INSURANCE DYNAMICS: MANAGING INFORMATION FLOWS

Douglas Franco, PhD
0582129636549 / 0582125007722
dfranco@cantv.net

ABSTRACT

Insurance Companies sell information, written in contracts called policies, to clients; who buy those contracts by paying a premium. Insurance Policies promises to pay for possible future casualties. Premium means first, casualties come later. Thus, it is essential to manage information flows to improve profits and stability. The complexity of Insurance is increasing to faster rate than our knowledge of it. Managers respond by focusing on smaller areas of their business. They have deeper understanding of their domain but lesser understanding of how their domain interacts with others. SD consolidates knowledge, fragmented across many actuarial and financial models, using data and expert input in order to represent reality. Loss Ratio, LR, claims cost to premiums, is a key profitability factor. Different actuarial models support LR basic statistics for underwriting decisions. However, the fragmented visions provided by actuarial analysis, mislead decisions and deteriorate performance. This paper integrates basic insurance statistics into a comprehensive SD model, to design the future of an insurance company with enough amplitude to let the problems to be solved and the road to succeed in. The paper stresses modeling rather than policy design, so experience can be used elsewhere. However, tampering and major deteriorating loops are analyzed. Senge (1999), Barlas (2000), have worked primarily on the human resources and physical flows of the insurance business. Senge has shown how misallocation of human resources to handle claims, increases costs; because, cost reduction programs usually decrease manpower to process claims; rising cost and customer dissatisfaction, by rising average cost and delay to process claims. Serge's work at Hanover, inspired in Forrester (1975), pioneered the uses of SD in the insurance business but it does not touch the heart of the insurance company: underwriting the policies. Therefore, policy underwriting goes with policy design when improving management of an insurance company. Peter's dances at Hanover focus on movements, the physics, rather than on music, the information, of the Insurance Business.

INTRODUCTION

A managerial problem is Policy Design under uncertainty, because casual and causal come together. Deming (2000), Georgantzas (2003) emphasize separating the causal and the casual, or special causes from common causes, for robust feedback design. They recommend treating the causal before the casual. Special causes come from management intervention and unusual exogenous factors, the common causes come from random events. Actuarial models describe randomness, but they are not designed to deal with causal problems.

Controlling common causes increases variation; therefore, reinsurance cost increases, since deviations in claims, raise the portion of premiums ceded to the reinsurer.

Physical flows of Money, Clients, and Contracts are preserved. Management decisions are modeled from current practice; but, they are enhanced by necessary statistical process control and structures to allow solutions.

Model is implemented in Ihink. The structure incorporates management requirements to address several problems, plus the minimal structure required to replicate reference modes.

The renovation of policies is one of the most effective levers to promote growth and lower variation. Stable clients put the law of the big numbers on our side. Policy renewal affects profits and costs, because it selects better clients, promotes growth, diminishes units cost and variation. The more clients you have, the lower is the variation on claims frequency, because deviation decreases with the number of items.

SD integrates basic statistics, with corporate dynamics. Accounting principles assure money' conservation; therefore, money is not treated as an information flow.

For common causes or casual events, there are random models to calculate the probabilities of success, when charging a certain sum for each assured dollar. Statistics are also used to design policies to select new possible clients and to renovate the policies to the traditional clients.

PREMIUMS

Policies are sold primarily by brokers and agents, who are attracted by sales commission and claims' delay. Growth is based upon the ability to attract those salesmen. Barlas (2000) studies extensively company growth, whose main positive loop is to hire more people to sell contracts. Forrester' (1975) Classic Market Growth model is an extraordinary source to represent insurance sales. He sells books, we sell contracts, and the difference is, perhaps, the number of pages.

Sales are not constant along the year; but, the fourth quarter often concentrates half of the yearly volume. Claims are evenly distributed along the year. Therefore, the ratio claims to premiums, Loss Ratio LR, go up at the beginning of the year, because claims are the same, while premiums are lower. High Loss Ratio induces managers to restrict underwriting by being more selective with clients, rejecting more renewals, or delaying claim payments. Fewer clients produce fewer premiums, pumping LR to even higher values.

TAMPERING

As businesses have become more complex and the interdependencies have increased, managers have struggled to maintain control and make decisions under uncertainty. Use of enterprise data warehousing and data mining has substantially increased the amount of data that is available to managers. However, more data often lead to superstition; casual is confused with causal. MIS produces all imaginable figures about insurance casualties, similar to baseball commentators, where the most outrageous numbers are made up, like, "how many women have crashed a yellow car on Wednesday evening". Management Information Systems, MIS databases mine superstitious figures. Manager's control of random variation exacerbates variation.

