



Institute
and Faculty
of Actuaries

Modeling the post-crisis world: sovereign debt and other credit risk issues

Dr. Matthew Lightwood
Conning Risk and Capital Management
Solutions

18 June 2013



Institute
and Faculty
of Actuaries

Modeling the post-crisis world: sovereign debt and other credit risk issues

What has changed? What are the challenges?
How far have we come? What can we learn?

erlise
 nsorship
 Thought leadership
 Progress
 Community
 Sessional Meetings
 Education
 Working parties
 Volunteering
 Research
 Shaping the future
 Networking
 Professional support
 Enterprise and risk
 Learned society
 Opportunity
 International profile
 Journals
 Support

15 October 2013

Agenda

- Credit in the Pre and Post Crisis World
- Problems in credit modeling
- Corporate Credit vs Sovereign Credit
- Solving the Problem: What can cutting edge models achieve?
- Quantitative comparison of Sovereign debt modeling approaches
- Summary



15 October 2013

3



Institute
and Faculty
of Actuaries

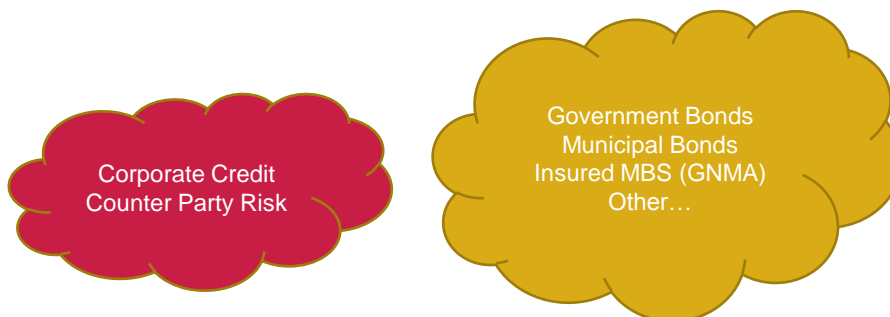
The Pre and Post Crisis World

erlise
 nsorship
 Thought leadership
 Progress
 Community
 Sessional Meetings
 Education
 Working parties
 Volunteering
 Research
 Shaping the future
 Networking
 Professional support
 Enterprise and risk
 Learned society
 Opportunity
 International profile
 Journals
 Support

15 October 2013

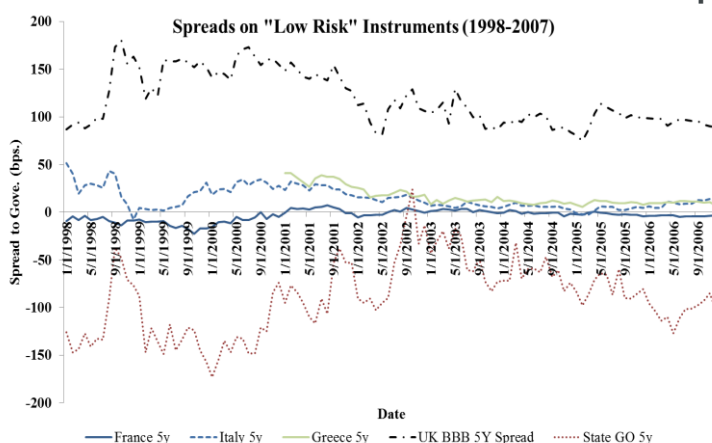
The Pre Crisis World

Pre 2007 life seemed so simple:



The Pre Crisis World

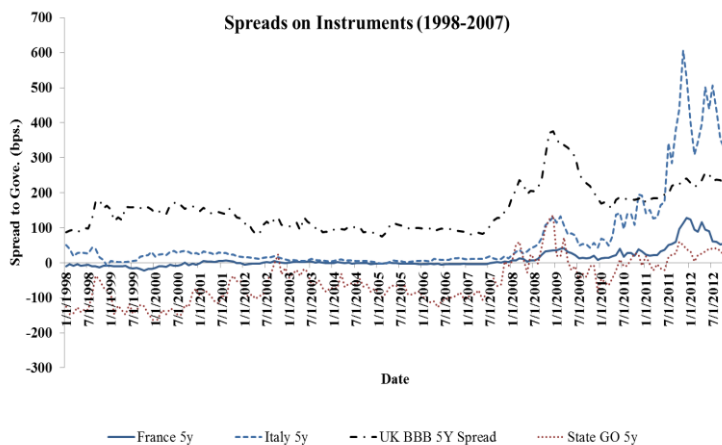
This view of the world was based on localised experience:



Source: Conning/Bloomberg

The Post Crisis World

Put this in perspective:



