

October 29, 2008

**Information Paper
for
CAS Board of Directors**

Subject: Annual Research Report

Responsible Officer: Roger Hayne

1. Background

The Board of Directors receives an annual report on CAS research activities at its November meeting.

2. Information

The 2008 Report is attached. The report consists of two components:

A. Overview and Status of 2008 CAS Research Activities

Details on CAS research projects are provided in this attachment, organized by topic.

B. CAS Research Commitments and Expenditures (2003-2009)

This document summarizes the annual funding commitments to research projects and call paper programs.

Annual CAS Research Report for 2008

Overview

Specific research achievements are detailed starting on page two. New call paper programs, request for proposals, working party initiatives and individual grant-winning papers were all commenced in 2008. Other less tangible initiatives are detailed below.

Improving communication, both internally and externally, was one important aspect of the Research department throughout 2008. A quarterly newsletter was developed that summarizes major projects of each committee. This helps to keep the committees abreast on what's going on and offers opportunities to learn from and perhaps coordinate with other research. It also serves as a forum for the Vice President to convey any other pertinent information. Similarly, there were two in-person Chairs meetings for the Research Chairs to discuss goals of the year. The Leadership Meeting in April had a break-out session just for the Research Committee Chairs while the Joint Meeting of the Research Chairs & Professional Education Chairs in September enabled the Committee Chairs to meet in person once again and also meet with the Professional Education Chairs to talk about how the two departments can work together. Overall, due to the development of the Professional Education department at CAS, there is more continuity between these two departments. Session requests come regularly to the Research Chairs from the Seminar and Meeting Planning Committees directly. Also, many of the Research Committees have liaisons that fill spots on the Seminar & Meeting Planning Committees to help plan sessions. Another communication initiative is in marketing research opportunities from non-CAS organizations. This has stepped up in the past year, with CAS announcing Calls for Papers for the 2009 IAA AFIR / LIFE Colloquium, the 2009 Bowles Symposium, the Risk Theory Society of ARIA, ASTIN, and the 2009 Enterprise Risk Management Symposium. Finally, some committees have worked on creating wikis, which allow for collaboration and sharing of information on the Web.

International cooperation was a focus in 2007 and continued to be more of a focus in 2008 and also is a focus in 2009. The Reserving Methods Survey is a good example of taking research conducted internationally and modifying it for a U.S. audience. This survey was previously conducted by the Institute of Actuaries in the UK and in Australia and their input was helpful in writing the U.S. survey. There have also been a great number of authors from foreign countries submit papers to the CAS, both in *Variance* and in the Call Paper programs. Additionally, committees and working parties are including participants from outside North America, while CAS members are also participating in international organizations. Finally, even the internal CAS R&D newsletter is distributed to the international community. Going forward, one goal of the Research Department is to increase access to international publications, both through links on the Web site and the addition of international journals to the Database of Actuarial Research (DARE). With this increased access to international research, our members should have more opportunities to aid and share in this research.

Status of 2008 CAS Research Activities Research Projects by Topic

1. Enterprise Risk Management

a. Project: 2008 Call for ERM Papers

Date Announced/Completed: Call for Papers announced in August 2007

Project Oversight Group: Ad Hoc Group consisting of representatives of the ERM Symposium sponsors as well as The Actuarial Foundation, the PRMIA Institute and the Enterprise Risk Management Institute International (ERMII).

Contact: Steven Siegel, Research Actuary, Society of Actuaries

Purpose/Topic: Analysis and Tools to Quantify Financial and Operational Risks Including Their Interaction.

Funding: The Joint CAS/CIA/SOA Risk Management Section Award for Practical Risk Management Applications includes a monetary prize of \$3,000.

Seminar/Meeting Presentations: 2008 ERM Symposium, April 2008, Chicago.

Publication: Papers are available on the ERM Web Site (linked from CAS Web Site).

Status: 65 abstracts were submitted for review. 26 papers were written and are available on the ERM Web site. 9 papers were presented at the ERM Symposium. The winner of the Joint CAS/CIA/SOA Risk Management Section Award for Practical Risk Management Applications was Donald Pagach and Richard Warr for their paper, "An Empirical Investigation of the Characteristics of Firms Adopting Enterprise Risk Management."

b. Project: 2009 ERM Call for Papers

Date Announced/Completed: Call for Papers announced in August 2008

Project Oversight Group: Ad Hoc Group consisting of representatives of the ERM Symposium sponsors as well as The Actuarial Foundation, the PRMIA Institute and the Enterprise Risk Management Institute International (ERMII).

Contact: Steven Siegel, Research Actuary, Society of Actuaries

Purpose/Topic: Analysis and Tools to Quantify Financial and Operational Risks Including Their Interaction.

Funding: The Joint CAS/CIA/SOA Risk Management Section Award for Practical Risk Management Applications includes a monetary prize of \$3,000.