Casualties occur randomly but managers react deterministically to Loss Ratio values. A high casualty pump LR up, and panic abduct management decisions; so, underwriting is restricted, superstition measures are adopted, variation is increased and reinsurance cost rises. Some desperate managers use "*premiums to kill claims*"; so, they take any chance looking for cash. Cash may cover claims now, in order to collapse later on.

REINSURANCE

Reinsures share premiums and claims, they receive a part of premiums and pay portion of the claims. A reinsurance commission is paid for each dollar ceded. The way reinsurance works is either share a portion of the premium and claims (proportional), or assigning a threshold, any claim below the threshold goes to the company, and any claim above the threshold goes to reinsurance.

Variation is essential; because, more variation brings higher reinsurance cost; because, more claim's costs exceed the threshold.

MANAGEMENT

The Managers Schema has four basic reports: Balance Sheet, Financial statement, Cash Flow and Valuation. Balance Sheet assures conservation of money. The present value of future cash flow DCF, represent the value of the company, as shown by Copeland (2000), who found high correlation between present value of cash flow and the market value price. Value trades off short and long run consequences. "*Worse before the better*" characterizes insurance dilemmas. For instance, retaining fewer premiums now, liberates unearned premiums and increase profits now; but decrease profits later on. Opening the doors to high risk clients increase revenues; but, bring more claims later. Delaying claim payments increase cash, but decrease customer satisfaction, bringing less premiums later.

ACTUARIAL STRUCTURE

LR is the quotient between the cost of the claims and the income per sales or premiums. It is the point of union between the management and statistics. The managers use it to make decisions, often trying to control chance.

The cost of the claims is the number of claims by the average cost of them, Claims*ClaimCost.

The income per sales is the price per each assured dollar, Tariff, multiplied by the assured average sum, multiplied by the number insurance policies,

N*AveragePremium = N * (Tariff*AverageInsuredSum)

So,

LR = Claims*ClaimCost/(N* AveragePremium) = Claims*ClaimCost/(N*Tariff*AverageInsuredSum)

But,

Claims/N = Frequency and

ClaimCost/AverageInsuredSum = Severity

Therefore,

LR = Frequency*Severity/Rate

Frequency*Severity is often called Natural Tariff.

So,

LR = Natural Tariff/Tariff

Frequency is a function of risk factors, like the age of the driver in automobile insurance or smoking habits in Health care insurance. Severity is function of measures to mitigate damage, like using the seat belt in automobiles or available fire extinguisher.

To decrease LR managers increase prices, Tariff. Or they set deductible to load portions of damages on client's shoulders, decreasing severity. The frequency descends with preventive measures, or selecting the clientele statistically. For instance, those that have more than three claims in a year whose amount exceeds twice the premium are not allowed to renew their policy. Or those that don't stop to smoke, or those that make serious traffic violations, or those establishments that don't fulfill the legal regulations of electric facilities, or gates that are not secure.

When there is not a sum insured, but a covering per event, then,

LR = Claims*ClaimCost/(N*AveragePremium)

LR = Frequency * ClaimCost/ AveragePremium = NaturalPremium/ AveragePremium

Where the NaturalPremium is the frequency multiplied by the average cost of the claim.

The insurance of health fall in this category, since there is not a sum insured, but the payment for event. In spite of the high cost of many serious illnesses as the cancer or AIDS, the frequency with which they happen is low; therefore, the premium to cover those illnesses is usually small. One of the keys of success in the medical insurance is to have high coverage on very expensive, but rare, illnesses.

Not to cover what clients can pay, and to cover what the client cannot pay is one of the secrets of a successful underwriting. To cover or not to cover, that is the question.

For example, to pay up to a million dollars per cancer is less expensive than to pay for medical visits.

The most expensive illness is not cancer; but free medical care.

The pattern helps to evaluate the consequences of adopting preventive measures to decrease frequency, as education and teams to diminish the claims cost, of setting deductibles in the insurance policies, or increase assured sums, or making decisions that affect the statistic root of the earnings of the insurance.

ACCOUNTING STRUCTURE

The accounting structure shown in the model was demanded by managers of the insurance company, to be able to evaluate the consequences of their decisions. It is well known the emphasis in SD for few levels. Certainly, this practice is very good for policy design, but, often, it leads to financial formulations that don't conserve money. Therefore, money is treated in this model, not as an information flow; but, as a material flow whose conservation is assured by using accounting principles.