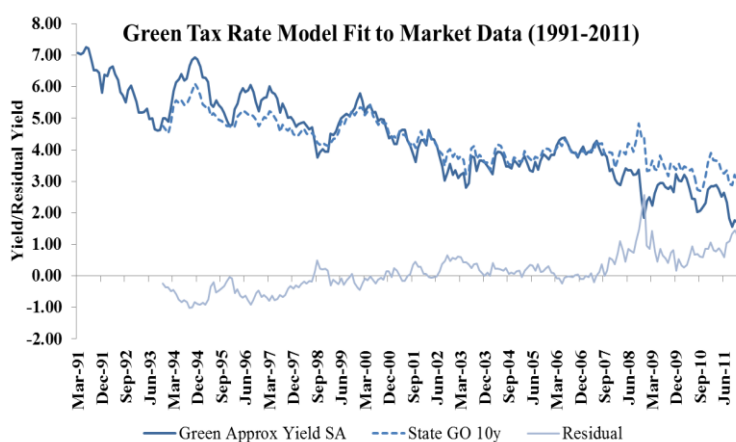
Source: Conning/Bloomberg



Institute
and Faculty
of Actuaries

The Post Crisis World

Models which were once well specified are no longer so



Source: Conning/Bloomberg

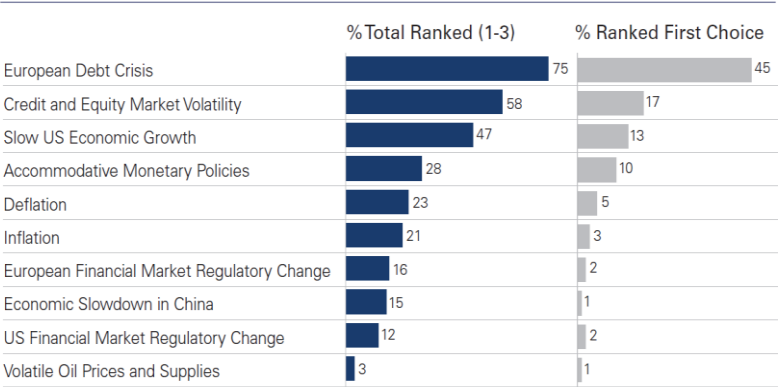


Institute
and Faculty
of Actuaries

The Post Crisis World

And everyone is now concerned about credit risk being everywhere

Which of the following issues pose the **GREATEST RISK TO YOUR INVESTMENT PORTFOLIO** over the next 12 months?



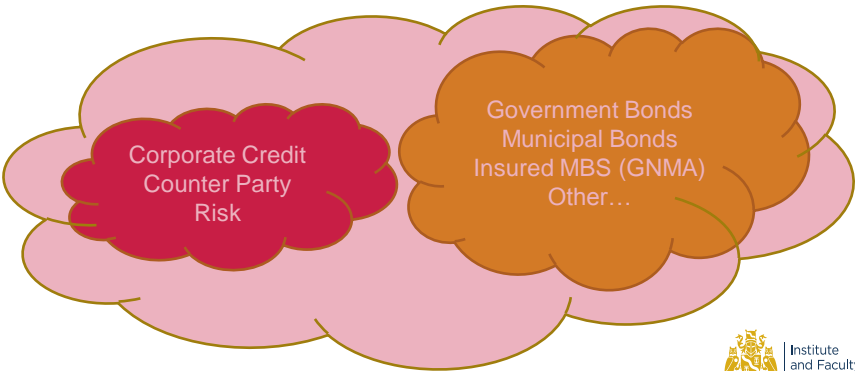
Source: Goldman Sachs



The Post Crisis World

People are asking;

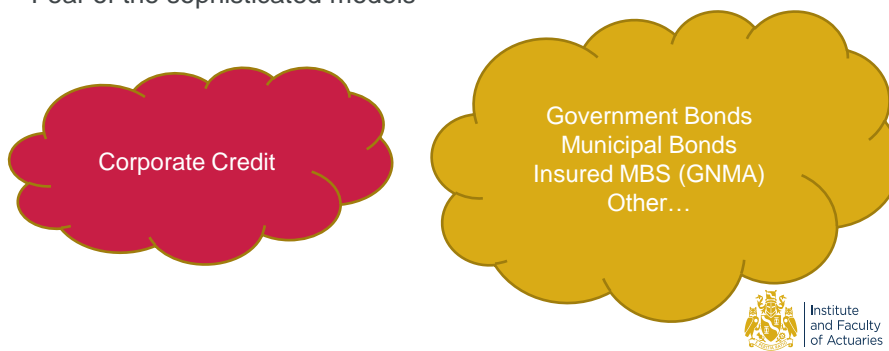
- are my credit risks adequately modeled?
- is my definition of a credit risky instrument broad enough?



