GROWTH IN INSURANCE USING ANALYTICS

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Abstract

New big data ideas and concepts have recently come to light to address the tremendous increase in data volumes in various corporate areas. However, in addition to creating new obstacles for traditional data processing systems, the phenomenal expansion of internet usage and social media has also introduced enormous volumes of data. Because it creates enormous volumes of collected records, both structured and unstructured, which typical data processing techniques cannot manage, the insurance industry is distinguished by its information-driven characteristic. According to research more than 2/3 of insurance companies use analytics to reduce issues and expenses and 60% say that data help in increasing sale and profitability. In this research, we examine the extra benefits of analytics compared to the need to process insurance data and make decisions. Additionally, the article included an analytical analysis that supported several gains made by insurance businesses, including the effective processing of sizable, diversified data sets and even the facilitation of improved decision-making. The article argues that adopting analytics is helpful because it enables the development of fresh, potent new business models, which in turn allow insurance to shift its emphasis from "understand and protect" to "predict and prevent."

Keywords

Insurance Risk, Insurance Company, Pricing an Insurance Contract, Run-off Trianlges, Chain-Ladder Method

1 Introduction

Even though insurance companies and actuaries have used analytics for decades, the phrase "advanced analytics" has lately gained popularity in the media and at industry conferences. Executives at both big and small carriers have prioritised creating centres of excellence (COEs) with devoted personnel concentrating on sophisticated analytics, commonly known as data science.[1].

Examples of how these investments have paid off in particular industries include the use of catastrophe modelling in property insurance, claims to model in workers' compensation, advanced algorithm systems for personal auto, and detection of fraud in life insurance and property and casualty (P&C) claims, both. Other business segments, including general liability, the majority of specialist segments, and other life insurance segments, have advanced more slowly. Overall, carriers have experienced conflicting outcomes from recently created COEs; in some instances, there have been blatant victories, while in others, the verdict is yet out. [2] However, business leaders in the sector mostly concur that sophisticated analytics may be leveraged to boost value in the insurance industry. Even a lot of experienced underwriters have admitted—perhaps reluctantly—that careful and extensive use of data can result in important advantages.

1.1Insurable Risk

Due to increase in population and technology, the risk also increased and all risk are not insurable. There are many conditions for risk to be insurable. There should be an interest in the risk being insured by the policyholder. Charging the premium can be challenging and for that a risk should be financial and reasonably quantifiable nature. There should be some relationship between the amount payable by insurance policy and financial loss incurred which means there will be a connection between claimed amount and financial loss[3].

1.2 Different types of insurance:

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There are many types of insurance such as property & casualty insurance, life insurance, pension and more. Some of them are as follows:

Property & Casualty Insurance: The insurance which covers property damages from automobile, fire, Marine, power plants, Business interruption, crop, construction, management liability, art and craft, exotic species, etc comes under property & casualty insurance. The amount claimed under this sort of insurance is based on two factors. The date of the event is the first consideration, followed by the amount that may be claimed for an accident.

Life Insurance: Life insurance also has different plans. In whole life insurance, it provides benefits on the death of the life insured whenever that might occur. Inheritance tax comes inside the whole life insurance. Another type of life insurance is term life in which benefits are provided on the death during the term selected at outset. In this insurance, the insurance key has personnel importance. While another life insurance is Endowment in which benefit is provided on the death on a known date in the person is alive and it is used as a saving vehicle – a lump sum on retirement. [4]

Income Protection: This type of insurance provides income when the person or their dependents is in the condition of incapacity or illness.

Critical illness: In this insurance, the person or their dependents during diagnosis of a critical illness provides a cash sum as per the policy documents.

Long-term Care: Financial stability for nursing home care is offered by this kind of insurance.

Joint life: In Joint life, the dependent will receive the money on the death of the insured. The main challenge in Joint life is the time when an accident or death of the insured occurs, whether the timing is not known, mortality tables, and how much money should the insurer pay as per the contract document.

Pension: In this plan, an employer will get a specific amount of money which is calculated on the employer's earning history, tenure of service and age. Some contribution from your salary has been contributed which is tax relief. At retirement, a big amount will be paid at once while the remaining part is converted into an annuity.

