Modelling Corporate Bonds

Current Issues In Life Assurance
London 28 April 2004 / Edinburgh 20 May 2004

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Presentation Outline

- Why model corporate bonds?
- Corporate bond investment characteristics
- Monte Carlo models
- Explaining bond spreads
- Conclusions
Why Model Corporate Bonds?

I hold them anyway and I need to model all my investments for realistic balance sheet / individual capital assessment.

I want to investigate whether I should diversify into corporate bonds, and if so, how much is best to hold.

I want to understand the impact of credit risk for product pricing and my own company share price.
Corporate Bond Investment Characteristics
Recent Good Corporate Performance

Source: Barclays capital
UK Corporate Bond Spreads: History

10 year yield spread over gilts

Source: Merrill Lynch / Datastream

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Historic Cumulative Default Rates

Source: Standard and Poor’s EU 2003 Default Study
Monte Carlo Models
Some complex individual bond models are now being used for capital modelling work.

Transition matrix
default by credit grade
spread by grade / term
recovery rates
correlation between bonds
rebalancing rules
new purchases / issues
correlation with reinsurer bad debt
correlation with stock market

Individual Bond Models
Structural Model (Merton)
Equity = Geared Equity + Debt

- Credit spreads reflect an option premium
  - Interest is expensed in accounting terms
  - but the option has cost and value
- Prestige ratings reflect lower option value
  - not “better” companies
Credit Graded vs Structural Models

- Model by grade is close to how portfolios are managed in practice
- Grades are subjective, out of date and sometimes arbitrary
- Historic data excludes the main catastrophe where modelling is needed

- Easily market consistent, because spread is a market price
- Correlations: bond/bond and bond/equity easily calibrated
- Structural model output can be arranged into bands and expressed as transition matrix
Modelling Dilemma: Why we need to be careful about small effects

- Under arbitrage-free models, corporate bonds behave like a (dynamically rebalanced) mixture of gilts and equities. There is one equity risk, but two places in a model where that risk is priced – the equity model and the corporate bond model.
- A strategy “sell equities and buy corporate bonds” is a close substitution whose attractiveness is very dependent on asset model parameters – in particular the relative cost of equity risk implicit in the equity ad corporate bond models. Worse still, the decision can be dependent on flukes of a particular set of random simulations.
- Danger that asset selection outcome determined by asset model calibration and not (much) by business dynamics
Explaining Bond Spreads
Historic Default << Yield Spreads

Source: S&P EU study

annualised historic defaults

yields vs gilts

Source: Merrill Lynch / Datastream

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Yield Spread vs Default

- Yield spread >> historic default rates
- How do we explain the differences?
  - free lunch?
  - sampling error?
  - risk premium?
  - gilt collectors’ premium?
  - liquidity premium?
Default Risk Premiums are Explainable

- Default involves extreme downside events
- The existence of skews in volatilities is well known in out-of-money options
  - default equates with extreme out-of-money puts
- Yield spread vs default difference not an obvious anomaly
- If your asset model does not capture equity skew effect then its probably not worth trying to replicate historic bond defaults

Skew effect:

FTSE 100 implied vol
Source: LIFFE
Historic Default Rates = Small Samples
So true default rates very uncertain anyway

Source: Standard and Poor's EU 2003 Default Study

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The Peso Effect: Rare default events are over-represented if they occur in the data set and under-represented if they do not.

Value of 1 Argentine Peso (in US$ - left scale)

Yield spread – Argentine vs US 3 month rate (right scale)

Source: DataStream
We can extrapolate equity returns but it is difficult to do the same for bond defaults.

Historical defaults offer no convincing tool for estimating a 1 in 200 year credit event. Therefore avoid over-emphasis on historical transitions and concentrate on market prices (spreads) instead.
Swap / Gilt spread explained by:
credit risk (repo vs libmid)
and transaction costs (libor vs libmid)

... so gilt collectors’ item effect and corporate
bond liquidity effect probably 5 bp at most

Credit 15
TC’s 10
Others 0
= Swap-Gilt 25 bp

Source: Datastream
Corporates – Subtle Considerations

- Corporate bonds might behave like equity plus gilts, but tax, statutory valuation and ECR treatment is different.
- Liquidity – needed to maintain credit exposure within limits, so estimate transaction costs carefully.
- Investment management costs, including risk management and audit.
- Possibility for income from repo market (especially on most liquid gilts if there is a squeeze and they go special on repo).
- What matters is effect on a life office *relative to what is priced into bonds in the first place.*
Conclusions
Conclusions

- Many similarities: puzzles for corporate bonds and puzzles for equities
  - why is the risk premium so high?
  - free lunch vs efficient markets vs arbitrage-free

- Building a complicated simulation model can (maybe, just maybe) give additional insights
  - Risk that a decision to hold corporate bonds (or not) is effectively hard-coded in the guts of an asset model calibration rather than deliberate consequence of the business model

- If an investment looks too good to be true - it probably is
  - actuaries’ equity free lunch claims discredited
  - let us not repeat the mistake with corporate bonds
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