www.ICA2014.org

LEARN
INTERACT
GROW

Sustainable Value: How and When to Grow ?

Rami Bou Nader
Ecole Normale Supérieure – Cachan

Emmanuel Pierron
AXA Global Direct – France

Value creation in P&C Insurance

- Pricing and Marketing strategies in P&C insurance in a value-based framework
- Focus on two questions:
  - How to select the most profitable customer segments at a given period
  - How the optimal pricing and prospecting strategy varies with respect to insurance cycle

2

Literature review

- Pricing optimization through underwriting cycles
  - Taylor (1987), Underwriting strategy in a competitive insurance environment
  - Emms (2005), Optimal strategies for pricing general insurance

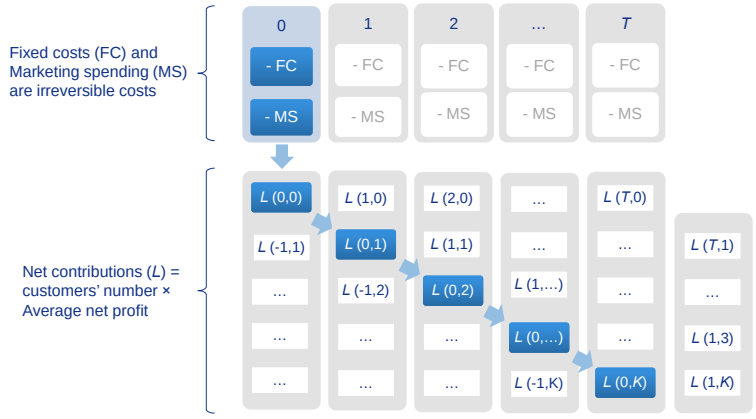
  Don't account for customer value. Marketing spending are not considered as a decision variable of the optimization program

- Customer Value in the P&C insurance sector
  - Perhov et Donkers (2001) , Predicting customer potential value an application in the insurance industry
  - Donkers et al. (2007), Modeling CLV: A test of competing models in the insurance industry

  Not a dynamic framework ; it isn't possible to derive any optimal pricing strategy. Don't account for the underwriting cycle

3

Value model



Insurer's objective	Maximization of his Global Value, defined as the sum of the free cash-flows generated over a finite time horizon

4

Value model

Long-term Prospecting Result (LTPR)

$LTPR = n_0(MS) \times PV - MS$

0

- MS

Prospect Value (PV) is defined as **the sum of the average cash-flows** a new prospect would generate over his **customer lifetime**

$\acute{L} = d_0(p_0 / \dot{p}_0) \times (p_0 - pp_0 - vc_0)$
$n_1 = d_0(p_0 / \dot{p}_0)$

$\acute{L}$ (0,0)

$L = n_1 \times d_1(p_1 / \dot{p}_1) \times (p_1 - pp_1 - vc_1)$
$n_2 = n_1 \times d_1(p_1 / \dot{p}_1)$

L (0,1)

$L = n_2 \times d_2(p_2 / \dot{p}_2) \times (p_2 - pp_2 - vc_2)$
$n_3 = n_2 \times d_2(p_2 / \dot{p}_2)$

L (0,2)

L (0,…)

L (0,K)

Notations

n_0 : number of prospects asking for a quote, depends on Marketing spending
n_k : number of customers at the beginning of period k
$d_k(p_k / \dot{p}_k)$: demand function of period k. It takes value between 0 and 1 and depends on the relative premium $p_k / \dot{p}_k$
pp : pure premium
vc : variable costs

5

Value maximization

- Assumptions:
  - No interaction between customers
  - Market premium is exogenous (non-dominant insurer)
  - Constant variable costs
- Maximizing the insurer's value is equivalent to maximizing separately:
  - the customer value of in-force portfolio defined as the sum of the net contributions generated by each one of the old generations
  - the LTPR of future generations defined as the net contributions generated by each one of the future generations minus the corresponding marketing spending
- Note that the fixed costs have no impact on the optimization program