2 An Insurance Company

2.1 **An Insurance Company – Underwriting:** In this type of insurance, the risk is identified, selected, priced and sold to the person with the help of a broker/agent or directly. The knowledge was intensive and the people were dependent. For analytics different factors have been considered like geography, gender, credit history, profession and more. The risk is quantified in terms of exposure which also help in determining the price, deductible and cover. It also helps in developing an experience rating model [5].

2.2 An Insurance Company – Claims: In claims, the person will be able to assess the claims which are made during insurance and settle the claims according to the contract. During claims, it has been seen whether the claim is paid or unpaid and according to the severity of the claims, the amount will be paid.

2.3 An Insurance Company – Actuarial: The actuary is a professional who is an expert in analysing financial risks using financial, mathematical and statistical tools. With the help of an actuary, the companies can estimate the premiums for their policies. Pricing actuary, Capital Modelling actuary, Risk actuary, pensions actuary, health care actuary, enterprise risk management actuary, predictive analytics, and machine learning are different types of actuary. In insurance companies, underwriters are replaced by Actuaries [6].

2.4 An Insurance Company – Marketing and Distribution: The marketing and distribution department is one of the most important departments in insurance as they help in marketing, interacting with agents, and brokers and selling the insurance policies directly to the customers also. With the help of this, the number of insurance of a company got increased. Customer analytics, retention models, pipeline management, broker commission, and account management all come under this department.

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2.5 An Insurance Company – Risk Engineering: Risk Engineering department helps to analyse the risk by determining the feasibility of insuring the such risk. the risk engineering, they analyse weather, material, maintenance, quality of equipment and more.

2.6 An Insurance Company – Finance & Accounting: The report of the earnings like any entity insurers do comes under finance & accounting. All the insurer has to maintain solvency according to the regulator. There is some capital reserve for future claims which is known as solvency and this model is known as the capital reserving model [7]. Some of the analytics are as follows:

- $Underwriting\ profitability = Earned\ Premium - Claims - Admin\ Expenses$
- $Combined\ ratio = [Losses + Expenses]/Earned\ Premium$
- $Loss\ ration = Loss/Earned\ Premium$

2.7 An Insurance Company – Investment Management: To pay the future claims, a part of the premium has been invested in bonds and sticks and the returns generated on this investment is used. To analyse this, asset allocation, liability management, various bonds and equity management models has been considered.

2.8 An Insurance Company – Human Resources: Human resource department helps in hiring, managing and developing the talent so that more new and advance features can be added in the insurance. This department look into staffing, retention, internal mobility, promotability, and cost management.

2.9 An Insurance Company – Operations & Information Technology: Operations and information technology department helps the organization to operate all the work systematically and provides all the technologies needed during the process like data required for pricing risk, developing exposure models, loss reserving models, asset-liability assessments etc. For analytical models, quality data is needed while robust data and measurement systems are still under development.

2.10 Insurance Pricing: Finding an insurance contract with a fair price that covers anticipated claims and is competitive on the market is the key objective. Expected claim costs, administrative costs, investment income, profit loading, and other factors must be taken into account in order to estimate a reasonable premium [8]. The formulae to calculate the fair premium is-

$$Fair\ Premium = PV\ of\ Expected\ Claim\ Cost + PV\ of\ A + Profit\ Load$$

3 Pricing an Insurance Contract

To determine the expected claim cost we have to look for the past claims data which tells about the frequency and severity of the past claims. We can also try and fit a probability distribution curve known as curve fitting. Pure premium can also be calculated to determine the expected claim cost.
Marketing, taxes, claims to handle the cost, underwriting cost and commission all come under the administrative costs which will indirectly affect the premium also. If we got the return on investment then the premium change will be reduced. The CEO and board will decide the profit while shareholders will expect a certain level of return.

3.1 Pricing an Insurance Contrast: Case 1

Policy Details: One accident is permitted each year under the insurance on an automobile, and complete coverage is offered so long as the entire value of the claim is paid. All valid claims will be reimbursed at the end of the year.

Data and Assumptions: 15% of the pure premium will come from underwriting costs while the interest rate will be 5% per annum. At the end of the year claim processing cost paid will be Rs. 5,000 and Rs. 5,000 will be the marketing cost which will be paid in the middle of the year. Rs.500 is a fixed commission which will be paid at the start of the year to the agent and 5% of the pure premium will be the profit loading.