Seminar/Meeting Presentations: 2009 ERM Symposium, April-May 2009, Chicago.

Publication: Papers will be available from the ERM Web Site (linked from CAS Web Site).

Status: Deadline for proposals was October 17, 2008

c. Project: Robust & Efficient Methods for Quantitative Risk Management

Date Announced/Completed: Funding was awarded in February 2008.

Researcher(s): Vytautas Brazauskas, University of Wisconsin-Milwaukee

Topic: To discover if more sophisticated risk segmentation methods help to improve underwriting policy, pricing accuracy, and profitability. The methods proposed in this project will estimate the threshold from the data and by doing so will reduce the subjectivity of the risk measuring process.

Funding: \$23,000 (split between CAS, The Actuarial Foundation and the SOA's Committee on Knowledge Extension Research)

Status: The paper is in progress. The author has received the first allotment of the payment, due when a signed copy of the agreement was made, and the second allotment of the payment, due when the paper was submitted to the *North American Actuarial Journal*. When and if his paper is accepted and published by the *North American Actuarial Journal*, he will receive his final payment.

2. Dynamic Risk Modeling

a. Project: Dynamic Risk Modeling Handbook Working Party

Date Announced: Announced in August 2004

Project Oversight Group: Dynamic Risk Modeling Committee

Chairpersons: Jim Rech and Run Yan

Purpose/Topic: This Working Party is focused on rewriting the Dynamic Financial Analysis Handbook. The current draft of the Handbook is available on the Dynamic Risk Modeling Committee Web Site. The revised (and renamed) Dynamic Risk Modeling Handbook is intended to provide a basic understanding and practical guidelines for the development and implementation of dynamic risk models common to the property and casualty insurance industry. In addition, it is hoped that this Handbook will become a basic reference source for the educational needs of future modelers and the practical day-to-day application needs of experienced practitioners.

Presentations of Interim Reports: 2005 Annual Meeting, 2006 CLRS, 2007 Spring Meeting

Presentation of Final Results: TBD

Publication: Draft chapters of the updated Handbook are available via the DRM Web page on the CAS Web Site.

Status: Chapters 1-5, 8, 9 and 10 are completed and the Working Party has disbanded. The DRM Committee has discussed a possible RFP for completion of Chapters 6 and 7.

b. Project: Public-Access DFA Model Working Party

Date Announced/Completed: Announced in August 2004

Project Oversight Group: Dynamic Risk Modeling Committee

Chairpersons: Morgan Bugbee and Patrick Crowe

Purpose/Topic: This working party has two charges. First, the working party will make short-term updates and enhancements to the public-access DFA model. Second, the working party will develop a plan for possibly ultimately evolving this model into an open-source framework. In this format, it is envisioned that the model would be posted on the CAS Web Site, and CAS members or others could propose independent updates and enhancements to the model. The new version would be submitted to the Dynamic Risk Modeling Committee (DRMC) with a description of the updates; the DRMC would review the model and documentation and, if appropriate, post the new version on the CAS Web Site.

Presentations: 2005 Annual Meeting, 2006 CLRS, 2007 Spring Meeting, 2008 Spring Meeting

Publication: The DFA Model is available on the CAS Web Site

Status: The DFA Model is completed and the Working Party along with the Dynamic Risk Modeling Committee announced a Call for Papers. (See 2c for details)

c. Project: 2009 Dynamic Risk Modeling Call for Papers

Date Announced: September 2008

Project Oversight Group: Committee on Dynamic Risk Modeling and the Public-Access DFA Model Working Party

Contact: Patrick Crowe and Morgan Bugbee

Purpose/Topic: Participants are to use the completed Public-Access DFA Model to illustrate how the Dynamic Risk Modeling process can be applied to solve real world property and casualty insurance problems. Papers should describe the problem to be solved, the author's approach to using the DFA Model within the DRM process, and any suggested improvements. Participants are encouraged to make any additional enhancements. This is being done to foster the use of Dynamo 4 and to generate publicly available improvements to the model. Participants may submit either or both written papers and improvements via add-on programs/macros to Dynamo 4.

Funding: \$5,000 for the best submission(s)

Seminar/Meeting Presentations: Enterprise Risk Management Seminar, April 2010.

Publication: CAS *eForum* on the CAS Web site

Status: Work in progress. Proposals are due November 1, 2008.

d. Project: Loss Simulation Model Working Party

Date Announced/Completed: Announced in December 2005

Project Oversight Group: Committee on Dynamic Risk Modeling

Chairpersons: Mark Shapland and Robert Bear

Purpose/Topic: This Working Party will focus on creating a simulation model that will generate claims (both individually and in bulk) that can be summarized into loss development triangles and complete rectangles. The model will be able to generate triangles by layer, by different type of claim information (e.g., paid, incurred, Salv & Sub, exposures, claim counts, etc.), by hazard, by line of business, etc. One of the primary purposes for these simulated loss development triangles will be to test various loss development methods and models, including tail factor methods. The working party will not be focusing on actual testing of methods and models, but will focus on creating the simulated data sets for future research related to testing. Accordingly, a primary criterion for judging the quality of this model will be to evaluate the simulated data to make sure that it is realistic - i.e., it cannot be distinguished statistically from real data sets. Prior to setting up the model, the group will develop criteria for using simulated data for evaluating different methods and models in order to both provide initial guidance on how future research might proceed and to make sure that the model is sufficiently robust to support that testing.

