



 

Credit Risk Practices in the (P&C) Industry (and much more!)

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Background

- **Default:** inability of the debt issuer to meet one, some or all of its obligations;
- **Credit risk:** potential losses on a security related to the uncertainty of both:
 - Moment of default (even if it may never occur);
 - Amount of loss given default;
- **Bankruptcy** code in the United States:
 - Chapter VII: Liquidation;
 - Chapter XI: Reorganization;


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Background

- 2008 financial crisis
 - Collapse of subprime mortgage market;
 - Bankruptcy of Lehman Brothers;
 - Technical default of many well-rated financial institutions (TARP);
 - AIG, Fannie Mae, Freddie Mac, Citigroup, Bank of America, etc.
 - Other companies as well: General Motors (Chapter 11);
- 2009-2012 Europe sovereign debt crisis
 - Portugal, Italy, Greece, Spain (PIGS) + Cyprus;
 - Austerity measures in many countries;



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Background



- Recent financial crisis demonstrated the importance and value of independent critical analysis of credit risk.
- Actuaries have a strong background in probability, statistics and finance to help manage long-term risks;
 - Hence, it is felt that actuaries could contribute to this debate;


 

Background



- Research project proposed by the Casualty Actuarial Society
 - Credit Risk Special Interest Section (CRISIS);
 - Committee on Valuation, Finance, and Investments (VFIC);
- Three objectives:
 - Develop an organized set of resources (compendium) on credit risk for the practicing actuary;
 - Analyze the current industry’s practice regarding credit risk;
 - Recommend novel methodologies toward credit risk modeling and management;
 - Forthcoming once the first two objectives are complete;



 

Background


- Joint venture
 - Casualty Actuarial Society;
 - Quantact;
- About Quantact: www.quantact.ugam.ca/en
 - Research group in actuarial and financial mathematics at the University of Quebec in Montreal;
 - 6 professors, 2 post-doctoral fellows, over 10 graduate students;
 - Goal is to stimulate research between colleagues and promote technological transfers to the industry;



 

Background


- Researchers assigned to this project
 - Mathieu Boudreault, Ph.D., F.S.A., A.C.I.A.
 - Ph.D. in financial mathematics, HEC Montréal (business school);
 - Thesis on a hybrid credit risk model;
 - Other consulting experience on segregated funds/variable annuities
 - Jean-Philippe Boucher, D.Sc.
 - Ph.D. in actuarial science (with Michel Denuit), UCL, Belgium;
 - Thesis on count models in P&C insurance;
 - Three years of industry experience in P&C;



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Objectives of this presentation


- Overview of the compendium
 - Structure;
 - Outline;
- Survey of the P&C industry practices in credit risk
 - Emphasize on its importance;
 - Overview of its structure and questions;
- Current research topics in (corporate) credit risk



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Compendium



- Set of resources (compendium) on credit risk for the practicing actuary;
- Organized in 12 chapters (one theme per chapter)
- Each chapter comprises:
 - 2-4 pages summary of the literature on the topic;
 - List of references, where to find data, computer codes;
 - When (legally) possible, the actual papers;



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Compendium



- Sources of information:
 - Academic and professional research articles:
 - SSRN (and other scientific portals);
 - defaultrisk.com;
 - Rating agencies and professional organizations (SOA, CAS, CFA Institute, PRMIA, GARP, etc.);
 - Includes conference articles and their presentation materials;
 - Books;
 - Master's and Ph.D. theses;
 - University online courses and professional webinars;



 

Compendium



- Sources of information (continued):
 - Data
 - Most are subscription-based (CRSP, Datastream, Compustat, Bloomberg, etc.)
 - Rating agencies
 - Computer programs
 - MATLAB Exchange Central
 - CRAN (R programming language)



 

Compendium



- Proposed outline (subject to change):
 1. Fundamentals of credit risk
 - a) What is credit risk: definitions, default and recovery rate, etc.;
 - b) Rating agencies;
 - c) Modeling and valuation paradigms;
 2. Single-name corporate credit risk
 - a) Structural, reduced-form and hybrid models;
 3. Portfolio corporate credit risk management
 - a) Academic and professional models;
 - b) Dependence modeling;
 4. Credit risk for individuals
 - a) Also known as consumer credit risk (mortgages, credit cards);
 - b) Credit scores;



 

Compendium



- Proposed outline (continued):
 - Single-name credit-sensitive products
 - Equity, corporate bonds, etc.
 - Credit default swaps
 - Municipal securities
 - Types and features;
 - Taxation issues;
 - Ratings from major agencies;
 - Multi-name credit-sensitive products
 - Characteristics and pricing
 - Securitization;
 - Asset-backed securities (CDO, MBS, etc.)