Solution:

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- $Pure\ premium = 100{,}000 * 0.07 + 50{,}000 * 0.03 = 7{,}000 + 1{,}500 = 8{,}500$
- $PV\ of\ expected\ claims = 8{,}500/1.05 = 8{,}095.23$
- $PV\ of\ Underwriting\ costs = (0.15) * 8{,}500 = 1275$
- $Expected\ claim\ processing\ costs = \$5{,}000 * 0.10 = 500$
- $PV\ of\ expected\ claim\ processing\ costs = 500/1.05 = 476.19$
- $PV\ of\ Marketing\ Expenses = 5000/(1.05)^{0.5} = 487.95$
- $PV\ of\ Commission = 500$
- $Profit\ Loading = 8{,}500 * 0.05 = 425$
- $Fair\ Premium = 9095.23 + 1214.28 + 476.19 + 487.95 + 500 + 425 + 11{,}259.38$

3.2 Pricing an Insurance Contract: Case 2

Policy Details: One accident is permitted every insurance year, and full coverage is offered at the conclusion of the policy year. The deductible for this insurance coverage will be $50,000.

Data and Assumption: Underwriting expenses with a 5 percent interest rate will make up 15% of the pure premium paid under this contract. The processing fee for claims is $5,000, and it will be reimbursed at the end of the year. The marketing expense, which will be paid in the middle of the year, will be $5,000, and the fixed commission, which will be paid to the agent at the start of the year, will be $500. Five percent of the pure premium will be profit.

Solution:

- $Pure\ premium = (100{,}000 - 50{,}000) * 0.07 = 3{,}500$
- $PV\ of\ expected\ claims = 3{,}500/1.05 = 3333.33$
- $PV\ of\ Underwriting\ costs = (0.15) * 3{,}500 = 525$
- $Expected\ claim\ processing\ costs = \$5{,}000 * 0.07 = 350$
- $PV\ of\ expected\ claim\ processing\ costs = 350/1.05 = 333.33$
- $PV\ of\ Commission = 500$
- $Profit\ Loading = 3{,}500 * 0.05 = 175$
- $Fair\ premium = 3333.33 + 525 + 333.33 + 487.95 + 500 + 175 = 5354.62$

3.3 Pricing an Insurance Contract: Case 3

Policy Details: The premium for a one-year policy on a vehicle with full coverage and a deductible of $50,000 will be paid at the end of the year, with the remaining 80,000 dollars being covered.

Data and Assumption: The underwriting fee will be 15%, plus 5% interest, and the processing fee for 5,000 claims will be paid at the end of the year. 5,000 will be paid as marketing expenses in the middle of the year, and 500 will be a set commission that will be paid in the beginning. Profit loading amounts to 5% of pure premium.

Solution

- $The\ Pure\ premium = (80{,}000 - 50{,}000) * 0.07 = 2{,}100$
- $PV\ of\ expected\ claims = 2{,}100/1.05 = 2004.76$
- $PV\ of\ Underwriting\ costs\ the = (0.15) * 2{,}100 = 315$
- $Expected\ claim\ processing\ costs = \$5{,}000 * 0.07 = 350$

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- $PV\ of\ expected\ claim\ processing\ costs = 350/1.05 = 333.33$
- $PV\ of\ Marketing\ Expenses = 5000/(1.05)^{0.5} = 487.95$
- $PV\ of\ Commission = 500$
- $Profit\ Loading = 2{,}100 * 0.05 = 105$
- $Fair\ premium = 2004.76 + 315 + 333.33 + 487.95 + 500 + 105 = 3746.05$

3.4 Comparing

While comparting case 1, case 2 and case 3 we observed a huge difference in the premium. While expected claims and expected claims processing cost also have some differences. Other than that, marketing expenses, & commission all are same. It shows how much difference we can expect on types of insurance we purchase.

