

Information Paper
For
CAS Board of Directors

Subject: Annual Research Report

Responsible Officer: Louise Francis

1. Background

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

2. Information

The 2009 Report is attached. The report consists of two components:

A. Status of 2009 CAS Research Activities

Details on CAS research projects are provided in this attachment. Per the Board's request when reviewing the 2006 Report, the research activities have been organized by topic.

B. CAS Research Commitments and Expenditures (2003-2011)

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

Annual CAS Research Report for 2009

Overview

During the 2008 – 2009 year, the CAS Research Department worked with Strategic Planning to develop centennial goals in support of the CAS's overall goal to "be recognized globally as a leading resource in educating casualty actuaries and conducting research in casualty actuarial science." The Research activities undertaken this year emphasized:

- continuing to build the relationships with non-North American and non-actuarial organizations and to undertake international collaborative projects
- focusing research resources on projects that will produce a practical, usable outcome for CAS members
- spending the increased funds allocated to research on significant projects that advance the Centennial Goals
- spending funds on such activities as working parties, call paper programs, request for proposals, and individual grant-winning papers.

A new committee and a new working party were formed in the past year. The Climate Change Committee has been actively involved in preparing educational materials for our membership and in sponsoring original research on climate change. The committee has members from Europe and Australia and includes scientists with specific expertise in Climate science. Along with the Image of the Actuary Advisory Group (a multi-organization actuarial collaboration), it organized a subcommittee to develop an actuarial Climate Volatility Index. The R Working Party, meanwhile, will focus on producing educational materials and tools that can be used to introduce CAS members to the widely used open source software tool that is especially useful in doing advanced analytics. With the help of the Working Party, we hope to be able to inspire members to move beyond spreadsheets and augment their traditional tool set.

International cooperation, which was a focus in 2007 and 2008, continued to be a focus of Research efforts in 2009. Several of the research committees have members from non- North American organizations. The Climate Change Committee and the R Working Party have members both from Australia and the UK, and the Dependency Working party is working with Australian actuaries in modeling dependencies in insurance random variables. In addition, at a recent meeting with the GIRO leadership we discussed placing at least one GIRO member on most CAS research committees. It should also be noted that many authors of Variance papers and Call Papers are from outside North America. The inaugural Variance Prize will go to an author from Germany (Thomas Mack).

In-person brainstorming to solve problems and discuss the goals of the committees and working parties continues to be important. As last year, there were two in-person Chairs meetings for the Research Chairs. 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 again and also meet with the Professional Education Chairs to talk about how the two departments can work together. The Research and PE chairs suggested extending approaches to Research and Professional Education that are already being used successfully such as using Limited Attendance Seminars (LAS) and webinars to expand what might have been learned at a session at one of the big meetings/seminars. In addition, including “hands-on” sessions at meetings where attendees bring a computer and work through structured exercises has been quite successful. The research committees continue to be active contributors to webinars and to sessions at CAS meetings.

A Research communications initiative was continued in 2009. A quarterly newsletter that was initiated in 2008 continues to be a communication vehicle among Research Chairs in 2009. The newsletter highlights what the committees are doing and has also been distributed to non-CAS researchers (such as GIRO and the IAAustralia) wanting to know something about CAS research initiatives.

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. In addition we hope to draw researchers from around the world to the CAS’s web site.

Status of 2009 CAS Research Activities

Research Projects by Topic

1. Enterprise Risk Management

- a. **Project: 2008 Call for ERM Essays on the Financial Crisis**
Date Announced: Call for Papers announced in November 2008
Project Oversight Group: Group consisting of representatives from the Joint Risk Management Section.
Contact: Don Mango, JRMS; Mark Altschull, SOA; Wayne Fisher, ERMII
Purpose/Topic: Essays on Lessons Learned from the Financial Crisis
Funding: None Needed
Seminar/Meeting Presentations: 2009 SOA Investment Seminar (NYC); 2009 CAS Spring Meeting (New Orleans)
Publication: Papers available on the SOA Web site (linked from CAS Web site).
Status: Completed.