6

LTPR optimization
Decision variables

- Optimizing the LTPR can be done with respect to the premiums (at NB and renewals) and the prospection investments
- With no global constraints, this optimization program consists on:
  - First, maximizing the Prospect Value (PV) with respect to prices (fixed costs and acquisition costs should not be included in the margin to optimize)

$$PV^* = \max PV$$

  - Then, maximizing the LTPR with respect to prospection investments

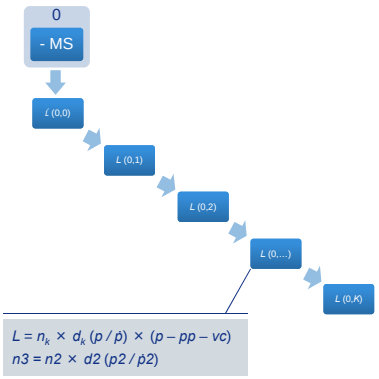
$$LTPR^* = \max \left(n_0(MS) \times PV^* - MS \right)$$

7

PV maximization

Maximizing the PV, a dynamic optimization problem

- ✓ The objective function to maximize is ***deterministic*** and ***non stationary***
- ✓ It's a ***discrete finite-time*** problem (in general, a P&C insurance policy has a standard one-year coverage period)
- ✓ The ***control variable*** is the price offered at each period (NB and renewals)
- ✓ The ***state variable*** is the survival rate at the beginning of each period
- ✓ The ***transition function*** depends on the current state (number of potential customers) and the current control (price), and is supposed to be ***deterministic*** and ***non stationary***.



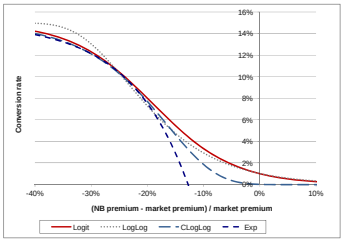
Dynamic programming

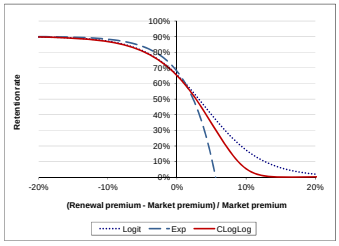
The optimal pricing strategy can be given by the dynamic programming algorithm. The intuition behind this algorithm is that the insurer must apply at each stage the price that maximizes the current cash-flow and the best cash-flows that can be excepted from future periods.

8

PV optimization
Numerical example (model 1)

- Assumptions about the demand functions:
  - The conversion rate depends on the NB premium / market premium ratio according to a logit function. Its maximum value is set to 15%
  - The retention rate depends on the renewal premium / market premium ratio according to a CLogLog function. Its maximum value depends on the price-insensitive lapse rate (10% for the baseline scenario)

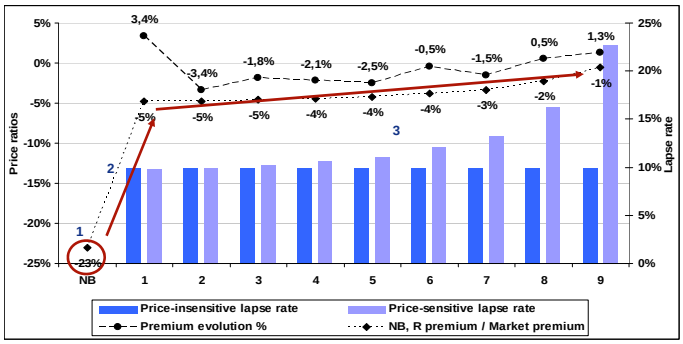




- Assumptions about claims costs, variable costs and the market average price (cf. appendix) :
  - Claims costs and variable costs are based on real data. The market LR is 77%

PV optimization
Numerical example (model 1)

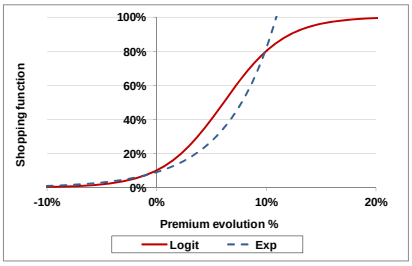
- According to the optimal pricing strategy, the insurer must:
  1. set competitive prices at NB
  2. reduce rapidly the gap between its premium and the market premium at the first renewal
  3. and keep reducing this gap smoothly over next renewals