Presentations: 2006 CLRS, 2007 Seminar on Reinsurance, 2007 Spring Meeting, 2007 CLRS, 2008 Spring Meeting, 2008 CLRS.

Publication: The Simulator and related documents are available on the CAS Web Site.

Status: Work in progress. A simulation model prototype in the APL programming language has been created and an RFP has been issued to produce a public access loss simulation model in a free or inexpensive software environment such as Visual Basic, R or J. (See 2e for details)

e. Project: Request for Proposal Creation of Public Loss Simulation Model(s)

Date Announced: September 2008

Project Oversight Group: Committee on Dynamic Risk Modeling and the Loss Simulation Model Working Party

Contact: Robert Bear

Purpose/Topic: The Loss Simulation Model Working Party has created a simulation model prototype in the APL programming language, but has not been able to make significant progress using other languages such as Visual Basic, R or J. While the current APL prototype works as it was intended, the programming language is not readily conducive to other educational and research opportunities compared to other languages. For example, using Visual Basic it is anticipated that most actuaries would be able to readily view, understand and learn from the code as well as be able to offer code to enhance the model. The Committee on Dynamic Risk Modeling requests proposals from qualified developers to produce a public access loss simulation model in a free or inexpensive software environment such as Visual Basic, R or J. The open source loss simulation model will be available to all CAS members along with the APL prototype now available on the CAS web site at www.casact.org/research/lsmwp. The model will include the basic features in the prototype as well as additional features approved by the CAS after reviewing cost estimates. (This web site includes a seminar presenting a progress report, components of an eventual Working Party paper, APL loss simulation model source and run time programs along with program instructions.) Appendix A to this RFP summarizes basic features of the APL Prototype, while Appendix B summarizes additional features that could be included in the scope of the project if the CAS agrees based upon cost estimates. Appendix C summarizes initial LSMWP work in developing a model in Visual Basic that will be at the disposal of the responders to this proposal.

Funding: Maximum \$25,000

Publications: CAS Web Site, possible submission to the CAS *eForum*.

Status: Work in progress.

f. Project: Estimating Allocated Capital using the Bootstrap

Date Announced/Completed: Funding was awarded in February 2008.

Researcher(s): Dr. Joseph Hyun-Tae Kim, University of Waterloo

Topic: Propose the use of the non-parametric bootstrap technique to estimate risk measures and simultaneously model dependency.

Funding: \$15,000 (split equally between CAS, The Actuarial Foundation and the SOA's Committee on Knowledge Extension Research)

Status: The paper is in progress. The author has received the first allotment of the payment, due when a signed copy of the agreement was made. Ultimately, the paper is expected to be submitted for publication to the *North American*

Actuarial Journal no later than November 30, 2008 and will receive the second payment at that time. When and if his paper is accepted and published by the *North American Actuarial Journal*, he will receive his final payment.

3. Reserves

a. Project: Bornhuetter-Ferguson-Initial Expected Losses Working Party

Date Announced/Completed: Announced in September 2004

Project Oversight Group: Committee on Reserves

Chairpersons: Chris Olson and Jeff Carlson

Purpose/Topic: The goal of this working party is to produce a paper regarding the initial expected loss assumption in the Bornhuetter-Ferguson reserving method. The working party is not expected to engage in primary research, but instead will leverage initial expected loss approaches already in use. With many competent actuaries using the Bornhuetter-Ferguson method, there are probably many very good initial expected loss approaches already in use, but not documented.

Presentations of Interim Reports: 2005 CLRS, 2005 Annual Meeting

Presentation of Final Results: TBD

Publication: TBD

Status: Work in progress.

b. Project: Tail Factors Working Party

Date Announced/Completed: Announced in September 2004

Project Oversight Group: Committee on Reserves

Chairpersons: Steve Herman and Mark Shapland

Purpose/Topic: Tail factors are widely used, have a huge impact on results, and yet there is minimal literature on the subject. The product of this working party will be a paper that will survey existing literature and then identify additional methods in use.

Presentations of Interim Reports: 2005 CLRS, 2005 Annual Meeting

Presentation of Final Results: 2007 CLRS

Publication: TBD

Status: Work in progress.

c. Project: Reserving Methods Survey

Date Announced/Completed: Survey written in August 2008, administered to membership in September 2008

Project Oversight Group: Committee on Reserves

Purpose/Topic: Based on similar surveys conducted in Australia and the UK, the survey was written to discover how practicing reserving actuaries are using various methods to do their work.