- b. **Project: 2009 ERM RFP on Financial Crisis**
Date Announced: Call for Papers announced in August 2008
Project Oversight Group: Joint Risk Management Section
Contact: Steven Siegel, SOA
Purpose/Topic: Subprime Mortgage Crisis – lessons learned
Funding: Joint CAS/CIA/SOA Risk Management Section awarded \$80,000 to two projects
Seminar/Meeting Presentations: TBD
Publication: Papers will be available from the ERM Web site (linked from CAS Web site)
Status: Papers are progressing on schedule. Deadline for proposals was November 2008. Projects were awarded in January 2009.

- c. **Project: 2010 ERM Call for Papers**
Date Announced: Call for Papers announced in August 2009
Project Oversight Group: Joint Risk Management Section plus PRMIA Institute
Contact: Steven Siegel, SOA
Purpose/Topic: Papers that explore risk management topics.
Funding: Joint Risk Management Section to provide possible prize funding
Seminar/Meeting Presentations: 2010 ERM Symposium, Chicago
Publication: Papers will be available from the ERM Web site (linked from CAS Web site).
Status: Papers are progressing on schedule. Finished papers are due January 2010.

- d. **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)

Publication: This paper was accepted by the *North American Actuarial Journal* in May 2009.

Status: Completed.

e. Project: Regime Switching Models: Applications to Mortality Modeling & Pricing

Date Announced/Completed: Funding was awarded in April 2009.

Researcher(s): Andreas Milidonis, Samuel Cox, Yijia Lin

Topic: This project would provide benefit to actuaries that must reflect mortality and longevity risks. The authors make the point that mortality and longevity risks are not typically modeled together. Since the mortality process is affected by both risks, they will model these risks together in their regime-switching model.

Funding: \$18,000 (split between CAS and the SOA's Committee on Knowledge Extension Research)

Status: Paper is in progress. Authors have received the first payment (\$1,333 from the CAS) for signing the copy of the letter of agreement.

f. Project: An Empirical Investigation of CDS Spreads Using a Regime Switching Default Model

Date Announced/Completed: Funding was awarded in April 2009.

Researcher(s): Andreas Milidonis

Topic: Recipients intend to use data on CDS spreads reported by Datastream for publicly traded companies to develop a default risk model. We believe that CAS members, in general, have an interest in this topic given our economic circumstances.

Funding: \$9,000 (split between CAS and the AERF Committee of the Actuarial Foundation)

Status: Paper is in progress. Author has received first payment (\$1,500 from the CAS) for signing a copy of the letter of agreement.

g. Project: Copula Regression

Date Announced/Completed: Funding was awarded in April 2009.

Researcher(s): Rahul Parsa, Drake University

Topic: Recipients project will detail the formulas and algorithms necessary for a copula regression analysis as well as provide the code for such. The final formulas and algorithms will be compared to Ordinary Least Squares and Generalized Linear Models analyses.

Funding: \$11,812 (split between CAS and the SOA's Committee on Knowledge Extension Research)

Status: Paper is in progress. Author has received first payment of \$1,500 from CAS, which was payable upon signing the letter of agreement.

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: Although Chapters 6 & 7 remain unfinished, this Working Party was disbanded as the majority of the Handbook was finished. A potential Working Party focusing on the remaining chapters or an RFP is under consideration.

- 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: One paper was completed and declared the winner of the Prize. \$2,500 was awarded to John Burkett, Gerry Kirschner, & Tim Pratt for "Risk Limit Selection with in an Integrated Framework."

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, 2009 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: \$25,000

Status: Work in progress. Hai You, the VP-Technology, at Gououon Actuarial Solutions was awarded the contract and has already received \$12,000 of his payment.