 

Compendium

- Proposed outline (continued):
 - Counterparty risk
 - Reinsurer and insurer credit risk;
 - Integration in derivatives' pricing;
 - Credit Valuation Adjustment (CVA) (Basel III)
 - Sovereign credit risk
 - Determinants;
 - Modeling and pricing;
 - Analysis of European crisis;
 - Financial accords, laws and regulations
 - Basel (I, II, III), Solvency (I, II), NAIC RBC, etc.
 - Enterprise Risk Management
 - Banks and insurance companies



 



 

Compendium

- Proposed outline (continued):
 - P&C industry practices
 - Only once the results of the survey are compiled and thoroughly analyzed
 - Not clear whether it will fit as a separate chapter and/or if a subsection will be added to each chapter;


Comments, suggestions on the proposed compendium ?



 

Survey of the P&C industry


- **Objective:** obtain relevant information regarding the current P&C industry practices with respect to the various types of credit risk
- Together with the compendium, we will have a very broad overview of how we can currently tackle the different types of credit risk
 - Serve as an important reference for actuaries;
- Help develop an innovative approach to credit risk modeling and management



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Survey of the P&C industry


- Similar initiative from the Society of Actuaries
 - Jointly sponsored by the Financial Reporting Section and Committees on Finance Research and on Life Insurance Research
 - *Credit Risk Modeling Techniques For Life Insurers* authored by Kamakura Corp. (including Robert Jarrow);
 - Report released in August 2012 (webcast in June 2013);
 - Features a short review of the literature (6 pages), mainly from the corporate credit risk point of view.
 - Most of the report is a summary of results from a survey of credit risk practices to life insurance companies;



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Survey of the P&C industry


- Built with SurveyMonkey interface.
- **Deadline: December 15th, 2013**
- Link: <https://www.surveymonkey.com/s/CASCreditRisk>
- Participation is *optional* and *partial* completion is possible.
- The strength and appropriateness of the future methods that we will develop depends on the quality of the data we obtain from the survey.
- Hence, **full** or **partial** participation is **strongly encouraged**.



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Survey of the P&C industry

- Questions 44-55 deal with credit risk on the liability side
 - Types of insurance products offered (if any);
 - Importance of these products for the company;
 - Types of professionals dealing with these risks;
 - How these insurance risks are priced, reserved, managed;
 - Features of the models;
 - Data used;


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Survey of the P&C industry

- **Summary**
 - Exhaustive survey because we want to provide a strong analysis and an innovative approach afterwards;
 - Quality of data will reflect on quality of analysis;
 - Although facultative, participation is very important !
 - Deadline: **December 15th, 2013**;
 - Link: <https://www.surveymonkey.com/s/CASCreditRisk>


Comments, suggestions on the proposed survey ?



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Current research topics in credit risk



- Credit risk:
 - Almost 6000 papers on SSRN;
 - Almost 2000 papers (1600 freely downloadable) from defaultrisk.com;
 - Over 100 000 papers on Google Scholar;
- Corporate credit risk
 - Single-name models: often used to price credit-sensitive securities
 - Portfolio models: mostly for risk management (reserves) but also for pricing portfolio credit derivatives
 - The latter market is much less active since the financial crisis



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Current research topics in credit risk

- Issues to be discussed:
 - Loss given default;
 - Dependence across firms (portfolio models);
 - Estimation of parameters:
 - Each firm;
 - Dependence;
- Important challenges !



 



 

Current research topics in credit risk

Loss given default (LGD)

- Largely overlooked until recently (about 2007);
- Mostly assumed constant over time, across firms, or beta-distributed;
- Significant relationship with the solvency of the firm;
 - A highly-rated firm (say investment-grade) that defaults will have a higher recovery rate (lower LGD) and vice-versa;
 - Supported by many recent studies (Altman among others);



 

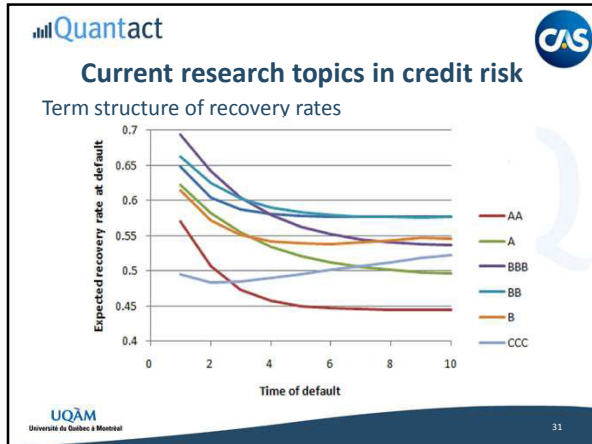
 

Current research topics in credit risk

Loss given default (LGD)

- Variable (or process) that determines solvency of the firm should influence both:
 - Timing of default (term structure of default probability);
 - LGD (term structure of recovery rates);
- See next graph: expected recovery rates
- Term structure of recovery rates;
 - Expectation, standard deviation, skewness, kurtosis, etc.