Presentations of Results: Results will be presented at the November 2008 Annual Meeting.

Publication: After the tabulation and presentation of the results, an accompanying paper might be written.

Status: The survey was open to members on the CAS Web site for approximately one month and about 200 responses were received. Results are being tabulated and a presentation written to be delivered at the 2008 Annual Meeting.

d. Project: 2008 Reserves Call for Papers

Date Announced: Announced in August 2007

Date Completed: September 2008

Project Oversight Group: Committee on Reserves

Contact: Tom Ryan and Gloria Huberman

Purpose/Topic: Papers were requested on the topics of: opinion issues; best estimates, variability, and ranges; methodologies; unique or changing exposures; and other matters affecting reserving.

Funding: A total fund of \$2,500 is available for the best papers submitted in response to the call, with \$1,500 awarded to the winner of the Ronald Bornhuetter Loss Reserve Prize.

Seminar/Meeting Presentations: CLRS, September 2008, Washington, DC

Publication: Papers were published in the 2008 Fall *eForum*. An executive summary of the papers will be published in the November 2008 issue of the *Actuarial Review*.

Status: 27 proposals for papers were submitted; 17 of those were turned into final papers and published in the *eForum*. 16 of the 17 papers were presented at the 2008 CLRS. The final paper will be presented at 2008 Annual Meeting. The Ronald Bornhuetter Loss Reserve Prize of \$1500 was presented to James Guszczka for his paper “Hierarchical Growth Curve Models for Loss Reserving,” while Dave Clark received \$500 in honorable mention prize money for his paper “Reserving with Incomplete Exposure Information.”

e. Project: Property-Liability Insurance Loss Reserve Ranges Based on Economic Value

Date Announced/Completed: Funding was awarded in February 2007

Researcher: Steve D’Arcy

Purpose: Demonstrate that insurers, rating agencies, regulators and financial analysts should focus on the economic value of loss reserves, not the nominal value, to measure the uncertainty inherent in the reserving process. Combine stochastic interest rate models with loss development simulation software to calculate path dependent values for loss reserves. Illustrate loss reserve ranges on both a nominal and economic value basis. Begin to convince the actuarial community that the economic value is the appropriate measure for calculating loss reserve ranges.

Funding: \$30,000 (\$20,000 from CAS and \$10,000 from The Actuarial Foundation).

Status: The completed research paper was submitted to *Variance* in October 2007 and is awaiting publication. When and if the paper is published in *Variance*, Mr. D’Arcy will receive his final payment. The researchers also prepared a version of this paper for the 2008 Committee on Reserves Call Paper Program and had it published in the Fall 2008 eForum. Additionally, the content of the paper was presented at the 2008 Spring Meeting and the 2008 Casualty Loss Reserve Seminar.

f. Project: Stochastic Claims Reserving: Micro Models for Run-Off, Incorporating Expert Opinion, and the Interaction with Extreme Value Methodology

Date Announced/Completed: Funding was awarded in February 2008.

Researcher(s): Katrien Antonio, Universiteit van Amsterdam

Topic: Put focus on the development of three issues in stochastic reserving: micro models for run off, incorporating expert opinion in reserving techniques and the interaction of reserving techniques with extreme value methodology.

Funding: \$7,500 (\$2,500 from CAS, \$2,500 from The Actuarial Foundation and \$2,500 from the SOA’s Committee on Knowledge Extension Research)

Status: The paper is in progress. The author has received the first allotment of the payment, due when a signed copy of the agreement was made. Ultimately, the paper is expected to be submitted for publication to either the *North American Actuarial Journal* or *Variance* no later than March 10, 2010.

4. Ratemaking

a. Project: 2009 Ratemaking Call for Papers

Date Announced/Completed: Announced in June 2007

Project Oversight Group: Committee on Ratemaking

Contact: John Lewandowski

Purpose/Topic: Papers were preferred that focused on the considerations listed in the CAS Statement of Principles Regarding Property and Casualty Insurance Ratemaking. In addition, other topics were welcomed, including expert underwriting systems, catastrophe ratemaking, scoring models, enterprise risk management, and specialty products.

Funding: \$2,500, for the best papers.

Seminar/Meeting Presentations: Ratemaking & Product Management Seminar, March 2009.

Publication: 2009 Winter *eForum* on the CAS Web Site.

Status: 20 proposals for papers were submitted; 12 final papers have been completed. The Committee is reviewing the final papers and will determine which are published, presented and recommended for a prize.

b. Project: Workers Compensation Ratemaking: A Textbook for the Practicing Actuary

Date Announced/Completed: Funding was awarded in July 2003.