Capital Market Modeling Perspective

Most of the models developed for Capital Modeling focused on corporate credit

- Driven partly by the academic literature
- Cost of developing new models
- Fear of the sophisticated models



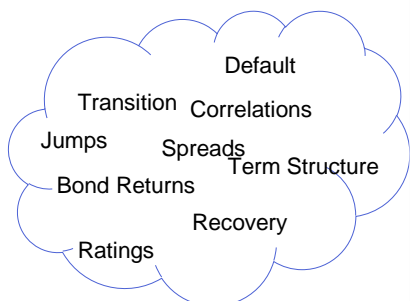
3 Problems in Credit Modeling

erlise
 nsorship
 Thought leadership
 Progress
 Community
 Sessional Meetings
 Education
 Working parties
 Volunteering
 Research
 Shaping the future
 Networking
 Professional support
 Enterprise and risk
 Learned society
 Opportunity
 International profile
 Journals
 Support

15 October 2013

Credit Modeling Problem 1

Mainstream corporate credit models are too simple



Transition Matrix

	AAA	AA	A	BBB	HY	Default
AAA	83.9%	11.7%	1.3%	1.1%	1.0%	0.9%
AA	1.0%	85.5%	9.1%	1.5%	1.5%	1.3%
A	0.1%	3.9%	88.2%	5.7%	2.2%	1.9%
BBB	0.1%	0.6%	6.9%	83.3%	6.1%	3.1%
HY	0.1%	0.3%	0.9%	5.0%	86.7%	7.0%

X

**Deterministic Risk Premia
+
Static Loss Given Default**



Institute
and Faculty
of Actuaries

Credit Modeling Problem 2

The credit risk component does not explain the spreads of credit risky instruments

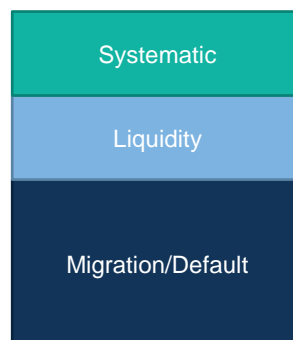
- High spreads imply high default probabilities

Table 7

Results from the regression of credit spread changes on financial and macroeconomic variables.

This table reports the parameter estimates and their Newey-West *t*-statistics from the regression of annual credit spread changes on contemporaneous values in the indicated variables. Change in default rate represents the change in the annual percentage default rate of U.S. nonfinancial corporate bonds for the 1866–2008 period, and the variables represent the corresponding changes in the explanatory variables described in Table 4.

Variable	Coefficient	<i>t</i> -Statistic
Intercept	0.00008	0.27
Change in default rate	−0.00161	−0.17
Stock return	−0.00292	−2.22
Change in volatility	0.00723	2.04
Change in riskless rate	−0.14680	−2.32
Consumption growth	−0.00189	−0.17
IP growth	0.00078	0.37
Inflation rate	−0.00002	−0.01
GDP growth	0.00483	0.83
Adj. <i>R</i> ²		0.1386



Source: Giesecke, Longstaff, Schaefer, Strebulaev, Corporate bond default risk: A 150-year perspective,



Institute
and Faculty
of Actuaries

Credit Modeling Problem 3

There are significant differences in the behaviour of different credit instruments

- Default rates
- Spread behaviour
- Bond Return Distributions
- Mechanics of default and restructuring

We will now look at some of these aspects

- Concentrate on corporate credit and Eurozone Sovereign credit
- Why do we need separate modeling approaches?
- What is possible using state of the art modeling approaches?
- Does it matter?



Default Rates Sovereign vs. Corporate

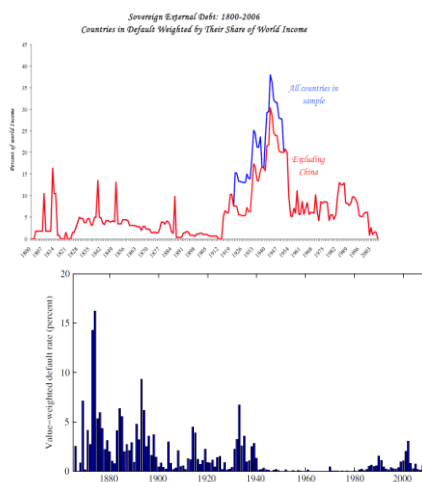


Fig. 1. Historical default rates. This graph plots the annual value-weighted percentage default rates for bonds issued by U.S. domestic nonfinancial firms for the 1866–2008 period.

