Measuring the Value of Risk Classification in a Dynamic Marketplace

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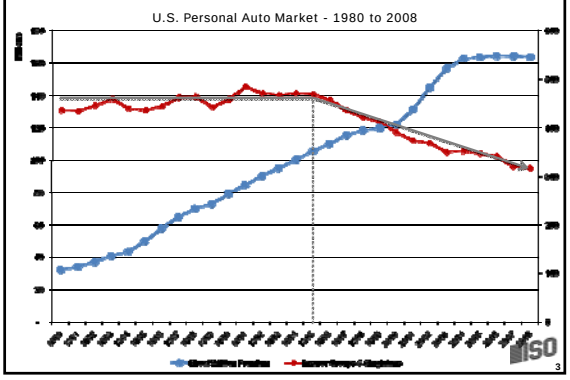
Overview

- Some macro indicators of economic value of risk classification
- Recognizing marketplace realities in measuring value
- A multi-year Net Present Value framework for model evaluation
- Some observations about model lift comparisons

Premium Dollars vs Number of Companies



80/20 Rule in this auto market

Lessons Learned

- **Looking Backward**
  - Pricing strategy was key driver for market success
  - Early adopters gained significant competitive advantage
  - Evidence of varying risk tolerances among insurers
- **Looking Forward**
  - Competitive pressures continue to mount
  - Pricing methodologies and data resources are evolving rapidly
  - Significant risk for underperforming strategies

Our Challenge

- **Enhanced rate segmentation can add significant value**

BUT

- **Increased segmentation has a cost**
- **How do we evaluate the value vs. cost?**
- **How do we make the case to decision makers?**

How Some Actuaries Make the Case to Increase Segmentation

We need to enhance our analytics in order to maintain our competitive pricing advantage!

I don't want to lose our pricing advantage. How much will it cost to implement an enhanced pricing strategy?

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7

How Some Actuaries Make the Case to Increase Segmentation

It will cost $10 million to modify our underwriting and agency systems.

That's a lot of money to spend! How much additional revenue will we bring in?

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How Some Actuaries Make the Case to Increase Segmentation

We will implement the new rate structure so that it will be revenue neutral.

You want me to spend $10 million to get NO additional revenue? That doesn't make any sense!

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9

How Some Actuaries Make the Case to Increase Segmentation

Why doesn't he understand how important this pricing strategy is to our business?

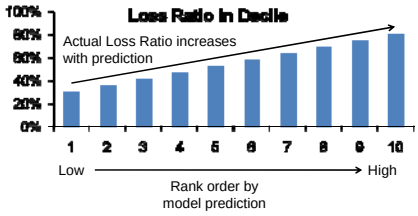
Where can I find an actuary with some business sense?

Measuring the Value of Rate Segmentation

- Measuring "Lift"
- Value-based measures
- Comparing Costs to Benefits

What do we mean by "Lift"

- Accuracy of prediction
- Relative to current prediction (sometimes)

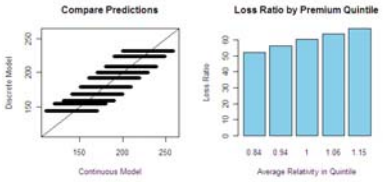


Measuring Lift

- **Usually involves some sort of data summarization**
  - Helps to remove noise from the data
- **Measure against a hold out data set**
  - Helps avoid overfitting the data
- **"Lift" is not the same as "Goodness of Fit"**
  - Fitting the data is not as important as predicting the mean accurately

Fit vs. Lift – An Example

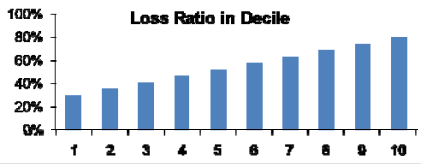
- **Two different class plans**
  - Continuous Model is much more accurate and shows lift over Discrete Model



- **Deviance measure improves only 0.1%**

Typical Lift Measures

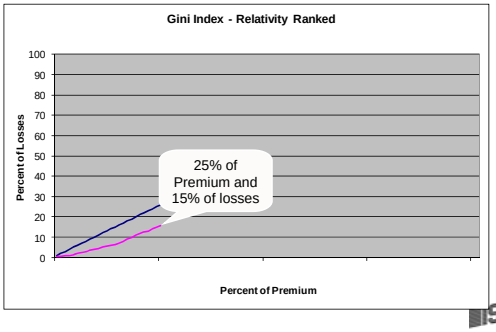
- **Prediction Mean Square Error**
  - Error is going to be high on individual losses, but directionally correct
- **Lift Chart "Top to Bottom" Ratio**
  - Ignores lift in the middle