Often, SD models adopt very simple and erroneous financial structures, omitting indispensable levels to guarantee conservation of money. For example, earnings, revenues minus costs, can go negative when costs exceed revenues, if there is not a loan level, then credits at zero interest rate are, indirectly, granted; because, free loans incline the balance to debt.

MANAGEMENT STRUCTURE

Managers react to increases in Loss Ratio, due to seasonal or random events, by either increasing prices or by taking fewer chances, both measures activate positive loops that pump Loss Ratio to higher values. For instance, in the first quarter, premiums are low and claims are the same, these seasonal increase in Loss Ratio, tights underwriting, accepting less chances, increasing tariffs, both decisions decrease premiums, increasing Loss Ratio to higher values. Severe decreases in premiums may lead to delays in claims payments, so claim's provider's increases costs, augmenting Loss Ratio. Similar reactions are experimented when random events increases Loss Ratio. Half of the insurance price usually comes from manager's amplification of uncontrollable events.

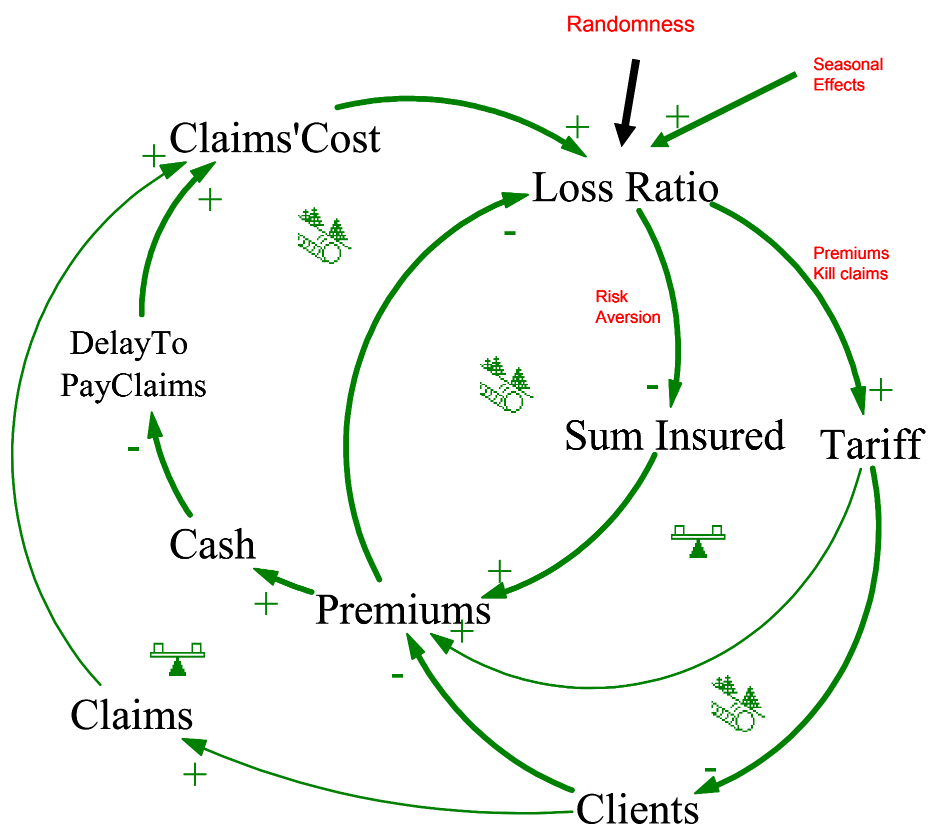

Figure 1. Policy Design. Positive loops exacerbating Loss Ratio, causing tariff increases

Loss Ratio feeds actuarial statistics, because the product of the Desired Loss Ratio multiplied by the Natural Tariff gives the value of Tariff. Natural Tariff comes from the product of frequency and severity. Frequency is the ratio of the number of claims and the number of policies. Severity is the ratio of the cost of the claim and the Insured Amount; it is the portion of the Insured Amount that is consumed, in the average, by casualties. It is usually 10% in automobiles, 45% in Fires, and 100% in life insurance.

SD changes the definitions of almost everything. The number of policies is an accumulation or a level, but the claims is an average rate, the number of casualties occurred during a period. The number of policies on that period is: the sum of the days each policy was active during that period, divided by the length of the period. Severity take in consideration only the Insured Sum of the policies which experience casualties, because the number of casualties in a month is very small related to Insured Sums, therefore, if claims are inexpensive, the ratio to average Insured Sums, is very small, but if claims are expensive then the ratio to average sums is huge.