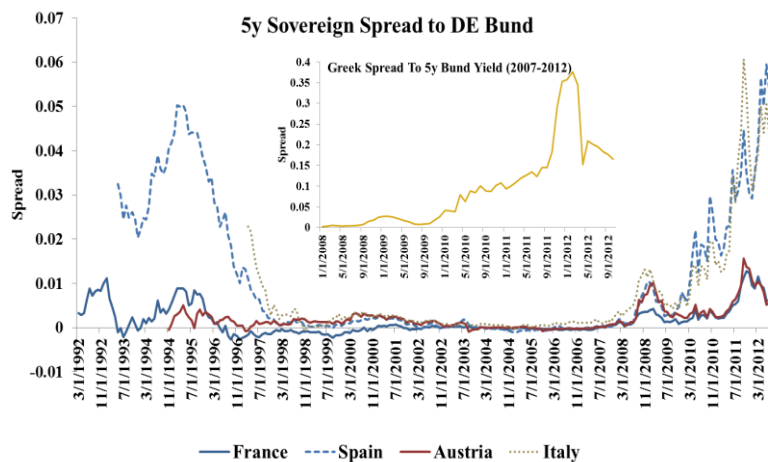
Source: Reinhart and Rogoff "This Time is Different: A Panoramic View of Eight Centuries of Financial Crises" (top), Giesecke, Longstaff, Schaefer, Strebulaev, Corporate bond default risk: A 150-year perspective, (Bottom)

Credit risk is likely to be a significant component of spread

- The Greek situation is nothing new
- In fact the current global situation is timid on a long historical basis
- Corporate default rates have spiked at various points in history too
- Free lunches can become expensive quickly



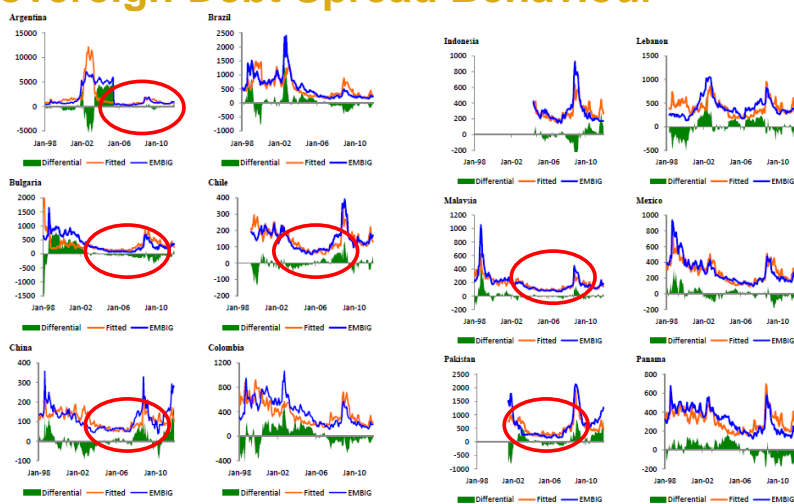
Sovereign Debt Spread Behaviour



Source: Conning/Bloomberg



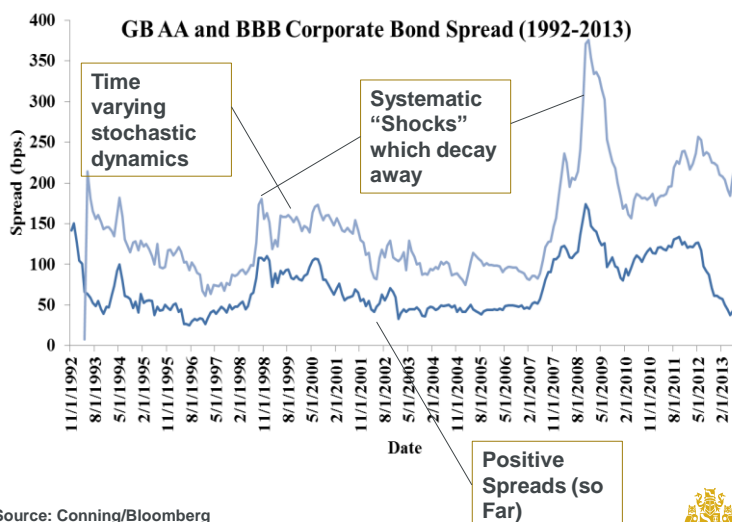
Sovereign Debt Spread Behaviour



Source: IMF Working Paper "Emerging Market Sovereign Bond Spreads: Estimation and Back-testing" (August 2012)