Researcher: Sholom Feldblum

Project Oversight Group: Committee on Ratemaking, on behalf of AERF

Contact: David Smith

Purpose/Topic: To update the Feldblum Workers Compensation ratemaking textbook published in 1992. The textbook will serve an educational and reference role, and cover all aspects of ratemaking (the 1992 edition focused on classification ratemaking only).

Funding: \$16,000 (\$8,000 from CAS and \$8,000 from AERF)

Status: The draft textbook is too large to be reviewed by the two reviewers initially identified. The author is working with CAS staff to make the textbook available to a larger pool of reviewers. Completed chapters will be posted to a page on the CAS Web Site. There are 17 chapters of the textbook, plus student exercises. When all the chapters have been posted (three chapters are still under development), an announcement will be sent inviting members to review the textbook. The chapters that are completed can be found at the CAS website at the following link: <http://www.casact.org/library/wcratemaking/>.

c. Project: Theory, Methodology and Methods of Multivariate Conditional Density Estimation and its Application to the Analysis of a Credit Scoring as a Fair Rating Variable

Date Announced/Completed: Funding was awarded in February 2007

Researcher: Sam Efromovich

Purpose/Topic: To contribute to actuarial theory and practice with a method of evaluation of the conditional probability distribution of risks as a function of traditional actuarial variables and credit scoring. To contribute to changing current policy which will allow the insurance industry and politicians to evaluate the effect of a credit scoring policy on unfair discrimination, intentional discrimination and disproportionate impact

Funding: \$20,000 (\$10,000 from CAS and \$10,000 from The Actuarial Foundation)

Status: Mr. Efromovich has written his paper and submitted it to the *Journal of the American Statistical Association* and received his second allotment of money in June 2008. Per the Letter of Agreement, the planned completion date was September 1, 2008. When and if his paper is accepted by the *Journal of the American Statistical Association*, he will receive his final payment.

5. Data Management

a. Project: Data Management and Information Educational Materials Working Party

Date Announced: November 2005

Date Completed: December 2008

Project Oversight Group: Committee on Management Data and Information

Chairperson: Rob Campbell

Purpose/Topic: Actuarial work relies on data. As such, ensuring appropriate data quality and availability is the concern of every actuary. This working party will identify key educational resources on data issues for actuaries by reviewing the literature on the topic and publishing its findings. The work product is intended to educate students and help practitioners.

Presentations of Interim Reports: 2006 Annual Mtg, 2007 Ratemaking Seminar, 2007 CLRS, 2007 Predictive Modeling Seminar

Presentation of Final Results: 2008 IDMA Annual Mtg, 2008 Ratemaking Seminar, 2008 CLRS

Publication: Reviews of educational texts have been published in the August 2006, November 2006, February 2007, May 2007, August 2007, November 2007, February 2008, May 2008, and August 2008 issues of the *Actuarial Review*. A complete set of reviews was published in 2007 Winter *Forum* and on the CAS Web Site. The committee's completed paper, "Actuarial I.Q. (Information Quality)" was published in the Winter 2008 *eForum* and on the CAS Web site.

Status: The Working Party has presentations planned for the 2009 IDMA Annual Meeting and the 2009 RPM Seminar to wrap up its charge.

- b. Project: 2008 Call for Data Management/Data Quality/Data Technology Papers**
Date Announced: December 2006
Date Completed: March 2008
Project Oversight Group: Committee on Management Data and Information
Contact: Rudy Palenik
Purpose/Topic: The purpose of this program is to develop a source of literature on data topics important to casualty actuaries.
Funding: \$2,500 to the best papers
Seminar/Meeting Presentations: Ratemaking Seminar, March 2008, Boston.
Publication: Winter 2008 *CAS E-Forum* on the CAS Web Site.
Status: Four papers were published in the Winter 2008 *eForum*; all four papers were presented during the 2008 Ratemaking Seminar. \$2,500 was dispersed to the authors of the winning paper, “Dirty Data on Both Sides of the Pond.”

6. Reinsurance

- a. Project: 2009 Reinsurance Call for Papers**
Date Announced/Completed: Announced in August 2008
Project Oversight Group: Committee on Reinsurance Research
Contact: Gary Blumsohn
Purpose/Topic: The Committee welcomed all papers on Reinsurance topics. Areas related directly to topics of current interest were preferred: Sub-prime mortgage, moving towards International Accounting Standards, risk inflation, and risk transfer.
Funding: \$2,000 and the Reinsurance Prize are available for the best paper.
Seminar/Meeting Presentations: May 2009 Reinsurance Seminar
Publication: 2009 Spring *eForum* on the CAS Web Site.
Status: Work in progress. Six proposals have been submitted which the Committee is reviewing.
- b. Reinsurance Research Corner**
Hosted by the CAS Reinsurance Research Committee at the 2008 Seminar on Reinsurance, the Research Corner is a forum to present preliminary reports on works in progress or recently completed. Research Corner participants can pose new problems and demonstrate innovative practical approaches. Individual investigators as well as representatives of research working parties and other groups are encouraged to participate. Attendees who wanted to present their work during this session were invited to contact the moderator, Gary Blumsohn, Chair of the Committee on Reinsurance Research, but walk-ins were also welcome.
- c. Project: Optimal Layers for Excess Catastrophe Loss Reinsurance**
Date Announced/Completed: Funding was awarded in February 2008.
Researcher(s): Luyang Fu, State Auto Insurance
Topic: An improved method to determine the optimal reinsurance layer, based on data generated from ISO’s AIR catastrophe models.
Funding: \$9,600 (\$5,000 from CAS and \$4,600 from The Actuarial Foundation)
Status: The paper is in progress. The author has received the first allotment of the payment, due when a signed copy of the agreement was made. Ultimately, the paper is expected to be submitted for publication to *Variance* no later than December 18, 2008.

