


New York, January 25<sup>th</sup> 2011





INTERNATIONAL ASSOCIATION OF FINANCIAL ENGINEERS  
*Advancing The Field of Financial Engineering*

# COUNTERPARTY CREDIT RISK MODELING WORKSHOP

Eduardo Canabarro, MORGAN STANLEY  
Michael Pykhtin, THE FEDERAL RESERVE BOARD  
Dan Rosen, R<sup>2</sup> FINANCIAL TECHNOLOGIES

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## Outline




Counterparty Credit Risk Workshop  
INTERNATIONAL ASSOCIATION OF FINANCIAL ENGINEERS  
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1. Introduction
2. Modeling Counterparty Credit Exposures
3. Pricing and Hedging CCR
4. Calculating Economic and Regulatory Capital for CCR
5. Concluding remarks

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$\min_{z_i} L(z) \text{ s.t. } \sum z_i^2 = C \quad \sum w_i B_i^T z_i \quad L = \sum x_i L_i$




**Counterparty Credit Risk Workshop**  
INTERNATIONAL ASSOCIATION OF FINANCIAL ENGINEERS  
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## Introduction

# Counterparty Credit Risk



**Dan Rosen**  
R<sup>2</sup> Financial Technologies  
dan.rosen@R2-financial.com



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## Preface...

**Counterparty risk** is

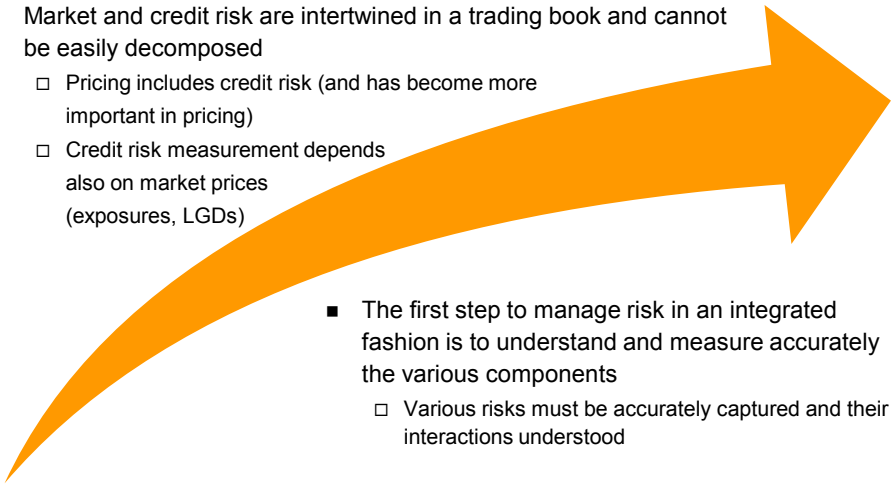
*“... probably the single most important variable in determining whether and with what speed financial disturbances become financial shocks, with potential systemic traits”*

Counterparty Risk Management Policy Group (CRMPG 2005)

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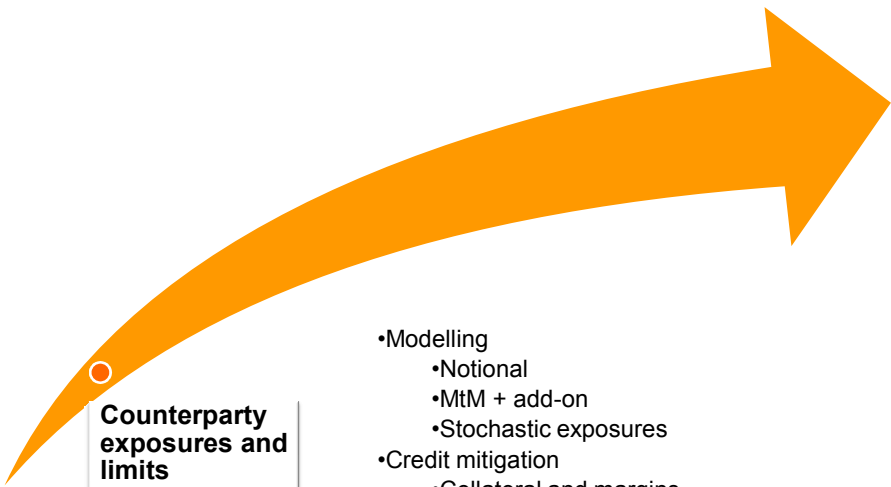
## Counterparty Credit Risk Evolution