Corporate Bond Spread Behaviour



Source: Conning/Bloomberg

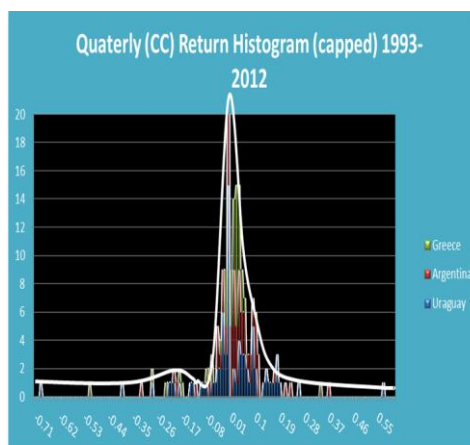


Institute
and Faculty
of Actuaries

Sovereign Debt – Bond Return Distributions

"High Risk" Sovereign Debt exhibits a marked "default hump" in the tail of the return distribution

- More pronounced than High Yield Corporates
- Might imagine given longer histories secondary and tertiary humps due to multiple credit events

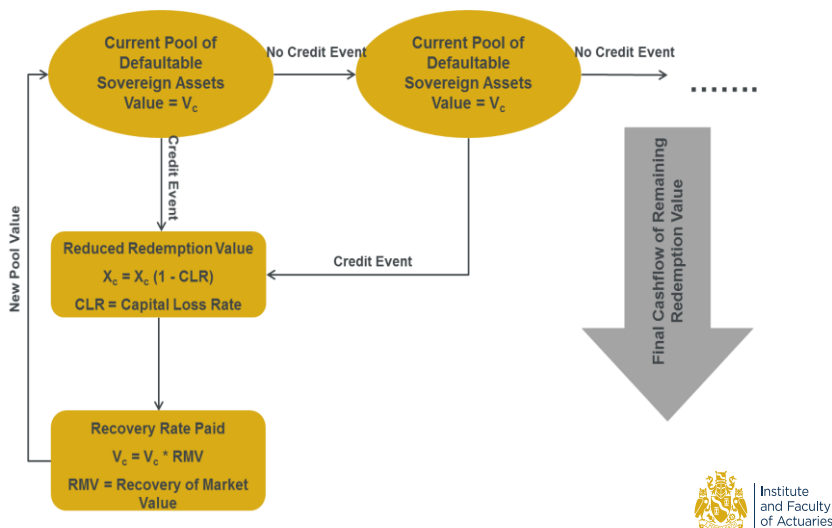


Source: Conning/Bloomberg



Institute
and Faculty
of Actuaries

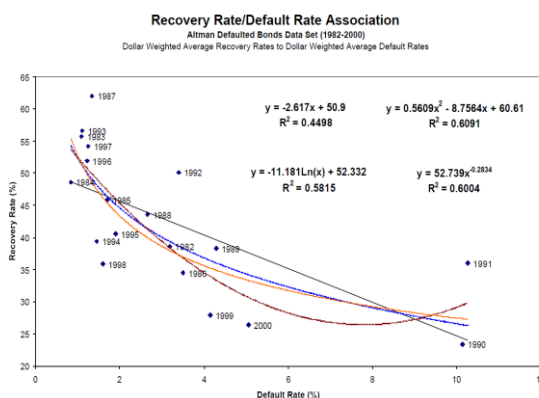
Sovereign Debt – Default Mechanics



Corporate Debt – Default Mechanics

Most corporate defaults are “absorbing” states

- The bonds don't transition out of default
- A recovery rate (RMV) is paid
- This RMV is time dependent and may depend on the prevailing default environment



Source: E. Altman, A. Resti, A. Sironi, Analyzing and Explaining Default Recovery Rates



Institute
and Faculty
of Actuaries

New Credit Modeling Approaches

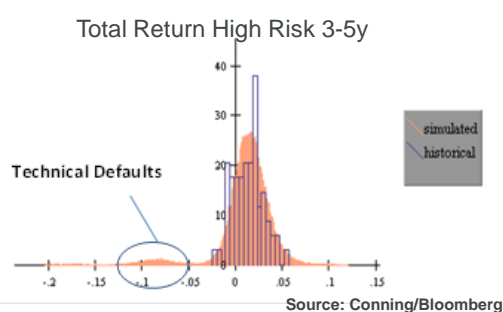
15 October 2013

erlise
 utorship
 Thought leadership
 Progress
 Community
 Sessional Meetings
 Education
 Working parties
 Volunteering
 Research
 Shaping the future
 Networking
 Professional support
 Enterprise and risk
 Learned society
 Opportunity
 International profile
 Support

