



The Actuarial Profession

making financial sense of the future

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.

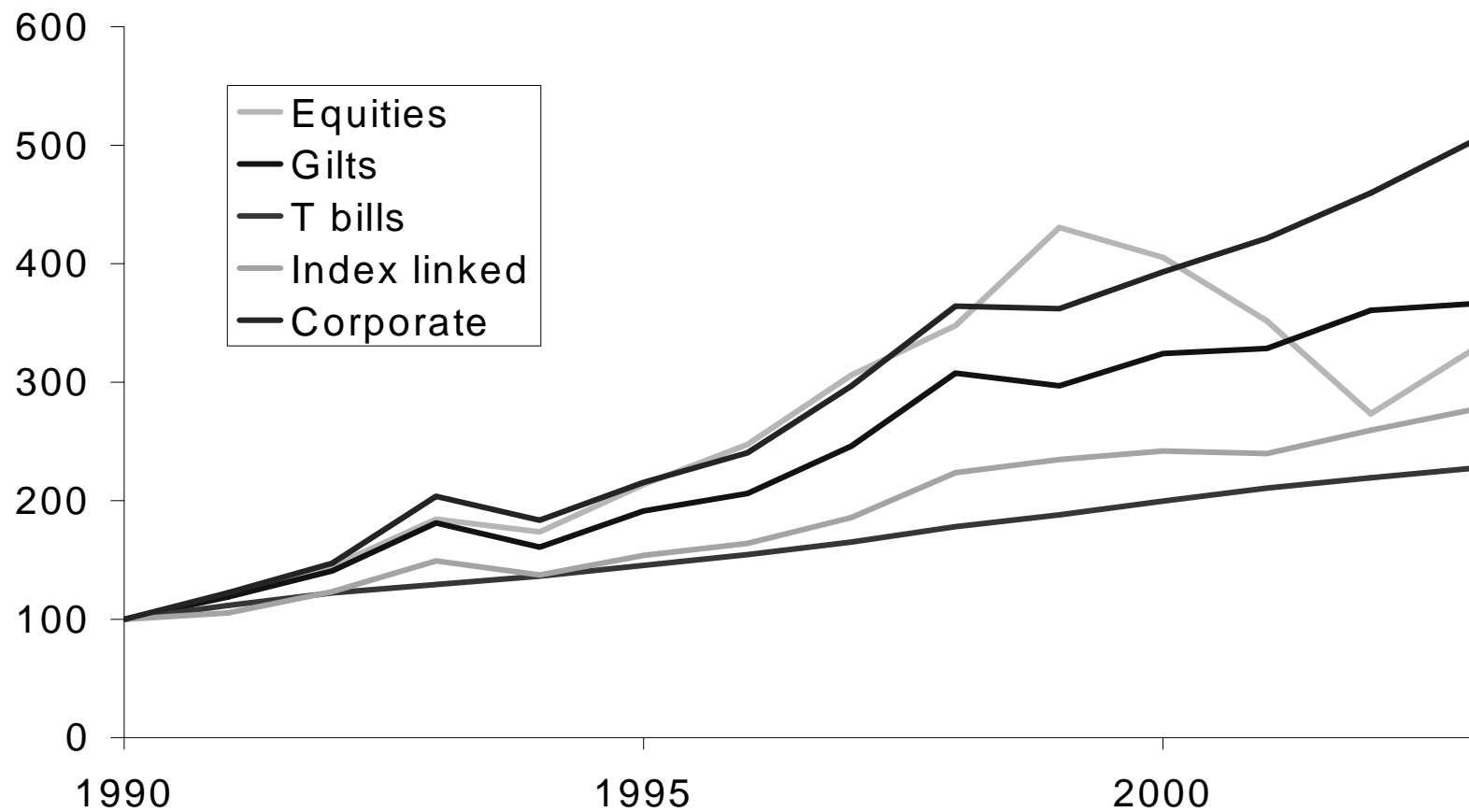