7. Risk Theory

a. Project: Data for Predictive Modeling Applications

Date Announced/Completed: Funding was approved in August 2006; project announced in December 2006 to no response and again in June 2007 to no response.

Project Oversight Group: Committee on Theory of Risk

Contact: Louise Francis

Purpose/Topic: Predictive modeling and data mining include a variety of techniques used by actuaries to predict outcomes of interest to insurance company managements such as claim frequency, claim severity and the likelihood that a claim is a fraud or abuse claim. Predictive modeling techniques are typically applied to large complex databases. The databases used for predictive modeling typically contain tens of thousands (and often millions) of records and hundreds of variables. However such large complex databases are not available publicly for use by academic researchers and members of the profession. The purpose of the project is to acquire a database that can be used by CAS members and others, such as members of the academic community, for predictive modeling research. Two key types of applications are underwriting applications using policyholder and claims databases and claims applications such as fraud prediction which may only use claims databases.

Funding: \$50,000 was committed for the project.

Status: The RFP was reissued in 2007, but there is still no interest.

b. COTOR Challenge

The Committee on Theory of Risk completed Round 5 of the COTOR Challenge, and solutions were presented at the 2008 Spring Meeting. In Round 5, claims were simulated for individual risks insured by a single entity within one line of business over the course of three years. In addition to the claim amount paid, each claim showed which risk incurred the loss, the MSA in which the claim occurred, and the year in which the claim occurred. With some information provided about the underlying distribution, the challenge was to estimate the expected number of claims that will be paid in the upcoming year; then place 95 percent confidence and prediction intervals about your estimate.

Winners were selected by a committee of COTOR members. Criteria included accuracy of estimates, use of interesting and innovative approaches, clarity of the description, as well as ease of use of the approach.

c. Project: Bounds for Ruin Probabilities and Value at Risk

Date Announced/Completed: Funding was awarded in February 2007.

Researcher(s): Yijia Lin, Dr. Samuel H. Cox, Ruilin Tian, and Dr. Luis Zuluaga

Purpose/Topic: The models underlying risk-based capital and enterprise risk management decisions necessarily involve several random variables. Often, the focus is on extremes of the distribution where there is little data to rely upon. The objective is to cast this as a moment problem in order to apply some recent results in optimization research.

Funding: \$15,000 (\$7,500 from CAS and \$7,500 from AERF)

Status: The researchers' objective is to solve three bound problems; they have solved the first two. Final paper submitted to NAAJ on July 30, 2007. When and if the paper is published in either the North American Actuarial Journal or Variance, the group will receive the final payment.

8. Other Topics

a. Project: 2008 CAS Discussion Paper Program

Date Announced: Announced in August 2007

Date Completed: June 2008

Project Oversight Group: Professional Education Policy Committee

Contact: Roger Bovard

Purpose/Topic: The topic of the 2008 Discussion Paper Program was "Applying Multivariate Statistical Models."

Funding: \$1,500, for the best paper (Michelbacher Prize)

Seminar/Meeting Presentations: CAS Spring Meeting, June 2008, Quebec City.

Publication: 2008 online *Discussion Paper Program* book on the CAS Web Site.

Status: 6 papers were completed and published in the *Discussion Paper Program* on the CAS Web site, 5 papers

were presented at the 2008 Spring Meeting. The Michelbacher Prize was not awarded.

b. Project: Stochastic Methods Used in Actuarial Science

Date Announced: April 2007

Purpose/Topic: The EC approved a recommendation to contribute \$15,000 in funding from the CAS Research Fund to the development of a textbook by the IAA on the topic of stochastic methods used in actuarial science, provided that the CAS is allowed to participate in the oversight of the project.