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 was 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

Contact: Mark Shapland

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

Contact: 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 Results: 2005 CLRS, 2005 Annual Meeting, 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: 2008 Annual Meeting

Publication: None

Status: Completed.

d. Project: 2010 Reserves Call for Papers

Date Announced: Announced in July 2009

Project Oversight Group: Committee on Reserves

Contact: Jon Michelson and Mark Shapland

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 prize fund of \$5,000 is available, to winners of the best papers (including up to \$1,500 awarded to the winner of the Ronald Bornhuetter Loss Reserve Prize) and the best software applications.

Presentations: 2010 Casualty Loss Reserve Seminar

Publication: Completed papers will be published in a future issue of the *eForum*.

Status: Papers are in progress. Twenty-four proposals were submitted. First drafts are due in December 2009.

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).

Presentations: 2008 Spring Meeting, 2008 Casualty Loss Reserve Seminar

Publication: *Variance*, Volume 3, Issue 1

Status: Completed.

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: R Working Party**

Date Announced/Completed: Announced in June 2009

Project Oversight Group: Committee on Ratemaking and Committee on Reserves

Contact: Lee Bowron and Thomas Kolde

Purpose/Topic: The Working Party will focus on producing educational materials and tools that can be used to introduce CAS members to the widely used open source software tool R, which is especially useful in doing advanced analytics. The Working Party's work will ideally help inspire members to move beyond spreadsheets and augment their traditional tool set.

Status: The Working Party is just getting started.

b. **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: Twelve papers were published in the 2009 Winter *eForum*.

Status: Completed. No prize was awarded.

c. Project: 2011 Ratemaking Call for Papers

Date Announced/Completed: Announced in June 2009

Project Oversight Group: Committee on Ratemaking

Contact: Todd Lehmann

Purpose/Topic: Papers on all ratemaking topics are accepted.

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

Seminar/Meeting Presentations: Ratemaking & Product Management Seminar, March 2011.

Publication: Completed papers will be published in a future issue of the *eForum*.

Status: Papers are in process. 19 proposals were received.

d. 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: Still in progress. 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/>.

e. 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.

f. Project: Modeling Driver Culpability in Multiple-Vehicle Collisions Using Conditional Regression

Date Announced/Completed: Funding was awarded in April 2009.

Researcher(s): Eric Weibel

Topic: The objectives of the project are to introduce actuaries to the Fatal Accident Reporting System, to introduce actuaries to Conditional Regression Analysis, and to analyze driver Accident Risk Factors in conjunction with the author's other work.

Funding: \$7,200 from CAS

Status: Paper is in progress. Author has received the first payment of \$2,000 (payable upon signing the letter of agreement) and the second payment of \$1,000 (payable upon evidence that the outlines of the paper are complete).

5. Data Management

a. Project: Data Management Webinar

Date: September 24, 2009

Project Oversight Group: Committee on Management Data and Information

Contact: John Stenmark, Virginia Prevosto

Purpose/Topic: "Raising Your Actuarial IQ (Improving Information Quality) Webinar" – presented by committee members Joe Izzo and Virginia Prevosto, this Webinar was an online presentation of data quality, pulling information from the Working Party on Data Management and Information Educational Materials' finished report.

Funding: None needed

Status: Completed. More than 150 people registered for this event.

b. Project: 2010 Call for Data Management/Data Quality/Data Technology Papers

Date Announced: December 2008

Date to be Completed: March 2010

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

Presentation: March 2010 RPM Seminar

Publication: Completed papers will be published in a future issue of the *eForum*.

Status: Still in progress. Approximately 4 papers are expected to be completed.

6. Reinsurance

a. Project: 2009 Reinsurance Call for Papers

Date Announced: Announced in August 2008

Date Completed: May 2009

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 for the Reinsurance Prize was available for the best paper.

Presentation: Four papers were presented at the 2009 Reinsurance Seminar in May 2009.

Publication: Four papers were published in the Spring 2009 *eForum*

Status: Completed. Neil Bodoff and Yunbo Gan were awarded the Reinsurance Prize for their paper, "An Analysis of the Market Price of Cat Bonds."

b. Reinsurance Research Corner

Project Oversight Group: Reinsurance Research Committee

Contact: Gary Blumsohn

Purpose/Topic: Held during the 2009 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.