GEMS[®] Defaultable Sovereign Debt Model

Model of yields and spreads

- Output is a stochastic term structure
- Stochastic credit events
- Reproduces wide range of observed dynamics
- Correlation (incl. tail correlation) with equity, interest rates, corporate bonds and other asset classes
- CLR and RMV
- Relatively Parsimonious (ca. 12 parameters govern the stochastic processes)



Institute
and Faculty
of Actuaries

The GEMS Corporate Yield Model

In 2010 Conning developed a new corporate bond model based on the latest published research

The model is a multi factor arbitrage free model of the corporate credit market

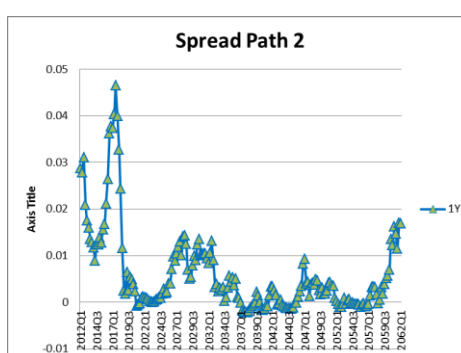
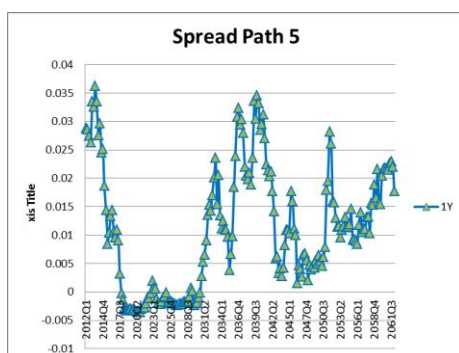
- Stochastic spreads
- Codependency with government yields
- Time varying transition and default dynamics
- Time varying recovery rates
- Real World and Risk Neutral versions
- Ability to produce the jump like behaviour in spreads observed during the 2008 crisis
- Accurate fits to initial market spread curves
- Correlation between spreads of different rating < 1
- Pricing of bonds within an arbitrage free framework



Defaultable Sovereign Spread Sample Paths

Inter Crises Lull and No Return to Pre Crisis Levels

Return to Pre Crises level for Extended Periods of Time



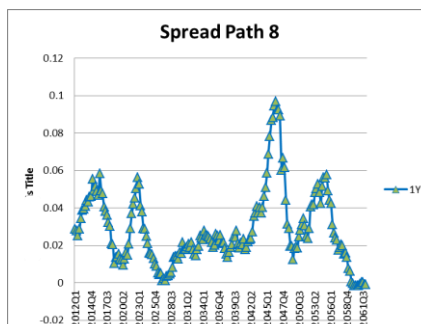
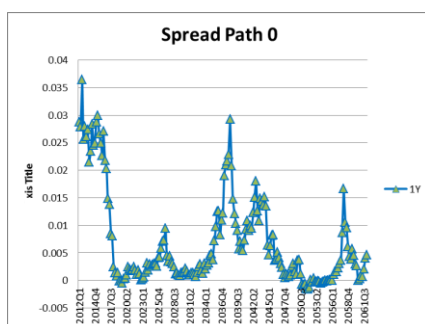
Source: Conning GEMS ESG