- Market and credit risk are intertwined in a trading book and cannot be easily decomposed
  - Pricing includes credit risk (and has become more important in pricing)
  - Credit risk measurement depends also on market prices (exposures, LGDs)
- The first step to manage risk in an integrated fashion is to understand and measure accurately the various components
  - Various risks must be accurately captured and their interactions understood

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## Counterparty Credit Risk Evolution



**Counterparty exposures and limits**

- Modelling
  - Notional
  - MtM + add-on
  - Stochastic exposures
- Credit mitigation
  - Collateral and margins
- Sophisticated limits and hierarchies

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## Counterparty Exposures, Limits and Mitigation

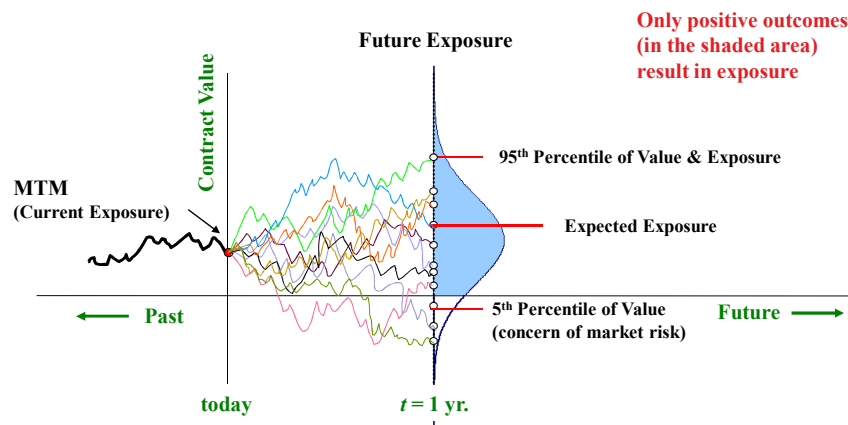


- Managing credit limits on a counterparty by counterparty basis has proven to be a simple, effective and actionable risk management tool
  - First level of portfolio credit risk analysis: get consolidated picture of the exposures from all the transactions with each counterparty
  - Major systems exercise – collection of all positions across instruments, geographies
- Exposures monitored through limits against each counterparty
  - Credit lines limiting maximum loss if counterparty defaults
- CCR mitigation: netting and margin agreements
  - Management of collateral

## Uncertainty of Future Exposure



- ▶ Future value and exposure are uncertain!



## Counterparty Credit Risk Evolution

**Counterparty exposures and limits**

**Economic capital Default risk**

- Basel II (IRB)
- EPE and alpha

**CCR valuation: CVA**

- Fundamental vs. Market values (CDS spreads)
- Unilateral → bilateral

**Hedging CCR JtD risk and CVA**

**Economic capital Credit + market risk (CVA)**

- Basel III...

*CVA is now an integral part of current accounting rules for P&L, and of the new proposal for banking regulation ("Basel III" rules)*

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## Regulatory capital and CVA

**"Mark-to-market losses due to credit valuation adjustments (CVA) were not directly capitalised. Roughly two-thirds of CCR losses were due to CVA losses and only one-third were due to actual defaults."**

Basel Committee on Banking Supervision (2009)

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## Dan Rosen



**Dr. Dan Rosen** is the CEO and co-founder of **R<sup>2</sup> Financial Technologies** and acts as an advisor to institutions in Europe, North America, and Latin America on derivatives valuation, risk management, economic and regulatory capital. In addition, an adjunct professor at the **University of Toronto's Masters program in Mathematical Finance**.