Funding: None needed.

Status: Completed.

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, and the second allotment, due when the paper was received by a refereed journal. The final payment will be made once the paper is accepted for publication.

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 was still no interest. Offline conversations with potential data providers indicate possible willingness to supply a Canadian database.

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

Date: 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: 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.

c. Project: Risk Premium Project Update RFP

Date: August 2009

Project Oversight Group: Committee on Theory of Risk

Contact: Richard Derrig

Purpose/Topic: The CAS wishes to capitalize on the extensive review of the actuarial and financial literature review by the Risk Premium Project through 2000 by updating that review

Funding: \$20,000

Status: Project is in progress. No suitable proposals came out of the RFP, so the committee is considering editing the RFP and reissuing it again.

d. Project: Putting Mark to Market Accounting on a Going Concern Basis RFP

Date: July 2009

Project Oversight Group: Committee on Theory of Risk

Contact: Richard Derrig

Purpose/Topic: The CAS is looking for a research team to compile a comprehensive research bibliography on various topics related to mark-to-market accounting principles

Funding: \$30,000

Status: Project is in progress. No suitable proposals came out of the RFP, so the committee is considering editing the RFP and reissuing it again.

8. Climate Change

a. Project: Actuarial Climate Volatility Index RFP

Project Oversight Group: Climate Change Committee

Contact: Caterina Lindman, Susan Woerner

Purpose/Topic: The purpose of this project is to educate actuaries, governments, businesses, educators and the public on climate change and its related risks within North America and globally. The index is to be a resource for actuaries and others in developing predictive models for anticipated climate change related losses or opportunities as well as for risk management strategies. Actuaries might utilize the data and measures of the indicators and index in evaluating the potential risks of climate related changes to their employers. For example, a high index for increased hurricane intensity might indicate the potential for increased property damage, personal injury or death. In addition, the data and index might also be useful to the American Academy of Actuaries and others in public policy discussions.

Funding: Funding will come from all three sponsoring organizations (SOA, CAS, CIA); CAS has agreed to provide \$10,000.

Status: The RFP is yet to be released but will be released in November 2009.

b. Project: Climate Change Webinar

Date: June 25, 2009

Project Oversight Group: Climate Change Committee

Contact: Susan Woerner

Purpose/Topic: “From Risk to Opportunity - Insurer Responses to Climate Change” – presented by committee member Evan Mills, this webinar explored how insurers are responding to climate change.

Funding: None needed. Money to pay presenter was taken from Webinar Fund.

Status: Completed. Over 130 people registered for this event.

9. Valuation, Finance & Investments

a. Project: Risk Margins RFP

Date: August 2009

Project Oversight Group: Committee on Valuation, Finance & Investments

Contact: Jason Russ

Purpose/Topic: The CAS is looking to produce a paper that: 1.) Provides a background summarizing the issues surrounding the IASB insurance contracts project; 2.) Provides a background summarizing the valuation of liabilities under the standards being promulgated; and 3.) Addresses the area of risk margins in depth

Funding: \$25,000

Status: The project is just getting started. A team from Milliman was selected to be awarded the contract.

b. Project: Testing of Insurance Liability Valuation Models RFP

Date: October 2009

Project Oversight Group: Committee on Valuation, Finance & Investments

Contact: Jason Russ

Purpose/Topic: The purpose of this RFP is to solicit research that tests whether or not existing theoretical valuation methods actually predict real market pricing, or aspects thereof. While the researchers may propose a method for testing, the RFP would be pre-disposed to existing well-documented theoretical models.

Funding: \$25,000

Status: In progress. This RFP is still accepting proposals.

10. Other Topics

a. 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.

b. 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

Presentation: None.

Publication: Paper will be published in an upcoming issue of *The Astin Bulletin*.

Status: Completed.

