 1.6 x 1.8= 4.4352

Adjusted Premium = Base Premium x Risk Factor = Rs 4435.20

CASE 4

FACTORS	VALUES	RISK FACTOR
AGE	70	5.0
GENDER	FEMALE	0.9
BLUE/WHITE-COLLAR	WHITE-COLLAR	1.0
GEOGRAPHY	HIGH RISK	1.4
SMOKER	YES	1.8

Base Premium for a 70-Year-Old-Woman- Rs 5500

Multiplying all risk factors- 5.0 x 0.9 x 1.0 x 1.4 x 1.8=11.34

Adjusted Premium= Base Premium x Risk Factor= Rs 62370

2.4. MEDICAL INSURANCE

Medical insurance is a financial agreement between an insurer and an individual or group, providing coverage for healthcare expenses due to illness, injury, or preventive services in exchange for periodic premium payments. The premium amount is determined through actuarial evaluation of various factors that affect medical risk, including age, gender, health status, policy type, sum assured, geographic location, and claim history. Each of these factors is assigned a numerical multiplier applied to a base premium, which represents the standard cost for a healthy individual under normal conditions. The final premium reflects the insured's overall risk profile, ensuring that higher-risk individuals contribute more, while lower-risk individuals benefit from more affordable pricing. This method ensures fairness, sustainability, and alignment between the insured's health characteristics and the financial structure of the policy.

CASE 1

FACTORS	VALUES
AGE	45
GENDER	MALE
HEALTH STATUS	HAD PREVIOUS ILLNESS
POLICY TYPE	FAMILY FLOATER
SUM ASSURED	1000000 RS
LOCATION	B-GRADE CITY
NO CLAIM BONUS	YES

1. Base Premium – Rs 10000
2. Age Factor (+20%)- Rs 12000
3. Health Status (+15%)-Rs 13800

4. Policy Type (+25%)-Rs 17250
5. Sum Assured (+30%)-Rs 22425
6. Location (+0%)- Rs 22425
7. No Claim Bonus Discount (-5%)- Rs 21303.75
8. GST (+18%)- Rs 25138.43

After systematically applying all relevant risk factors, adjustments, and statutory tax obligations, the final calculated medical insurance premium for Case 1 amounts to **Rs 25138.43**.

CASE 2

FACTORS	VALUES
AGE	30
GENDER	FEMALE
HEALTH STATUS	NO PREVIOUS ILLNESS
POLICY TYPE	INDIVIDUAL
SUM ASSURED	500000 RS
LOCATION	METRO CITY
NO CLAIM BONUS	NO

1. Base Premium – Rs 10000
2. Age Factor (+10%)- Rs 11000
3. Health Status (+0%)-Rs 11000
4. Policy Type (+10%)-Rs 12100
5. Sum Assured (+10%)-Rs 13310
6. Location (+10%)- Rs 14641
7. No Claim Bonus Not Applicable (0%)- Rs 14641
8. GST (+18%)- Rs 17276.38

After applying all relevant premium adjustments and statutory taxes, the final medical insurance premium for Case 2 amounts to **Rs 12,534.68.**

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4. CONCLUSION

In conclusion, this study has demonstrated that premium determination in the insurance industry is a multifaceted process that hinges on precise risk assessment. By dissecting four major types of insurance- automobile, marine, life, and medical, we've observed that each category employs a distinct methodology shaped by the nature of the risks involved, the complexity of underwriting, and the demographic or operational specifics of the insured subject. Whether it's calculating adjusted premiums using layered risk factors in life insurance or estimating expected losses through loss distributions in vehicle and marine coverage, the common thread lies in the actuarial rigor and predictive modeling that ensures both sustainability and fairness. Furthermore, the inclusion of commissions, marketing, and administrative costs in fair premium pricing underscores how insurance is not just a safety net but a carefully calibrated financial product. As insurance markets evolve with emerging risks, like climate change, cyber threats, or demographic shifts, the importance of robust, data-driven premium structures will only grow. This research provides a foundational understanding of how actuarial science and real-world considerations combine to build trust, financial stability, and equitable coverage across the insurance landscape.

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