Dr. Rosen lectures extensively around the world on financial engineering, enterprise risk and capital management, credit risk and market risk. He has authored several patents and numerous papers on quantitative methods in risk management, applied mathematics, operations research, and has coauthored two books and various chapters in risk management books (including two chapters of *PRMIA's Professional Risk Manger Handbook*). In addition, Dr. Rosen is a member of the Industrial Advisory Boards of the *Fields Institute* and the *Center for Advanced Financial Studies* at the *University of Waterloo*, the Academic Advisory Board of *Fitch*, the Advisory Board, Educational and Credit Risk Steering Committees of the *IAFE* (International Association of Financial Engineers), the regional director in Toronto of *PRMIA* (Professional Risk Management International Association), and a member of the *Oliver Wyman Institute*. He is also one of the founders of *RiskLab*, an international network of research centers in Financial Engineering and Risk Management, initiated at the University of Toronto. Dr. Rosen was inducted in 2010 as a *fellow* of the **Fields Institute for Research in Mathematical Sciences**, for his "outstanding contributions to the Fields Institute, its programs, and to the Canadian mathematical community".

Up to July 2005, Dr. Rosen had a successful ten-year career at *Algorithmics Inc.*, where he held senior management roles in strategy and business development, research and financial engineering, and product marketing. In these roles, he was responsible for setting strategic direction, new initiatives and alliances; the design and positioning of credit risk and capital management solutions, market risk tools, operational risk, and advanced simulation and optimization, as well as their application to industrial settings.

He holds an M.A.Sc. and Ph.D. in Chemical Engineering from the University of Toronto.

## Selected Recent Publications



- Rosen D. , 2010, Rethinking Valuations, in Rethinking Risk Measurement (Ed. K. Boecker), RISK Publications
- Rosen D. and Saunders D. 2011, Structured Finance Valuation and Risk Management with Implied factor Models, in Advances in Credit Derivatives, Bloomberg Publications
- Nedeljkovic, J., Rosen D. and Saunders D. 2010, Pricing and Hedging CLOs with Implied Factor Models, Journal of Credit Risk, fall issue
- Rosen D. and Saunders D. 2009, Valuing CDOs of Bespoke Portfolios with Implied Multi-Factor Models, Journal of Credit Risk, Fall Issue
- Rosen D. and Saunders D. 2011, Wrong-Way CVA and CVA VaR,
- Pykhtin M., Rosen D. 2010, Pricing Counterparty Risk at the Trade Level and CVA Allocations, Federal Reserve Research Paper Series (forthcoming in J of Credit Risk)
- Rosen D. and Saunders D. 2010, Computing and Stress Testing Counterparty Credit Risk Capital, in Counterparty Credit Risk Modelling, (ed. E. Canabarro), Risk Books
- Garcia Cespedes J. C., de Juan Herrero J. A., Rosen D., Saunders D. 2010, Effective modelling of Counterparty Credit risk Capital and Alpha, Journal of Risk Model validation
- De Prisco B., Rosen D., 2005, Modelling Stochastic Counterparty Credit Exposures for Derivatives Portfolios, Counterparty Credit Risk (M. Pykhtin, Editor), Risk Books

## Selected Recent Publications



- Rosen D. and Saunders D. 2010, Economic Capital, in Encyclopedia of Quantitative Finance
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- Rosen D. and Saunders D. 2010, Measuring Capital Contributions of Systemic Factors in Credit Portfolios, Journal of Banking and Finance
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- Mausser H. and Rosen D. 2007, Economic Credit Capital Allocation and Risk Contributions, in Handbook of Financial Engineering (J. Birge and V. Linetsky Editors)
- Garcia Cespedes J. C., Keinin A., de Juan Herrero J. A. and Rosen D. 2006, A Simple Multi-Factor "Factor Adjustment" for Credit Capital Diversification, Special issue on Risk Concentrations in Credit Portfolios (M. Gordy, editor) Journal of Credit Risk, Fall 2006
- Rosen D., 2004, Credit Risk Capital Calculation, in Professional Risk Manager (PRM) Handbook, Chapter III.B5, PRMIA Publications
- Aziz A., Rosen D., 2004, Capital Allocation and RAPM, in Professional Risk Manager (PRM) Handbook, Chapter III.0, PRMIA Publications

$$\min_{\sum z_i^2 = c} L(z) = \sum w_i B_i^T z_i \quad L = \sum x_i L_i$$



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