Table 1.1: Comparing Case1, Case 2 and Case 3

Present Value of	Full Coverage	With Deductible	Deductible & Policy Limit
Expected Claims	8,095.2	3,333.3	2,004.8
UnderwritOne-years	1,275	525	315
Marketing Expenses	487.95	487.95	487.95
Expected Claims Processing Cost	476.19	333.33	333.33
Commission	500	500	500
Profit Loading	425	175	105
Premium	11,259.38	5,354.62	3,746.05

3.5 Rating Factors

Bathe se case

Rating Factor:
$Geography * \frac{Blue\ collar}{White\ collar} * age * gender * pin\ code = 1$

Premium: 11,259

3.6 New Customer

Table 1.2: Details of New Customers in Bihar

Rating Factors	Rating	Factor
Geography	Bihar	1.2
Blue/White Collar	Blue	1
Age	35	0.8
Gender	Female	0.95
Pin Code	800001	1.05

Customer in Bihar

$Rating\ Factor$:
$Geography * \frac{Blue\ collar}{White\ collar} * age * gender * pin\ code = 1$
1088

$Premium$: 1,1088*8,095.2 + 1,275 + 487.95 + 476.19 + 500 + 425 = 10,916.14

4 Use of Analytics in insurance

- Deductible mitigates the effects of frequent, modest claims.
- Policy restrictions ensure that the insurer is shielded from relatively uncommon but serious claims and may stay in operation.
- Less risk exposure means lower premium income for the insurance company.
- Each insurer has a unique set of rating standards, which are arbitrary.
- Analytics:
    - Identify pertinent rating criteria
    - To increase premium revenue, decide on the deductible and policy limit.
    - Reduce the possibility of paid claims

5 Pricing Term Life Insurance Contract

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5.1 **Policy Details:** A male who is 30 years old has 5 years term life insurance with one time premium payment which covers 10,00,000.

Data & Information: With guaranteed mortality, the interest rate will be 10%, and the payout will be made at the end of the claim year with 5% paid to BOC at 5% loading profit.

While comparing both the case of 30 years old man and 40 years old man, we found that with increase of age, the probability of death will increase and probability of survial will decrease as probability of death is inversely proportional to probability of survival. Due to this, the acturial value will also increase as age will increase as shown in both the charts below.

Comparing the Two Cases

Table 2.1: Details of Death Benefit at 30 years old man

Death Benefit: 5 Year Term Life at 30

Year	Age	P(Death)	P(Survival)	Sum Assured	Discount Factor	Actuarial Present Value
0	30					
1	31	0.000602	0.999398	1,000,000	0.909090909	547.27
2	32	0.000617	0.999383	1,000,000	0.826446281	509.92
3	33	0.000636	0.999364	1,000,000	0.751314801	477.84
4	34	0.000660	0.99934	1,000,000	0.683013455	450.79
5	35	0.000689	0.999311	1,000,000	0.620921323	427.815
						2413.63

$$Premium = 2413.638(1 + (0.05 + 0.05)) = 2654.933$$

Table 2.2: Details of Death Benefit at 40 years old man

Death Benefit: 5 Year Term Life at 40

Year	Age	P(Death)	P(Survival)	Sum Assured	Discount Factor	Actuarial Present Value
0	40					
1	41	0.000851	0.999149	1,000,000	0.9090909090	773.64
2	42	0.000922	0.999078	1,000,000	0.826446281	761.98
3	43	0.001003	0.998997	1,000,000	0.751314801	753.57
4	44	0.001096	0.998904	1,000,000	0.683013455	748.58
5	45	0.001201	0.998799	1,000,000	0.620921333	745.73
						3783.50

$$Premium = 3783.5 * (1 + (0.05 + 0.05)) = 4161.84$$

5.2 Pricing Term Life Insurance Contract

Policy Details: With 5 years endowment policy type, a male of 30 years has 5 year term plan in one time premium payment which cover of 10,00,000.

Data & Information: With assured mortality, 10% interest rate with no commission, taxes and profit loading and has payment at the end of year [9].

5.3 Endowment Insurance

A type of life insurance known as endowment insurance matures and pays out whether the insured is alive or not. One of the most expensive types of life insurance, this policy has several potential applications. Before investing in endowment insurance, as with other forms of investments, it is advisable to consult with a financial counselor or accountant to ensure that it is the best choice. For those who are concerned about experiencing changes in income or financial need, endowment insurance may not be the best option due to its extreme rigidity.

