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33rd ANNUAL GIRO CONVENTION
Data Quality Working Party Report

Hilton Vienna Hotel, Am Stadtpark

Data Quality Working Party Members

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Agenda

- Literature Review
- Horror Stories
- Survey
- Experiment
- Actions
- Questions
- Concluding Remarks

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Literature Review

Data quality is maintained and improved by good data management practices. While the vast majority of the literature is directed towards the I.T. industry, the paper highlights the following more actuary- or insurance-specific information:

- Actuarial Standard of Practice (ASOP) #23: Data Quality
- Casualty Actuarial Society White Paper on Data Quality
- Insurance Data Management Association (IDMA)
- Data Management Educational Materials Working Party

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Actuarial Standard of Practice (ASOP) #23

- The American standard for all practice areas developed by the Actuarial Standards Board
- Provides descriptive standards for:
  - selecting data,
  - relying on data supplied by others,
  - reviewing and using data, and
  - making disclosures about data quality
- http://www.actuarialstandardsboard.org/pdf/asops/asop023_097.pdf

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CAS White Paper on Data Quality

- Developed by the Casualty Actuarial Society's Committee on Management Data and Information
- Provides guidelines to satisfy ASOP 23
- Says evaluating data quality involves examining the data for validity, accuracy, reasonability and completeness
- Describes a system of standardised procedures to insure the integrity of statistical data for personal automobile
- http://www.casact.org/pubs/forum/97wforum/97wf145.pdf

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Insurance Data Management Association

- The IDMA is an American organisation which promotes professionalism in the Data Management discipline through education, certification and discussion forums
- The IDMA web site:
  - Suggests publications on data quality,
  - Describes a data certification model, and
  - Contains Data Management Value Propositions which document the value to various insurance industry stakeholders of investing in data quality
- http://www.idma.org

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CAS Data Management Educational Materials Working Party

- Reviewing a shortlist of texts recommended by the IDMA for actuaries (9 in total)
- Publishing a review of each text in the CAS *Actuarial Review* (starting with the current (August) issue)
- Writing a paper to synthesise the readings into an actuarial introduction to data management
- The paper should be published in the Winter 2007 CAS *Forum*
- Both the reviews and the final paper will be available through www.casact.org

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Literature Review Summary

- Standards are generally prescriptive but descriptive information is available
- www.idma.org and www.casact.org are good sources for more information, containing papers and other information in addition to those reviewed in the paper
- Look for an introductory overview paper to be published in the Winter 2007 CAS *Forum*

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Horror Stories – Non-Insurance

- Heart-and-Lung Transplant – wrong blood type
- Bombing of Chinese Embassy in Belgrade
- Mars Orbiter – confusion between imperial and metric units
- Fidelity Mutual Fund – withdrawal of dividend
- Porter County, Illinois – Tax Bill and Budget Shortfall

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Horror Stories - Reserving

- NAIC concerns over non-US country data
- Canadian federal regulator uncovered:
  - Inaccurate accident year allocation
  - Double-counted IBNR
  - Claims notified but not properly recorded
- Former US regulator – requirement for reconciliation exhibits in actuarial opinions motivated by belief that inaccurate data being used.

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Horror Stories – Rating/Pricing

- Examples faced by ISO:
  - Exposure recorded in units of $10,000 instead of $1,000
  - Large insurer reporting personal auto data as miscellaneous and hence missed from ratemaking calculations
  - One company reporting all its Florida property losses as fire (including hurricane years)
  - Mismatched coding for policy and claims data

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Horror Stories - Katrina

- US Weather models underestimated costs Katrina by approx. 50% (Westfall, 2005)
- 2004 RMS study highlighted exposure data that was:
  - Out-of-date
  - Incomplete
  - Mis-coded
- Many flood victims had no flood insurance after being told by agents that they were not in flood risk areas.

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Survey

- Purpose: Assess the impact of data quality issues on the work of general insurance actuaries
- 2 questions:
  - percentage of time spent on data quality issues
  - proportion of projects adversely affected by such issues

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Targeted Approach to Distribution

- Members of the Working Party
- Members of CAS Committee on Management Data and Information
- Members of CAS Data Management and Information Educational Materials Working Party
- Members of the Working Party each personally contacted a handful of additional people

This resulted in 38 responses

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Results - Percentage of Time

Employer	No	Mean	Median	Min	Max
Insurer/Reinsurer	17	26.4%	25.0%	5.0%	50.0%
Consultancy	13	27.1%	25.0%	7.5%	60.0%
Other	8	23.4%	12.5%	2.0%	75.0%
All	***38***	***26.0%***	***25.0%***	***2.0%***	***75.0%***

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Results - Percentage of Projects

Employer	No	Mean	Median	Min	Max
Insurer/Reinsurer	15	27.9%	20.0%	5.0%	60.0%
Consultancy	13	43.3%	35.0%	10.0%	100.0%
Other	8	22.6%	20.0%	1.0%	50.0%
All	***36***	***32.3%***	***30.0%***	***1.0%***	***100.0%***