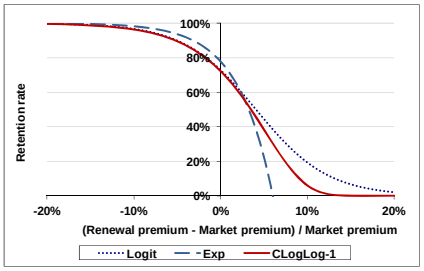


NB premium	407 €
Conv. Rate	10 %
PV*	10 €
NBV*	104 €

PV optimization
Numerical example (model 2)

- We consider here that the price-sensitive part of the retention rate is a combination of 2 functions:
  - the shopping function which reflects the probability of customers to start shopping around and getting quotes from other insurers (depends on the premium evolution)
  - the retention function which reflects the probability of customers who shopped around not to lapse (depends on the gap between their premium and the market one)

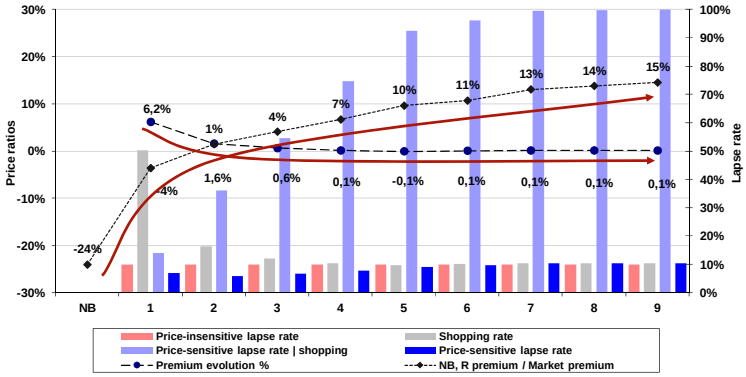




11

PV optimization
Numerical example (model 2)

- We notice that the higher premium evolution occurs at the first renewal. This implies a large shopping rate. However, the premium is maintained at a level that doesn't dramatically damage customers retention
- For next renewals, the premium evolution is less aggressive, resulting in a lower shopping rate, and a higher margin

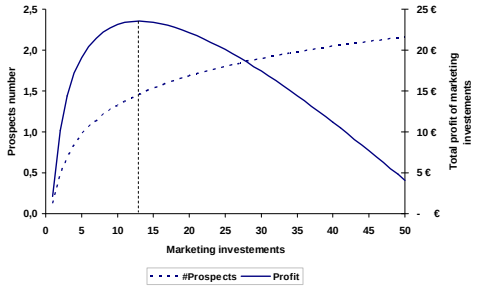


NB premium	401 €
Conv. Rate	10 %
PV*	20 €
NBV*	200 €

12

LTPR optimization
Prospecting decisions through the underwriting cycles

- PV can be interpreted as the maximum amount the insurer must invest to attract a new prospect
- Modeling the prospects number with respect to marketing budget allows the insurer to determine the optimal amount to invest in prospecting campaigns
  - In the following figure, the prospects number varies logarithmically with respect to marketing investments. With Customer Value equal to 25€, the optimal marketing investment is 13M€.



LTPR optimization
Prospecting decisions through the underwriting cycles

- Obviously, the optimal prospecting investment increases when marketing campaigns attract more prospects
- The optimal marketing investment increases as Customer Value increases
  - Figure 2 shows the optimum marketing investments with respect to two different Customer Values (25€ vs. 30€)