Gini Index

- Measures accuracy of rank ordering
- Directly considers entire range of predictions
- Can be used to compare different predictions

Drawing the Lorenz Curve



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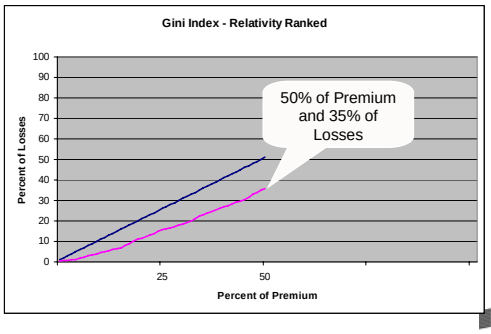

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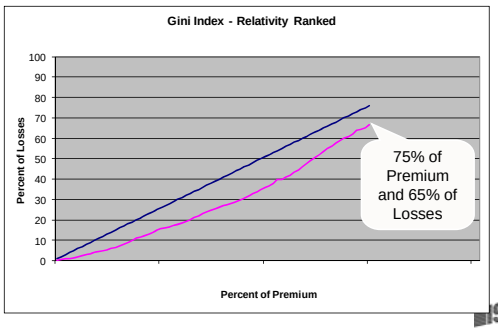

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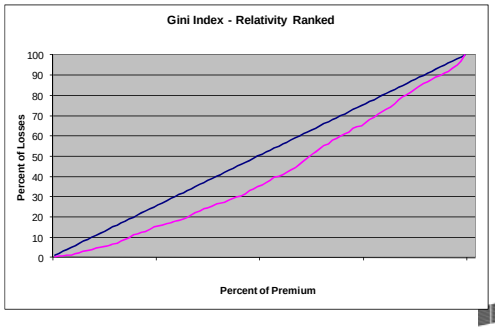
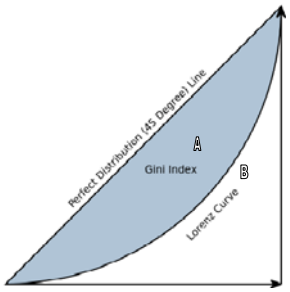


Lorenz Curve and Gini Index



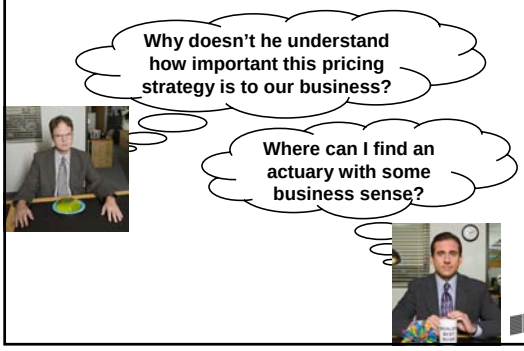
More about Gini Index

- **Can perform statistical tests using Gini index**
  - Identify significant improvements in rank orderings
- **Reference:**
  - Working paper available on Jed Frees' website (University of Wisconsin)
  - "Summarizing Insurance Scores using Gini Index"

Demonstrating Value

- **So far, all measures have dealt with statistical value**
  - Basis for model building decisions
- **Need to introduce a framework to measure economic value**
  - Basis for model implementation decisions

How Some Actuaries Make the Case to Increase Segmentation



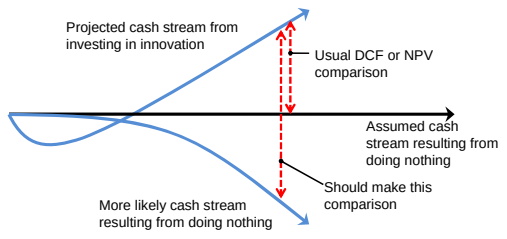
What's wrong with this dialog?