Status: Work in progress by the IAA.

c. Project: 2009 Health Care Call for Papers

Date Announced: March 2008

Project Oversight Group: Committee on Health Care Issues

Contact: Betsy Wellington

Purpose/Topic: Papers on all healthcare topics were welcomed but papers that focus on practical approaches to pricing or reserving for healthcare related lines of business were preferred. Specific topics of interest that were mentioned included: Impact of tort reform on pricing and reserving for Medical Malpractice or Managed Care Liability; Relationship between underwriting cycle and litigation trends; Impact of medical errors and quality of care initiatives on Medical Malpractice and Managed Care Liability; Workers' Compensation cost shifting of medical expenses between group health insurance and workers' compensation coverage; The impact of the Medical Malpractice fragmented marketplace (self-insurance, traditional insurance, Risk retention groups, etc.); and the effect of geographical differences on Medical Malpractice insurance or Managed Care Liability

Funding: \$2,500 for the best papers, with no more than \$1,500 going to one paper

Seminar/Meeting Presentations: Ratemaking and Product Management Seminar, March 2009

Publication: CAS *eForum* on the CAS Web site

Status: Only one proposal was submitted and although the committee decided to approve the proposal, the author dropped out and no completed papers will come out of this call.

d. Project: Climate Change Issues Task Force

Date Announced: Announced in August 2008

Contact: Susan Woerner, Chairperson

Purpose/Topic: The Climate Change Issues Task Force was developed out of the Image of an Actuary campaign. A research topic that actuaries across the campaign could work on was sought and climate change was chosen. It was decided that the CAS needed to create a task force to keep an eye on what the Image of the Actuary research project was doing as well as potentially find ways that CAS members might be affected by climate change issues.

Status: This group is just getting started as FY08 ends. There is nothing to report besides that committee members are being gathered.

e. Project: New Goodness-of-fit Tests for Pareto Distribution

Date Announced/Completed: Funding was awarded in February 2008.

Researcher(s): Maria Rizzo, Bowling Green State University

Topic: New approach to goodness-of-fit for the Pareto distributions based on Euclidean distances between sample elements.

Funding: \$5,000 from CAS

Status: The paper is in progress. The author has received the first allotment of the payment, due when a signed copy of the agreement was made. Ultimately, the paper is expected to be submitted for publication to a refereed journal no later than September 1, 2008.

CAS Research Commitments and Expenditures (2003-2009)

FY 2009 (Budgeted to Research Fund: \$169,540)

Sponsor	Project / Researcher	Original Commitment	Expense to Date	Commitment Balance
Reinsurance Research	2009 Call Paper Prize	2,000	---	2,000
Dynamic Risk Modeling	2009 Call Paper Prize	5,000	---	5,000
Dynamic Risk Modeling	Loss Simulation Model RFP	25,000	---	25,000
Health Care Issues	2009 Call Paper Prize	2,500	---	2,500
Ratemaking	2009 Call Paper Prize	2,500	---	2,500
TOTAL		\$37,000	---	\$37,000

FY 2008 (Budgeted to Research Fund: \$75,000)

Sponsor	Project / Researcher	Original Commitment	Expense to Date	Commitment Balance
Reserves	2008 Call Paper Prize <i>(Note: Not all prize money awarded)</i>	\$2,500	\$2,000	\$500
Management Data	2008 Call Paper Prize	2,500	2,500	---
CAS/AERF/SOA	AERF Project: Stochastic Claims Reserving; Antonio, Beirlant, Kaas	2,500	833	1,667
CAS/AERF/SOA	AERF Project: Robust and Efficient Methods for Quantitative Risk Management; Brazauskas	5,000	5,333.33	---
CAS/AERF	AERF Project: Optimal Layers for Excess Catastrophe Loss Reinsurance; Fu	5,000	1,500	3,500
CAS/AERF	AERF Project: Estimating Allocated Capital Using the Bootstrap; Kim, Hardy	5,000	1,333	3,667
CAS/AERF	AERF Project: New Goodness-of-Fit Tests for Pareto Distribution; Rizzo	5,000	1,500	3,500
TOTAL		\$27,500	\$14,999.33	\$12,834

FY 2007 (Budgeted to Research Fund: \$50,000)

Sponsor	Project / Researcher	Original Commitment	Expense to Date	Commitment Balance
Ratemaking	2007 Call Paper Prize <i>(Note: No prize awarded.)</i>	\$2,500	---	---
CAS/AERF	AERF Project: Property-Liability Insurance Loss Reserve Ranges Based on Economic Value, D'Arcy	20,000	\$9,000	\$11,000
CAS/AERF	AERF Project: Multivariate Conditional Density Estimation, Efromovich	10,000	6,000	4,000
CAS/AERF	AERF Project: Bounds for Ruin Probabilities and Value at Risk, Cox	7,500	4,500	3,000
IAA	IAA Project: Stochastic Methods Used in Actuarial Science	15,000	15,000	---
CAS/SOA	Ph.D. Grants Program – Jun Zhou	10,000	---	10,000
TOTAL		\$65,000	\$34,500	\$28,000

FY 2006 (Budgeted to Research Fund: \$50,000)