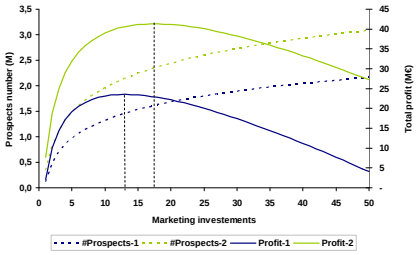


Figure 1

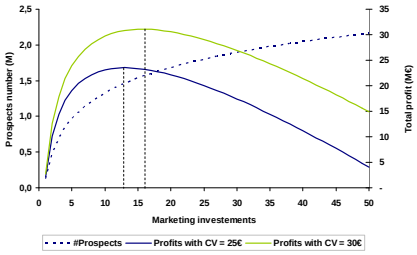
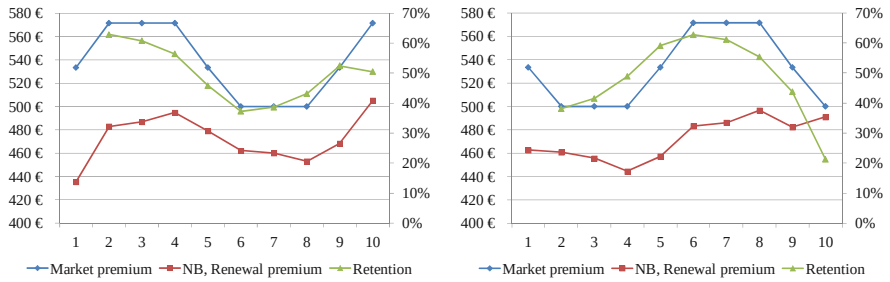


Figure 2

- Hence, the insurance company can adapt its prospecting decisions as Customer Value varies through the underwriting cycles

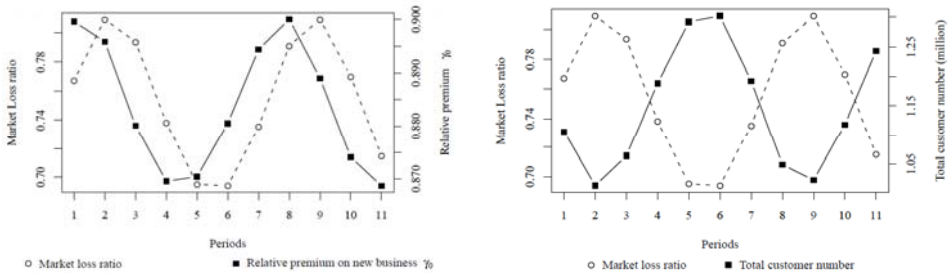
Pricing through underwriting cycles

- The following example shows that the NB premium must account for the future states of the cycle.
- Every thing else being equal, the insurer must be more competitive before the high period of the insurance cycle.



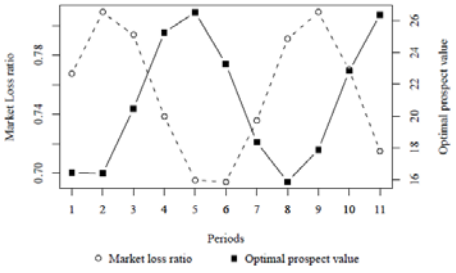
Pricing through underwriting cycles

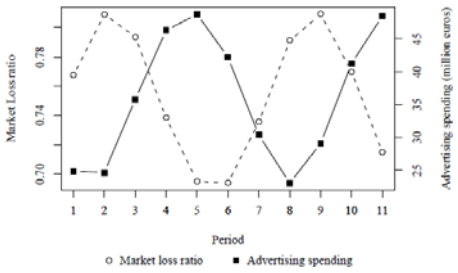
- The optimal price set at each period must account for the maximum value that can be created in the future. Consequently, the insurer's price positioning must anticipate the fluctuations of the market loss ratio:
  - The insurer must give priority to growth before the hard (profitable) phase of the cycle by setting competitive prices on new business.
  - Conversely, he must set less competitive prices before the soft phase of the cycle since the expected value that can be created during this phase is lower.



Pricing through underwriting cycles

- Advertising spending at each period must be defined conditionally to the optimal prospect value: all else being equal, more advertising spending must be invested during periods that feature a high prospect value.