CAS Research Commitments and Expenditures (2003-2011)

FY 2011 (Budgeted to Research Fund: ???)

Sponsor	Project / Researcher	Original Commitment	Expense to Date	Commitment Balance
Rate-making	2011 Call Paper Prize	2,500.00	-	2,500.00
TOTAL		\$ 2,500.00	-	\$ 2,500.00

FY 2010 (Budgeted to Research Fund: \$100,000)

Sponsor	Project / Researcher	Original Commitment	Expense to Date	Commitment Balance
Louise Francis	Annual Meeting Assistance - 2007 Variance Prize Winner Travel to Boston	1,500.00	-	1,500.00
Louise Francis	Annual Meeting Assistance - Introduction to R Tutorial	5,000.00	5,000.00	-
Management Data	2010 Call Paper Prize	2,500.00	-	2,500.00
Reserves	2010 Call Paper Prize	5,000.00	-	5,000.00
TOTAL		\$ 14,000.00	5,000.00	\$ 9,000.00

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

Sponsor	Project / Researcher	Original Commitment	Expense to Date	Commitment Balance
Reinsurance Research Climate Change Committee	2009 Call Paper Prize	2,000.00	2,000.00	-
IAAustralia/ CAS Dependency Working Party	Actuarial Climate Volatility Index RFP	10,000.00		10,000.00
	International WP/Gelnn Meyers leads CAS effort	5,000.00	-	5,000.00
Theory of Risk	Risk Premium Project Update RFP	20,000.00	-	20,000.00
Theory of Risk	Putting Mark to Market Accounting on a Going Concern Basis RFP	30,000.00	-	30,000.00
VFIC	Testing of Insurance Liability Valuation Models RFP	25,000.00	-	25,000.00
VFIC	Risk Margins RFP	25,000.00	-	25,000.00
Dynamic Risk Modeling	2009 Call Paper Prize <i>(Note: Not all prize money awarded.)</i>	5,000.00	2,500.00	-
Dynamic Risk Modeling	Loss Simulation Model RFP	25,000.00	12,000.00	13,000.00
Health Care Issues	2009 Call Paper Prize <i>(Note: No prize money awarded.)</i>	2,500.00	-	-
CAS/SOA	AERF Project: Regime Switching Models: Applications to Mortality Modeling and Pricing; Milidonis, Cox & Lin	4,000.00	1,333.00	2,667.00

CAS/AERF/SOA	AERF Project: An Empirical Investigation of CDS Spreads using a Regime Switching Default Risk Model; Milidonis	3,000.00	1,500.00	1,500.00
CAS/CKER	AERF Project: Copula Regression; Parsa	5,000.00	1,500.00	3,500.00
CAS	AERF Project: Modeling Driver Culpability in Multiple-Vehicle Collisions Using Conditional Regression; Weibel	7,200.00	3,000.00	4,200.00
Ratemaking	2009 Call Paper Prize <i>(Note: No prize money awarded.)</i>	2,500.00	-	
TOTAL		\$ 171,200.00	\$ 23,833.00	\$ 139,867.00

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>	2,500.00	2,000.00	-
Management Data	2008 Call Paper Prize	2,500.00	2,500.00	-
CAS/AERF/SOA	AERF Project: Stochastic Claims Reserving; Antonio, Beirlant, Kaas	2,500.00	833.00	1,667.00
CAS/AERF/SOA	AERF Project: Robust and Efficient Methods for Quantitative Risk Management; Brazauskas	5,000.00	5,000.00	-
CAS/AERF	AERF Project: Optimal Layers for Excess Catastrophe Loss Reinsurance; Fu	5,000.00	3,000.00	2,000.00
CAS/AERF	AERF Project: Estimating Allocated Capital Using the Bootstrap; Kim, Hardy	5,000.00	1,333.00	3,667.00

CAS/AERF	AERF Project: New Goodness-of-Fit Tests for Pareto Distribution; Rizzo	5,000.00	5,000.00	-
TOTAL		27,500.00	19,666.00	7,334.00