- **Focus only on implementation costs**
  - In a competitive marketplace, there is a cost to doing nothing
  - Lost business, lost revenue, and increasing cost of remaining policies
- **Short-term view of revenue impact**
  - "Revenue Neutral" applies only to average premiums on current book
  - There can be long-term revenue impacts

How to make the case better

- **Better projections of revenue and profit impacts**
  - Look beyond "Revenue Neutral" implementation
- **Better consideration of marketplace dynamics**
  - Includes customer retention and competitive effects
- **Demonstrate the value in monetary terms**

The Discounted Cash Flow Trap



Source: Christensen, Kaufmann, Shih, "Innovation Killers: How Financial Tools Destroy Your Capacity to Do New Things", Harvard Business Review, Jan 2008

Illustration

- Two insurers write 3 policies each
- Laggard Insurance prices all policies in same class
- Luminary Mutual uses more accurate segmentation
- Both companies have same profit provisions (10% of premium)

Reference: Cummings, "The Business Impact of Advanced Analytics", Contingencies, Nov/Dec 2009, pp 46-51.

Illustration – Initial State

Laggard Insurance

Actual Expected Cost	Policy Premium	Profit
$600	$880	$280
$800	$880	$80
$1,000	$880	-$120
	Total	**$240**

Luminary Mutual

Actual Expected Cost	Policy Premium	Profit
$600	$660	$60
$800	$880	$80
$1,000	$1,100	$100
	Total	**$240**

Illustration – After Year 1

Laggard Insurance

Actual Expected Cost	Policy Premium	Profit
$800	$880	$80
$1,000	$880	-$120
$1,000	$880	-$120
	Total	**-$160**

Luminary Mutual

Actual Expected Cost	Policy Premium	Profit
$600	$660	$60
$600	$660	$60
$800	$880	$80
	Total	**$200**

Value of Lift (VoL)

- **Assume a competitor comes in and takes away the above average risks.**
- **Because of adverse selection, the new loss ratio will be higher than the current loss ratio.**
- ***What is the value of avoiding this fate?***
  - $400 in this illustration ($240 expected profit vs. $160 loss)
  - Insurer could have spent additional $400 for segmentation and been no worse off
- **May express the VoL as a $ per car year.**
  - $133 per policy

Illustration – After Year 1

Laggard Insurance

Actual Expected Cost	Policy Premium	Profit
$800	$880	$80
$1,000	$880	-$120
$1,000	$880	-$120
	Total	**-$160**

Luminary Mutual

Actual Expected Cost	Policy Premium	Profit
$600	$660	$60
$600	$660	$60
$800	$880	$80
	Total	**$200**

New Policy Premium = $1,027

Illustration – After Year 2

Laggard Insurance

Actual Expected Cost	Policy Premium	Profit
$1,000	$1,027	$27
$1,000	$1,027	$27
	Total	**$54**

Luminary Mutual

Actual Expected Cost	Policy Premium	Profit
$600	$660	$60
$600	$660	$60
$800	$880	$80
$800	$880	$80
	Total	**$280**

New Policy Premium = $1,100

Illustration – After Year 3

Laggard Insurance

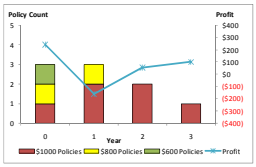
Actual Expected Cost	Policy Premium	Profit
$1,000	$1,100	$100
	Total	**$100**

Luminary Mutual

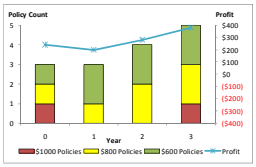
Actual Expected Cost	Policy Premium	Profit
$600	$660	$60
$600	$660	$60
$800	$880	$80
$800	$880	$80
$1,000	$1,100	$100
	Total	**$380**

Illustration Summary

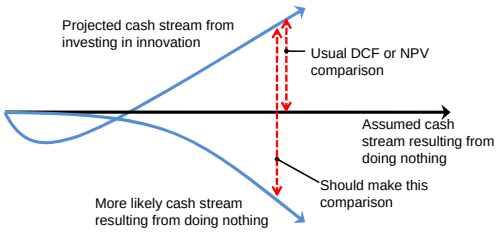
Laggard Insurance



Luminary Mutual



The Discounted Cash Flow Trap



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Calculating NPV

Laggard Insurance
"Do Nothing"

Year	Profit
0	$240
1	-$160
2	$54
3	$100
NPV	**$207**

Luminary Mutual
"Invest in Segmentation"