17

Pricing through underwriting cycles

- Learning vs. Earning dilemma: the estimation of price elasticity is quite challenging without price experimentation
- More effort should be devoted to predicting the insurance cycle
- The model must account for the competitors pricing strategies: what if competitors follow the same pricing strategy? What will the market equilibrium be like?
- The model could be extended to a stochastic framework in order to take into consideration the uncertainty of its components
- For operational and concrete managerial conclusions, we need to include some global constraints (e.g. targets in terms of GWP or profits)

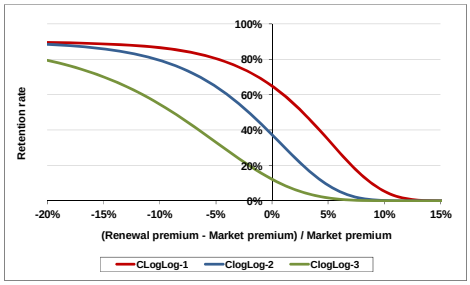
18

Advanced Pricing: Techniques and Strategy

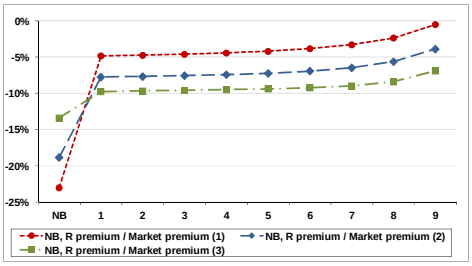
Thank you !

Appendix 1 – Sensitivity tests
Price sensitivity

- The optimal value decreases as price sensitivity increases



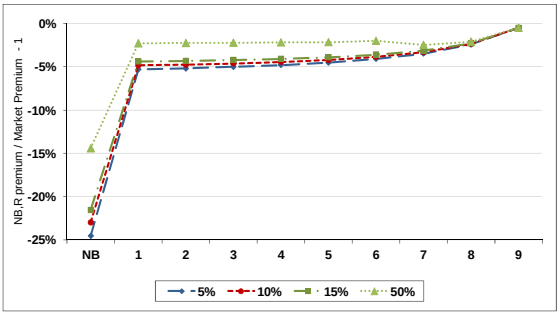
Retention function	NB premium	Conv. rate	PV*	NBV*
CLogLog-1	407 €	10 %	10 €	104 €
CLogLog-2	430 €	7 %	6 €	75 €
CLogLog-3	460 €	5 %	3 €	56 €



Appendix 1 – Sensitivity tests
Price insensitive lapse rate

- Improving the price insensitive lapse rate can provide an important leverage for value creation

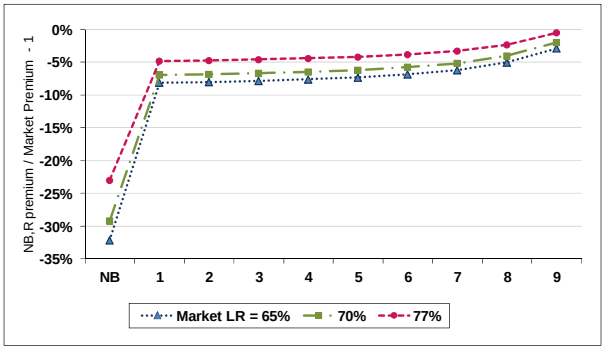
Price insensitive lapse rate	NB premium	Conv. rate	PV*	NBV*
5%	399 €	10%	12 €	120 €
10%	407 €	10%	10 €	104 €
15%	415 €	9%	8 €	92 €
50%	452 €	5%	3 €	58 €
100%	480 €	3%	1 €	48 €



Appendix 1 – Sensitivity tests
Market LR

- The market LR has an evident impact on the optimal value

Market LR	NB premium	Conv. rate	PV*	NBV*
65%	425 €	13%	42 €	323 €
70%	411 €	12%	26 €	213 €
77%	407 €	10%	10 €	104 €



Appendix 1 – Sensitivity tests
Residual value

- Increasing the time horizon doesn't affect significantly the NB optimal premium, nor the optimal value

#periods	NB premium	Conv. rate	PV*	NBV*
1	407 €	10%	10 €	103 €
2	407 €	10%	10 €	104 €
3	406 €	10%	10 €	105 €
5	406 €	10%	10 €	106 €
10	405 €	10%	10 €	107 €
40	405 €	10%	10 €	107 €