Defaultable Sovereign Spread Sample Paths

Periodic Crises Followed by
Return to Pre Crisis Levels

Record Crisis Spreads and
High Default Rates

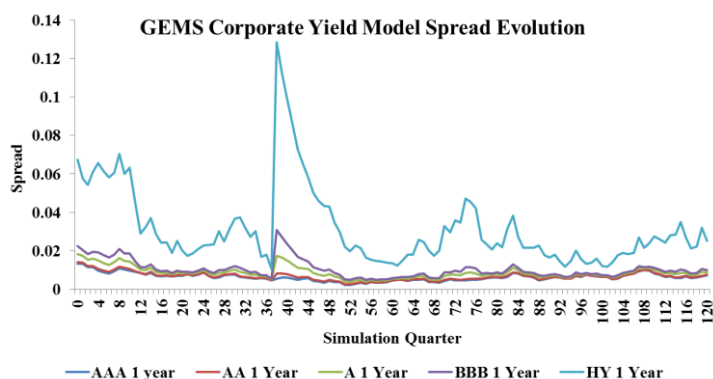


Source: Conning GEMS ESG



Institute
and Faculty
of Actuaries

GEMS Corporate Credit Spread Evolution



Source: Conning GEMS ESG

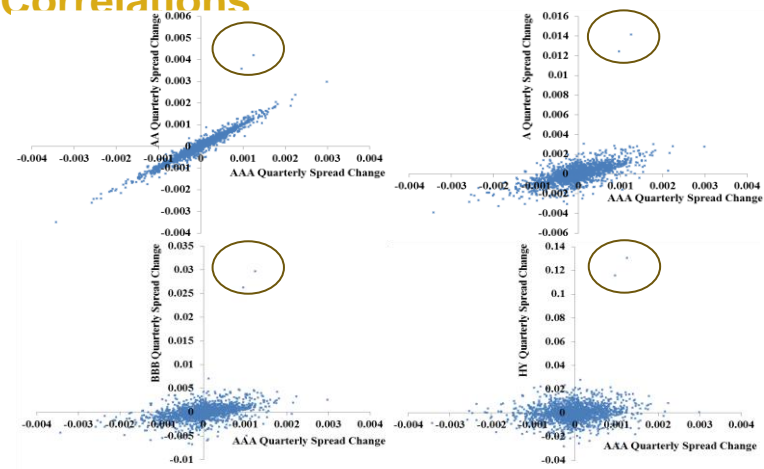
2008 was characterised by a rapidly increasing spreads

- The model incorporates a process for capturing such events
- Jumps decay away smoothly over time



Institute
and Faculty
of Actuaries

Model Corporate Credit Spread Correlations



Source: Conning GEMS ESG



Modeling Sovereign Debt - A Short Case Study

erlise
nsorship
Thought leadership
Progress
Community
Sessional Meetings
Education
Working parties
Volunteering
Research
Shaping the future
Networking
Professional support
Enterprise and risk
Learned society
Opportunity
International profile
Journals
Support

15 October 2013

Sovereign Debt – Common Approaches

Institutional investors investing in this asset class have come under regulatory pressure to adopt a more realistic approach

Several approaches are commonly seen

- Ignore it and treat them as non-defaultable
- Modelling a return index
- Modelling using a corporate bond model (e.g. Merton, JLT, JLT+, other)

None of these approaches is particularly satisfying because Sovereign credit is not like other credit

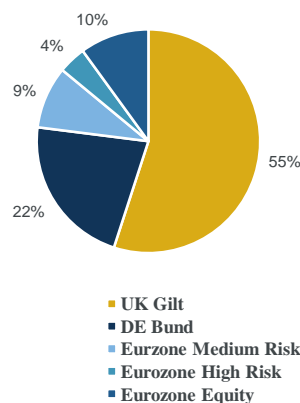


Does Modeling Approach Matter?

Look at Several Portfolios:

- Start from universe of active bonds from UK, DE, Eurozone (at 31/03/2013)
- Consider portfolios with modified durations from 3 to 10 years, initial value GBP 1bn
- Hold duration and asset allocation constant
- Model the Sovereign Debt 3 ways
 - Non Defaultable
 - AA or BBB Corporate
 - Defaultable Sovereign Model

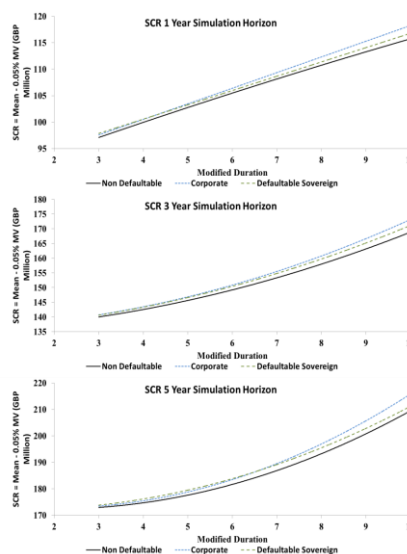
Study Asset Allocation



Result

Differences in cost of capital over 1, 3 and 5 year horizons:

- Low duration portfolios show the smallest differences (ca. GBP750k)
- As duration increases model selection is increasingly important (ca. GBP 1m)
- Corporate bond models generally overestimate the risk
- Non defaultable models underestimate it
- For longer time horizons the differences are generally larger



Source: Conning GEMS ESG



Institute
and Faculty
of Actuaries

15 October 2013

33

Summary

Our view of credit risk has changed

- Our definition is broader
- The need for robust modeling approaches greater

But there are challenges for both researchers and users

- Markets are complex

Sovereign credit differs from corporate credit in a number of important ways

- Spread behaviour – dormant/active “cycles”
- Return distributions – “loss tail hump”
- The precise details of future cash flows post credit events



Institute
and Faculty
of Actuaries

15 October 2013

34

Summary

Some aspects of two models built specifically to address limitations in corporate and sovereign credit modeling were presented

How important is model selection?