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>	2,500.00	-	-
CAS/AERF	AERF Project: Property-Liability Insurance Loss Reserve Ranges Based on Economic Value, D'Arcy	20,000.00	15,000.00	5,000.00
CAS/AERF	AERF Project: Multivariate Conditional Density Estimation, Efromovich	10,000.00	6,000.00	4,000.00
CAS/AERF	AERF Project: Bounds for Ruin Probabilities and Value at Risk, Cox	7,500.00	4,500.00	3,000.00
IAA	IAA Project: Stochastic Methods Used in Actuarial Science	15,000.00	15,000.00	-
CAS/SOA	Ph.D. Grants Program – Jun Zhou	10,000.00	-	10,000.00
TOTAL		65,000.00	40,500.00	22,000.00

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	10,000.00	9,600.00	400.00
COTOR	RFP for Data for Predictive Modeling Applications	50,000.00	-	50,000.00
CAS-RMS	ERM Analysis of P/C Insurance Companies	10,000.00	10,000.00	-
Reserves	2006 Call Paper Prize (<i>Note: \$1,000 not awarded.</i>)	2,500.00	1,500.00	
Management Data	2006 Call Paper Prize	2,500.00	2,500.00	-
TOTAL		75,000.00	23,600.00	50,400.00

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	1,000.00	1,000.00	-
Ratemaking	2005 Call Paper Prize (<i>Note: No prize awarded.</i>)	2,500.00	-	-
Reinsurance	2005 Call Paper Prize (to augment Ferguson Reinsurance Prize Fund)	1,000.00	1,000.00	-
Management Data	2005 Call Paper Prize (<i>Note: \$250 not awarded.</i>)	2,500.00	2,250.00	-
CAS-CKER	Brazauskas study of Robust and Efficient Methods for Credibility	9,500.00	9,500.00	-
TOTAL		16,500.00	13,750.00	-

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	1,000.00	1,000.00	-
Ratemaking	2004 Call Paper Prize (<i>Note: No prize awarded.</i>)	2,500.00	-	-
Reserves	2004 Call Paper Prize (<i>Note: \$1,000 not awarded.</i>)	2,500.00	1,500.00	-
Dynamic Risk Modeling	Review and Comparison of Rating Agency Capital Models (<i>Note: Researchers performed this work for free.</i>)	20,000.00	-	-
CAS/SOA	Ph.D. Grants Program – Y. Lu	10,000.00	10,000.00	-
TOTAL		36,000.00	12,500.00	-

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	1,000.00	1,000.00	-
Ratemaking	2003 Call Paper Prize (<i>Note: \$1,000 not awarded.</i>)	2,500.00	1,500.00	-
Management Data	2003 Call Paper Prize	1,000.00	1,000.00	-

Reserves	2003 Call Paper Prize (<i>Note: \$1,000 not awarded.</i>)	2,500.00	1,500.00	-
ERM/DFA	2003 Call Paper Prize (<i>Note: No prize awarded.</i>)	5,000.00	-	-
ERM	Value Creation through ERM – Non-Insurance Company Commercial Enterprises (<i>Note: Project discontinued after \$6,000 initial study.</i>)	40,000.00	6,000.00	-
CAS	2003 Bowles Symposium (<i>Note: \$2,500 not awarded.</i>)	12,500.00	10,000.00	-
CAS/AERF	AERF Project: Workers' Compensation Ratemaking: A Textbook for the Practicing Actuary; Feldblum	8,000.00	2,500.00	5,500.00
CAS/AERF	AERF Project: Empirical Estimation of Dependence in a Portfolio of Insurance Claims; Valdez	6,000.00	3,000.00	3,000.00
CAS/SOA	Ph.D. Grants Program – M. Wen	10,000.00	10,000.00	-
CAS	Fair Value Research Project	50,000.00	50,000.00	-
TOTAL		138,500.00	86,500.00	8,500.00