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Current research topics in credit risk

Dependence models

- Quite obvious that defaults are dependent: default contagion during recessions and financial crises
- Much less obvious that LGDs are also higher at the same time.
 - Double whammy effect !
 - Determinants of default are common for both the moment of default and the LGD;
- See next table
 - Beta-distributed recovery rates are useless if independent from one firm to the other due to LGD diversification;

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Current research topics in credit risk

Dependence models

- Portfolio of 225 corporate bonds (125 IG and 100 HY);
- 1-year loss on the portfolio (% of initial value);

VaR	Constant	Beta	Model
90%	8.13	8.14	10.16
95%	10.07	10.07	12.89
99%	14.07	14.05	18.64
CTE	Constant	Beta	Model
90%	10.76	10.76	13.91
95%	12.53	12.52	16.44
99%	16.21	16.21	21.85



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Current research topics in credit risk

Parameter estimation – Firm level

- Structural models rely upon knowledge of the *market* value of the assets of the company → not observed
- Reduced-form models are constructed with a stochastic process for the default intensity → not observed as well;
- Possible sources of data;
 - Balance sheet information (quarterly, accounting rules);
 - Ratings database (not firm-specific, loss of confidence);
 - Security prices such as equity, bonds, derivatives (CDS), etc. is a very popular choice;



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Current research topics in credit risk

Parameter estimation – Firm level

- Challenge with security prices:
 - Differentiate permanent shocks (changes in fundamentals) with transient shocks (noise);
 - However, traditional estimation techniques (calibration, maximum likelihood) cannot differentiate between the two;
 - Both permanent and transient shocks are treated as changes in fundamentals with these approaches;



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Current research topics in credit risk

Parameter estimation – Firm level

- Consequences:
 - Overestimation of the volatility of the fundamentals of the company;
 - Overestimation of the default probability;
- Solution:
 - Filtering techniques (engineering) such as non-linear Kalman filters (EKF or UKF);
 - Well known in signal processing literature with applications to radars, GPS, OCR, face recognition, etc.
- Caution: false sense of security because... (answer in 2 slides)


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Current research topics in credit risk

Parameter estimation – Portfolio level

- At the portfolio level (dependence parameters);
 - Default correlation for each pair of firm;
 - Possibly other dependence parameters as well (tail and systemic risk);
- Possible sources of data;
 - Historical counts of defaults and losses;
 - Too few observations and hence too unstable;
 - Security prices is again a popular choice but... it is also noisy;
- Biggest challenge:
 - Estimate all correlation estimates (grows with the square of the number of firms)


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Current research topics in credit risk

Parameter estimation – Portfolio level

- How do we compute correlation?
 - Very common to compute correlations based upon stock prices;
 - Bias since equity correlation does not necessarily relate to correlation in the core components (asset, default intensity);
 - Not a bad assumption but stock prices are also noisy !
- Security prices (equity, bonds, CDS, etc.) have a fundamental and a noisy component
 - Only permanent (fundamental) shocks are correlated across firms;
 - Transient shocks are likely not (or much less);


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Current research topics in credit risk

Parameter estimation – Portfolio level


- Difficult to separate permanent from transient shocks at the portfolio level unless we use filtering techniques;
- Results:
 - Correlations before: 10-20% range
 - Correlations after: 40-80% range
 - Huge increases in the required reserves !
 - 1-year 95% CTE from 5% to 15% in the preceding example

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Current research topics in credit risk

- **References:**
 - M. Boudreault, G. Gauthier and T. Thomassin (2013), Recovery rate risk and credit spreads in a hybrid credit risk model, *Journal of Credit Risk* 9 (3), Fall 2013
 - M. Boudreault, G. Gauthier and T. Thomassin (2013), Contagion effect on bond portfolio risk measures in a hybrid credit risk model, *Finance Research Letters*, In press
 - M. Boudreault, G. Gauthier and T. Thomassin, Estimating asset correlations for portfolio credit risk using in the presence of trading noise, Working paper in preparation for submission.

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