Table 2.3: Details of Endowment Insurance at different age

Death Benefit

Year	Age	P(Death)	P(Survival)	Sum Assured	Discount Factor	Actuarial Present Value
0	30					
1	31	0.000602	0.999398	1,000,000	0.9090909090	547.27
2	32	0.000617	0.999383	1,000,000	0.826446281	509.92
3	33	0.000636	0.999364	1,000,000	0.751314801	477.84
4	34	0.000660	0.99934	1,000,000	0.683013455	450.79
5	35	0.000689	0.999311	1,000,000	0.620921323	427.815
						2413.63

Table 2.4: Survival Benefit in Endowment Insurance

Survival Benefit

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Year	Age	P(Death)	P(Survival)	Sum Assured	Discount Factor	Actuarial Present Value
5	35	0.000689	0.999311	1,000,000	0.620921323	620493.51

$$Premium = 2{,}413.63 + 6{,}20{,}493.51 = 6{,}22{,}907$$

6 Run-off triangles

6.1 Capital Reserving: Run-off triangles

The majority of run-off triangles occur in non-life insurance since it might take some time following a loss to fully comprehend the breadth of the claims that must be paid. It's crucial to assign the claim to the year the insurance was issued. There are several potential causes for delays in the ultimate claim payment. It is clear that the insurance company cannot offer an exact estimate of the yearly claim volume. That amount must be estimated as precisely and confidently as possible.[10]

6.2 Run-off trianlges – Accident and Development Year

The accident year is the year that the occurrence took place and the insurer became exposed (AY). The delay or development period is the length of time before a payment is made, measured in years (DY). The claim data is divided using the development and accident years.

Run off Triangle

In 2001, the final claim payment for claims made after 1996 was made, totaling 24. The "Run-off" period for claims on insurance issued in 1996 is anticipated to finish in 2001. $5108 + 960 + 490 + 210 + 75 + 24 = 6867$ is the total claim for insurance issued from $1996\ to\ 2001.5670 + 1060 + 530 + 230 + 80 = 7570$ is the total claim for insurance issued from 1997 to 2001.

Given that "Run-off" did not occur for claims from 1997, 1998, 1999, 2000, or 2001 (unlike it did for claims from 1996), how much money should the insurer set aside for these claims?

Table 3.1: Claim Payment by Policy Year according to Run of Triangle

Claim Payment by Policy Year						
Year	0	1	2	3	4	5
1996	5108	960	490	210	75	24
1997	5670	1060	530	230	80	
1998	6240	1160	580	250		
1999	7200	1340	670			
2000	7900	1480				
2001	9000					

Determine the Cumulative Claims

Table 3.2: Cumulative claims payment by Policy Year according to Run of Triangle

Cumulative Claim Payment by Policy Year						
Year	0	1	2	3	4	5
1996	5108	6068	6558	6768	6843	6867
1997	5670	6730	7260	7490	7570	
1998	6240	7400	7980	8230		
1999	7200	8540	9210			
2000	7900	9380				
2001	9000					

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Step 2: Determine the Development Factor

Table 3.3: Development Factor according to Run of Triangle

D(1,0)	38118/32118	1.187
D(2,1)	31008/28738	1.079
D(3,1)	22488/21798	1.032
D(4,3)	14413/14258	1.011
D(5,4)	6867/6843	1.004

Year	0	1	2	3	4	5
1996	5108	6068	6558	6768	6843	6867
1997	5670	6730	7260	7490	7570	7597
1998	6240	7400	7980	8230	8319	8349
1999	7200	8540	9210	9502	9605	9639
2000	7900	9380	10121	10441	10555	10592
2001	9000	10681	11525	11890	12019	12061

Step 3: Determine the Claim Amount

$$Claim\ (2001,1) = 9000 * 1.187$$
$$Claim\ (2001,2) = 9000 * 1.187 * 1.079$$
$$Claim\ (2001,3) = 9000 * 1.187 * 1.079 * 1.032$$

$$Claim\ (2001,4) = 9000 * 1.187 * 1.079 * 1.032 * 1.011$$

$$Claim\ (2001,5) = 9000 * 1.187 * 1.079 * 1.032 * 1.011 * 1.004$$

Step 4: Complete the Triangle

Table 3.4 Completing the Triangle by Policy Year

Cumulative Claim Payment by Policy Year

Step 5: Compute the reserves for Future claims

Table 3.5: Compute the reserves for Future claims

Cumulative Claim Payment by Policy Year							
Year	0	1	2	3	4	5	Reserves
1996	5108	6068	6558	6768	6843	6867	0
1997	5670	6730	7260	7490	7570	7597	27
1998	6240	7400	7980	8230		8349	119
1999	7200	8540	9210			9639	429
2000	7900	9380				10592	1212
2001	9000					12061	3061