- Comparisons with other modeling approaches showed significant differences -> differences become larger with increasing duration

Work still to be done

- Stochastic recovery rates where appropriate
- Liquidity effects

In spite of this improved approaches to credit risk modeling have been developed in the last 6 years. Ultimately we should always aim to use the most realistic granular models, because the effect of model choice is not simple to estimate.



Institute
and Faculty
of Actuaries

15 October 2013

35

Questions

Comments

Expressions of individual views by members of the Institute and Faculty of Actuaries and its staff are encouraged.

The views expressed in this presentation are those of the presenter.



Institute
and Faculty
of Actuaries

15 October 2013

36

Disclaimer

This document is prepared and issued by Conning Asset Management Limited ("CAML"). CAML is authorised and regulated by the Financial Conduct Authority. The information contained in this document is confidential and is intended solely for the recipients to whom it is transmitted by CAML.

The information in this document is not and should not be construed as any advice, recommendation or endorsement from CAML to any legal, tax, investment or other matter. Nothing in this document constitutes an offer to deal in investments, to buy or sell any security, future, option or other financial instrument, to provide advisory services or to form the basis of any contract or contractual obligation. This document is not to be reproduced or used for any purpose other than the purpose for which this document was prepared and transmitted by CAML. It should not be distributed to or used by any persons other than the intended recipients without the prior consent of CAML.

CAML is a member of the Conning group of companies and may provide investment management and advisory services together with group companies in the United States of America, Ireland, Germany, and Hong Kong. Such clients may not have the benefit of rights designed to protect investors under the regulatory system of the United Kingdom.

Any statistics contained within this document have been compiled in good faith and do not constitute a forecast, projection or illustration of the future performance of investments. The past performance of investments is not necessarily a guide to future returns. Values of investments may fall as well as rise, and changes in rates of exchange may cause the value of investments to rise or fall in value, such that investors may not receive full return of capital invested.

The information contained in this document is compiled from internal and other sources which we consider to be reliable or are expressions of our opinion. Whilst every effort has been made to ensure that the information is correct at the date of publication, CAML does not guarantee the accuracy or completeness of the information. Recipients of this document need to evaluate the merits and risks of the information provided. Decisions based on the information contained within this document are the sole responsibility of the recipient. With the exception of statutory obligations, CAML, its Directors, officers and employees accept no liability whatsoever for any loss or damage which may arise in relying on any opinion, expression or conclusion contained within this document, its content or otherwise arising in connection with this document.

Legal Disclaimer

Copyright 2013 Conning, Inc. This document and the software described within are copyrighted with all rights reserved. No part of this document may be reproduced, transcribed, transmitted, stored in an electronic retrieval system, or translated into any language in any form by any means without the prior written permission of Conning. Conning does not make any warranties, express or implied, in this document. In no event shall Conning be liable for damages of any kind arising out of the use of this document or the information contained within it.

This document contains information that is confidential or proprietary to Conning (or their direct and indirect subsidiaries). By accepting this document you agree that: (1) if there is any pre-existing contract containing disclosure and use restrictions between your company and Conning, you and your company will use this information in reliance on and subject to the terms of any such pre-existing contract; or (2) if there is no contractual relationship between you and your company and Conning, you and your company agree to protect this information and not to reproduce, disclose or use the information in any way, except as may be required by law.

ADVISE®, FIRM®, and GEMS® are registered trademarks of Conning, Inc.



Registered in England No. 3654447
FSC Registration Number: 189316

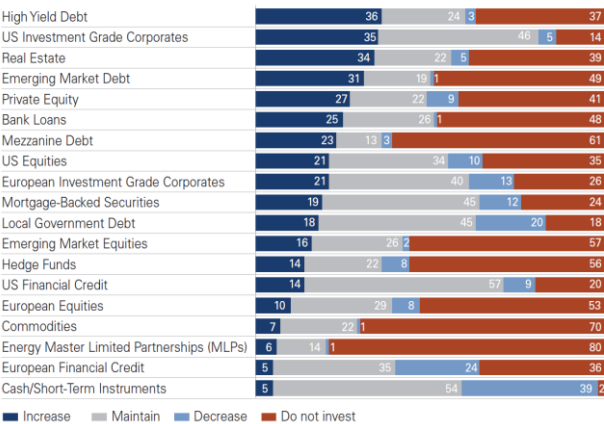
C11# 1657353
Registered Office : 55 King William Street, London, EC4R 9AD

The Post Crisis World

And as interest rates fell allocations to credit risky asset classes increased

- This is likely to continue
- Credit risks must be properly managed

Are you planning to increase, decrease or maintain YOUR ALLOCATION to the following asset classes in the next 12 months? (%)



Source: Goldman Sachs