For instance, in life insurance severity is always one, no matter if the corpse belongs to a rich or a poor man. In automobile, severity tends to be 10%. If the car is an expensive one, the crashes are expensive; but, if the car is a small one, the crashes are less expensive. The portion of the insured sum that is deteriorated is proportional cars' prices.

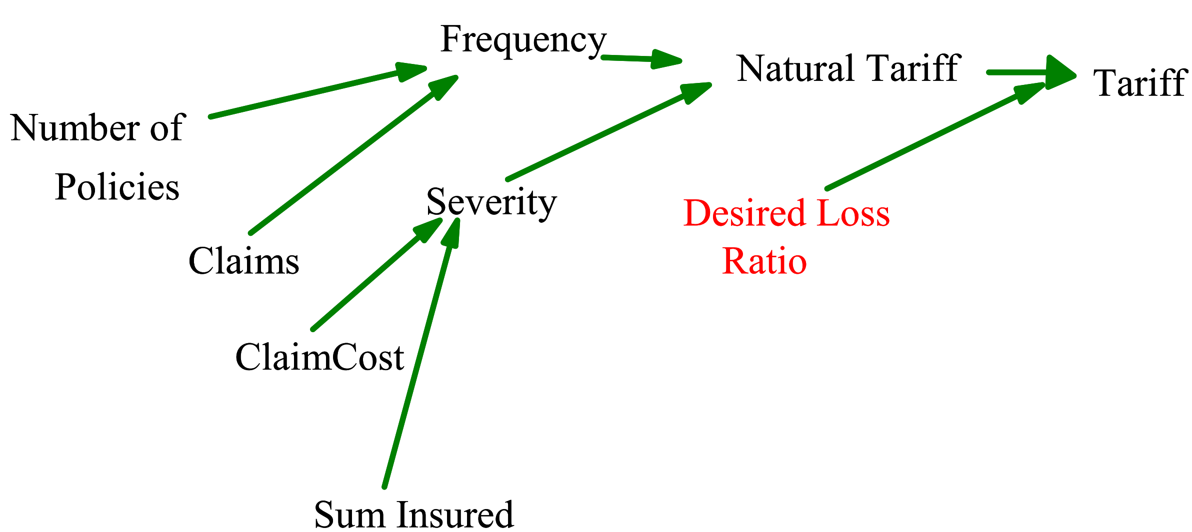

Figure 2. Policy Underwriting

CONCLUSION

The model is useful to separate causal from casual influences in an insurance company. It can be used, not only for better allocation of manpower resources, but to improve the underwriting process. The relationship between loss ratio, frequency, severity, prices, costs, establishes robust basis for underwriting.

Manager's decisions add to insurance prices a toll of inefficiencies. Half of the insurance prices approximately come from feedback loops that distort actuarial calculations. SD allows improving policy design as well as policy underwriting.

Agent base to model manager behavior and some information flows, promise improvements in policy design. So, future models are going to incorporate such structures.

REFERENCES

Barlas, Y; K. Çırak and E. Duman "Dynamics of Strategic Insurance Management" ,*System Dynamics Review* ,Vol.16, no.1, 2000, pp. 43-58.

Booth, P., R. Chadburn, D. Cooper, S. Haberman, and D. James. 1999. *Modern Actuarial Theory and Practice*, Chapman and Hall

Copeland Tom, Koller Tim, Murrin Jack .2000. *Valuation: Measuring and Managing the Value of Companies*, 3rd Edition by McKinsey & Company, Inc.,

Culp, Christopher L. 2001. *The Risk Management Process*. New York: John Wiley and Sons, Inc, 381-417.

Deming E. 2000. *Out of the Crises*. MIT press

Jones Bruce L. 2000. *Introduction to Actuarial Models and Modeling: An Interactive Approach*, ACTEX Textbooks,

Klugman S.A., Panjer H.H., and Willmot G.E. 1998. *Loss Models: From Data to Decisions*, John Wiley and Sons, New York

Forrester, Jay W. 1975. *Collected papers of Jay W.Forrester*. Waltham, MA: Pegasus Communications.

Georgantzas. Nicholas .2003. Tampering - A Dynamic System View. ***Fordham University***

Lemaire Jean. 1985. Automobile Insurance, Actuarial Models. Kluwer Nihoff Publishing, Hingham MA, USA

O'Brien William. 2002. *Character and The Corporation. Society for Organizational Learning*, GBN, Society for Organizational Learning.

Senge Peter. 1999. *The Dance of Change*, Doubleday,