Sponsor	Project / Researcher	Original Commitment	Expense to Date	Commitment Balance
COTOR	RFP for Facilitator Handbook for Class on Modeling Loss Reserves (engaged consultant for	\$10,000	\$9,600	---

	\$9,600 fee)			
COTOR	RFP for Data for Predictive Modeling Applications	50,000	---	50,000
CAS-RMS	ERM Analysis of P/C Insurance Companies	10,000	10,000	---
Reserves	2006 Call Paper Prize (<i>Note: \$1,000 not awarded.</i>)	2,500	1,500	---
Management Data	2006 Call Paper Prize	2,500	2,500	---
TOTAL		\$75,000	\$23,600	\$50,000

FY 2005 (Budgeted to Research Fund: \$50,000)

Sponsor	Project / Researcher	Original Commitment	Expense to Date	Commitment Balance
CAS	American Risk and Insurance Association Prize	\$1,000	\$1,000	---
Ratemaking	2005 Call Paper Prize (<i>Note: No prize awarded.</i>)	\$2,500	---	---
Reinsurance	2005 Call Paper Prize (to augment Ferguson Reinsurance Prize Fund)	1,000	\$1,000	---
Management Data	2005 Call Paper Prize <i>Note: \$250 not awarded.</i>	2,500	2,250	---
CAS-CKER	Brazauskas study of Robust and Efficient Methods for Credibility	9,500	9,500	---
TOTAL		\$16,500	\$13,750	---

FY 2004 (Budgeted to Research Fund: \$25,000)

Sponsor	Project / Researcher	Original Commitment	Expense to Date	Commitment Balance
CAS	American Risk and Insurance Association Prize	\$1,000	\$1,000	---
Ratemaking	2004 Call Paper Prize <i>Note: No prize awarded.</i>	2,500	---	---
Reserves	2004 Call Paper Prize <i>Note: \$1,000 not awarded.</i>	2,500	\$1,500	---
Dynamic Risk Modeling	Review and Comparison of Rating Agency Capital Models <i>Note: Researchers performed this work for free.</i>	20,000	---	---
CAS/SOA	Ph.D. Grants Program – Y. Lu	10,000	10,000	---
TOTAL		\$36,000	\$12,500	---

FY 2003 (Budgeted to Research Fund: \$50,000)

Sponsor	Project / Researcher	Original Commitment	Expense to Date	Commitment Balance
CAS	American Risk and Insurance Association Prize	\$1,000	\$1,000	---
Ratemaking	2003 Call Paper Prize <i>Note: \$1,000 not awarded.</i>	2,500	1,500	---
Management Data	2003 Call Paper Prize	1,000	1,000	---
Reserves	2003 Call Paper Prize <i>Note: \$1,000 not awarded.</i>	2,500	1,500	---
ERM/DFA	2003 Call Paper Prize <i>Note: No prize awarded.</i>	5,000	---	---
ERM	Value Creation through ERM – Non-Insurance Company Commercial Enterprises <i>Note: Project discontinued after \$6,000 initial study.</i>	40,000	6,000	---
CAS	2003 Bowles Symposium <i>Note: \$2,500 not awarded.</i>	12,500	10,000	---
CAS/AERF	AERF Project: Workers' Compensation Ratemaking: A Textbook for the Practicing Actuary; Feldblum	8,000	2,500	\$5,500
CAS/AERF	AERF Project: Empirical Estimation of	6,000	3,000	3,000

	Dependence in a Portfolio of Insurance Claims; Valdez			
CAS/SOA	Ph.D. Grants Program – M. Wen	10,000	10,000	---
CAS	Fair Value Research Project	50,000	50,000	
TOTAL		\$138,500	\$86,500	\$8,500

Summary of Budgets vs. Commitments

CAS Fiscal Year	Budget	Expenses and Commitment Balance	Uncommitted Balance	
			Year	Cumulative
1991	\$ 50,000	\$ 37,335	\$ 12,665	\$ 12,665
1992	25,000	10,230	14,770	27,435
1993	50,000	5,000	45,000	72,435
1994	100,000	49,500	50,500	122,935
1995	50,000	11,000	39,000	161,935
1996	50,000	30,535	19,465	181,400
1997	50,000	70,923	(20,923)	160,477
1998	50,000	28,234	21,766	182,243
1999	0	29,036	(29,036)	153,207
2000	50,000	13,500	36,500	189,707
2001	0	69,300	(69,300)	120,407
2002	25,000	53,500	(28,500)	91,907
2003	50,000	95,000	(45,000)	46,907
2004	25,000	12,500	12,500	59,407
2005	50,000	13,750	36,250	95,657
2006	50,000	73,600	(23,600)	72,057
2007	50,000	62,500	(12,500)	59,557
2008	75,000	27,833.33	47,166.67	106,723.67
2009	169,540	37,000	132,540	239,263.67