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Survey Conclusions

- Data quality issues have a significant impact on the work of general insurance actuaries
  - about a quarter of their time is spent on such issues
  - about a third of projects are adversely affected
- The impact varies widely between different actuaries, even those working in similar organisations
- Limited evidence to suggest that the impact is more significant for consultants

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Hypothesis

Uncertainty of actuarial estimates of ultimate incurred losses based on poor data is significantly greater than that of good data

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Data Quality Experiment

- Examine the impact of incomplete and/or erroneous data on actuarial estimate of ultimate losses and the loss reserves
- Use real data with simulated limitations and/or errors and observe the potential error in the actuarial estimates

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Data Used in Experiment

- Real data for primary private passenger bodily injury liability business for a single no-fault state
- Eighteen (18) accident years of fully developed data; thus, true ultimate losses are known

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Actuarial Methods Used

- Paid chain ladder models
- Incurred chain ladder models
- Frequency-severity models

- Inverse power curve for tail factors

- No judgment used in applying methods

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Three Experiments

1. Vary size of the sample; that is,
    1) All years
    2) Use only 7 accident years
    3) Use only last 3 diagonals

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Three Experiments

2. Simulated data quality issues
    1. Misclassification of losses by accident year
    2. Early years not available
    3. Late processing of financial information
    4. Paid losses replaced by crude estimates
    5. Overstatements followed by corrections in following period
    6. Definition of reported claims changed

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Three Experiments

3. Bootstrapping

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Results – Experiment 1

- More data generally reduces the volatility of the estimation errors

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Results – Experiment 2

- Extreme volatility, especially those based on paid data
- Actuaries ability to recognise and account for data quality issues is critical
- Actuarial adjustments to the data may never fully correct for data quality issues

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Results – Experiment 3

- Less dispersion in results for error free data
- Standard deviation of estimated ultimate losses greater for the modified data (data with errors)
- Confirms original hypothesis

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Conclusions Resulting from Experiment

- Greater accuracy and less variability in actuarial estimates when:
  - Quality data used
  - Greater number of accident years used
- Data quality issues can erode or even reverse the gains of increased volumes of data:
  - If errors are significant, more data may worsen estimates due to the propagation of errors for certain projection methods
- Significant uncertainty in results when:
  - Data is incomplete
  - Data has errors

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Actions

- Data Quality Advocacy
- Data Quality Measurement
- Management Issues
- Screening Data

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Data Quality Advocacy - Examples

- The Casualty Actuarial Society:
  - The Data Management and Information Education Materials Working Party
- The Insurance Data Management Association is an excellent source of information on insurance data quality
  - The IDMA web site www.idma.org
  - The IDMA also sponsors an annual conference where data quality is typically a topic on the schedule and its web site contains suggested readings on data quality
  - The CAS and IDMA jointly sponsor a Data Quality/Data Technology call paper program every two years. Authors have submitted and published papers focusing on data quality.

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Data Quality Measurement Ideas

- Quantify traditional aspects of quality data such as accuracy, consistency, uniqueness, timeliness and completeness using a score assigned by an expert
- Measure the consequences of data quality problems
  - measure the number of times in a sample that data quality errors cause errors in analyses, and
  - the severity of those errors
- Use measurement to motivate improvement

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Management Issues

- Redman : Manage Information Chain
  - establish management responsibilities
  - describe information chart
  - understand customer needs
  - establish measurement system
  - establish control and check performance
  - identify improvement opportunities
  - make improvements

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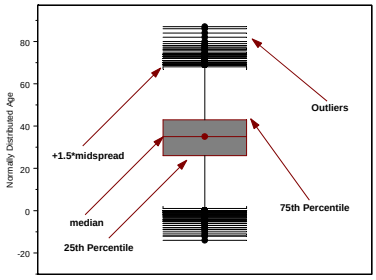
Screening Data – Graphical Displays



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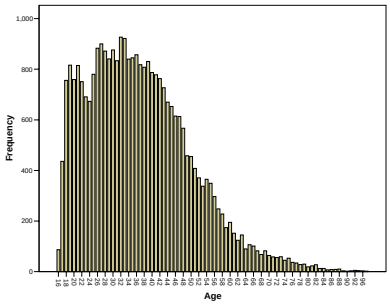

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Screening Data - Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
License Year	*30,250*	*490*	*2,049*	*1,990*	*16.3*
Valid N	*30,250*				

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Multivariate Methods

$$\mathbf{MD} = (\mathbf{x} - \boldsymbol{\mu})' \boldsymbol{\Sigma}^{-1} (\mathbf{x} - \boldsymbol{\mu})$$

$\mathbf{x}$ is a vector of variables

$\boldsymbol{\mu}$ is a vector of means

$\boldsymbol{\Sigma}$ is a variance-covariance matrix

MD is Mahalanobis Distance

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Conclusions

- Data quality issues significantly impact the work of general insurance actuaries; and
- Such issues could have a material impact on the results of general insurance companies

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Concluding Remarks

The Working Party believes that insurers should devote more time and resources to increasing the accuracy and completeness of their data by improving their practices for collecting and handling data. In particular, insurers would benefit from the investment of increased senior management time in this area. By taking such action, they could improve both their profitability and their efficiency.

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