$$Additional\ Capital\ to\ be\ Reserved: 27 + 119 + 429 + 1212 + 3061 = 4847$$

7 Chain-Ladder Method

7.1 Current Trends & Challenges

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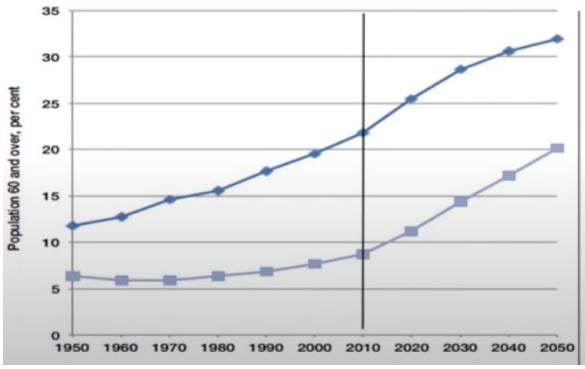

Countries with the highest shares of 60+ populations in 2011 and 2050 (percentage), (among countries with 2011 population of 1 million or more)

2011		2050	
Japan	31	Japan	42
Italy	27	Portugal	40
Germany	26	Bosnia and Herzegovina	40
Finland	25	Cuba	39
Sweden	25	Republic of Korea	39
Bulgaria	25	Italy	38
Greece	25	Spain	38
Portugal	24	Singapore	38
Belgium	24	Germany	38
Croatia	24	Switzerland	37

Figure 1.1: Trend & Challenges according to different counties in different countries

7.2 Cyber Security

An extensive, worldwide cyberattack may result in average economic losses of $53 billion, comparable to the devastation caused by a catastrophic natural disaster like 2012's Superstorm Sandy in the United States. [11] Insurers are finding it difficult to predict their potential exposure to losses from cyberspace in light of the rising dangers and demand for cyber insurance. Business disruptions and computer maintenance frequently incur expenses (Lloyd's of London).

7.3 Debt for Pensions

The Centre for Retirement Research reports that in 2000, the typical pension plan was completely funded (CRR). Only 72% was the official financing percentage at the end of 2015. The American Academy of Actuaries and Society of Actuaries' most recent estimates place the funding level at 27%.

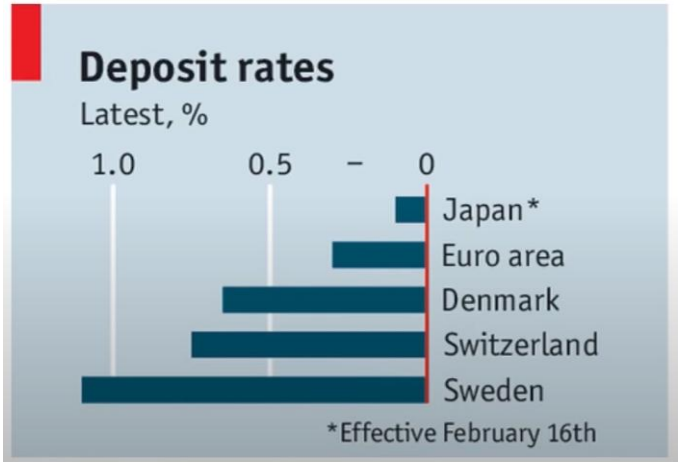

Figure 1.2 Low Interest Rates in different countries

7.4 Geopolitical risk

Trans-Pacific Partnership and Trans-Atlantic Trade and Investment Partnership withdrawal of significant parties. Leaving the Paris Accord, the US According to Dani Rodrik, a Harvard economist, the "globalisation trilemma" states that only two of democracy, national sovereignty, and global economic integration can live concurrently.