Year	Profit
0	$240
1	$200
2	$280
3	$380
NPV	**$875**

NPV Calculated using a 15% Discount Rate

Calculating NPV – Considering Marginal Costs

Laggard Insurance
"Do Nothing"

Year	Profit
0	$240
1	-$160
2	$54
3	$100
NPV	**$207**

Luminary Mutual
"Invest in Segmentation"

Year	Profit	Marginal Costs	Net Profit
0	$240	$100	$140
1	$200	$20	$180
2	$280	$25	$255
3	$380	$25	$355
		NPV	**$723**

NPV of "Status Quo" Scenario = $788

NPV Calculated using a 15% Discount Rate

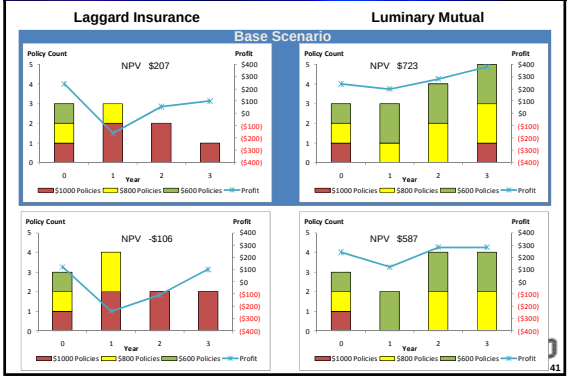
Impact of Pricing Strategy

- **Assessing the value of a pricing strategy**
  - Requires understanding of marketplace dynamics
  - Requires projections of revenue, retention, and conversion effects
- **Basis of comparison is not "status quo"**
  - Project the "do nothing" scenario appropriately

Relaxing the Assumptions

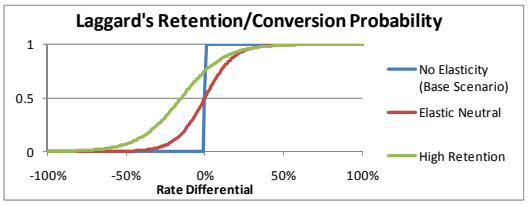
- **Pricing**
  - What if Laggard tried to compete by lowering profit expectations?
- **New Scenario**
  - Laggard uses 5% profit provision
  - Luminary keeps 10% profit provision

Competing on Profit Provision

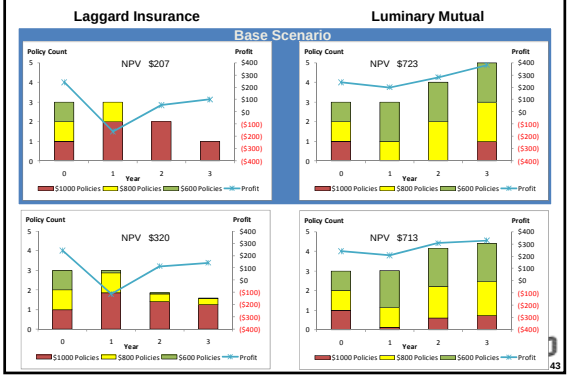


Relaxing the Assumptions

- **Retention/Conversion**
  - Assume some policies will stay with current insurer despite price differences

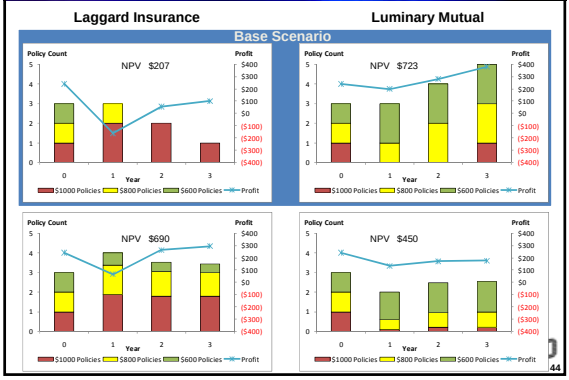


Neutral Price Elasticity



43

High Retention Price Elasticity



44

Further Extensions

- **Include multiple entities**
- **Refinement of conversion/retention effects in a competitive marketplace**
- **More sophisticated pricing implementation strategies**
- **Projections are inherently uncertain**
  - Use stochastic simulation to project future scenarios under uncertainty
  - Connection with Strategic Risk Management

45

Questions?

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