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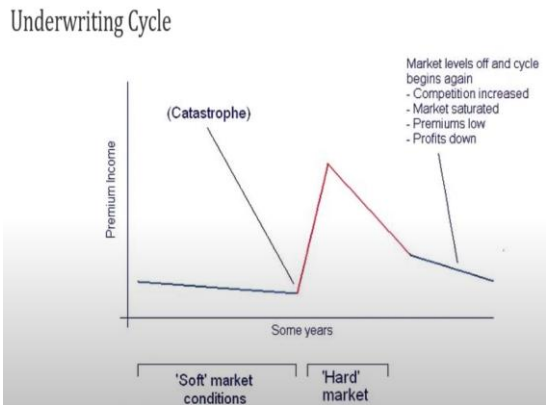

Figure 1.3 Underwriting Cycle in different market conditions

7.5 Telematics: Fleet telematics is a technique for tracking a vehicle's location, movement, status, and behaviour within a fleet. Telematics alerts in the event of an accident can automatically send information to an insurance provider right away following the incident, giving the first notification of loss. Rapid evaluation of data from sensors on brakes, air bags, seat belts, and other systems allows the insurance to ascertain the seriousness of the crash[12].

7.6 Various Estimates: Modelling a catastrophe Losses is a challenging problem that need for extensive analytical research (Floods in Thailand) modelling a catastrophe A lot of analytical research is needed to understand the issue of losses (Floods in Thailand).

7.7 Terrorism: Property and inventory damages are covered. In the event that a firm is unable to operate due to an assault, it can also obtain "business interruption" coverage. Often, NBCR (nuclear, biological, chemical, and radiological) assaults are not covered. Additionally, different policies are typically used to address cyber-risks.

7.8 AI and Automation: The claim processing time was sped up to five seconds thanks to the recent introduction of AI claims handling, which saved 40,000 labour hours. Tom de Swaan from Zurich Insurance Group. In order to save $1.3 million annually, the Japanese insurer Fukoku Mutual Life Insurance started deploying AI in January by replacing 34 employees.

8. Conclusion

Insurance providers keep looking for lucrative clients. Finding lucrative consumers is increasingly harder and harder. Analytics are utilised to determine the "good" risk and price it. Robots are handling claims processing! Current analytics has its limitations, as demonstrated by the tailored contact price we use to ensure the Board of Directors of Apple, Amazon, HSBS, and other companies. Analytical methods can lessen but not completely remove human interaction.

10. References

1. Senousy, Y. M. B., Mohamed, N. E. K., & Riad, A. E. D. M. (2018). Recent trends in big data analytics towards more enhanced insurance business models. *International Journal of Computer Science and Information Security*, *16*(12), 39-45.
2. Nyce, C., & Cpcu, A. (2007). Predictive analytics white paper. *American Institute for CPCU. Insurance Institute of America*, 9-10.
3. Guiso, L., & Jappelli, T. (1998). Background uncertainty and the demand for insurance against insurable risks. *The Geneva Papers on Risk and Insurance Theory*, *23*(1), 7-27.
4. Black, K., Skipper, H. D., & Huebner, S. S. (1994). *Life insurance* (p. 12). Englewood Cliffs, NJ: Prentice Hall.
5. Pokorski, R. J. (1997). Insurance underwriting in the genetic era. *Cancer: Interdisciplinary International Journal of the American Cancer Society*, *80*(S3), 587-599.
6. Lemaire, J. (2013). *Automobile insurance: actuarial models* (Vol. 4). Springer Science & Business Media.
7. Beauchamp, N. J. (2014). Basics of finance and accounting. *Journal of the*

eISSN 1303-5150

American College of Radiology, *11*(6), 541-542.

8. Phillips, R. D. (1994). *Financial pricing of insurance in the multiple-line insurance company*. University of Pennsylvania
9. Mahajan, K. (2013). Analysing consumer decision making process in life insurance services. *International Journal of Marketing, Financial Services & Management Research*, *2*(5), 60-68.
10. De Felice, M., & Moriconi, F. (2003). Risk based capital in P&C loss reserving or stressing the triangle. *Research Group on Insurance Companies and Pension Funds*
11. Lemnitzer, J. M. (2021). Why cybersecurity insurance should be regulated and compulsory. *Journal of Cyber Policy*, *6*(2), 118-136.
12. Handel, P., Skog, I., Wahlstrom, J., Bonawiede, F., Welch, R., Ohlsson, J., & Ohlsson, M. (2014). Insurance telematics: Opportunities and challenges with the smartphone solution. *IEEE Intelligent Transportation Systems Magazine*, *6*(4), 57-70

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