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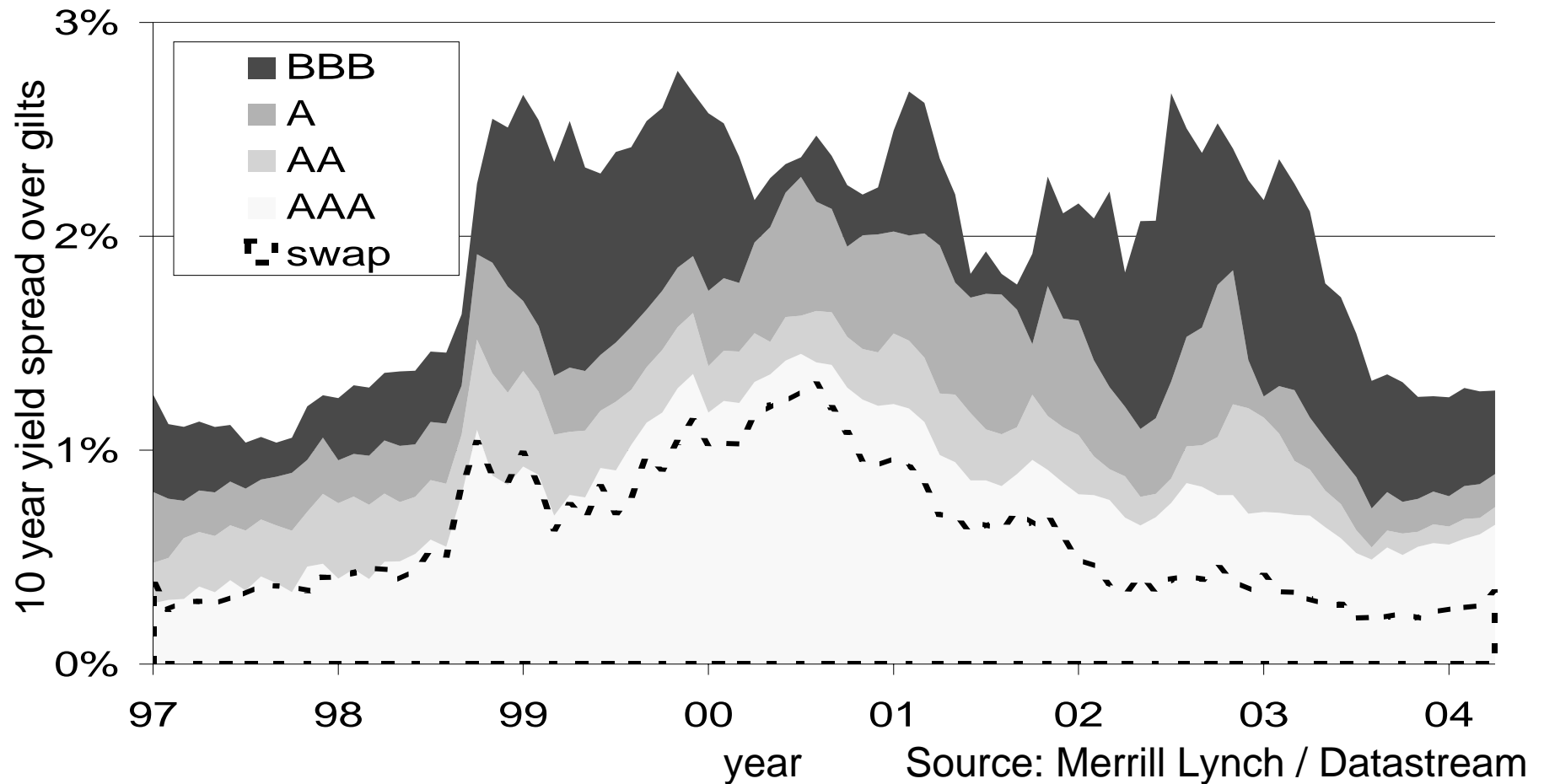
Corporate Bond Investment Characteristics

Recent Good Corporate Performance

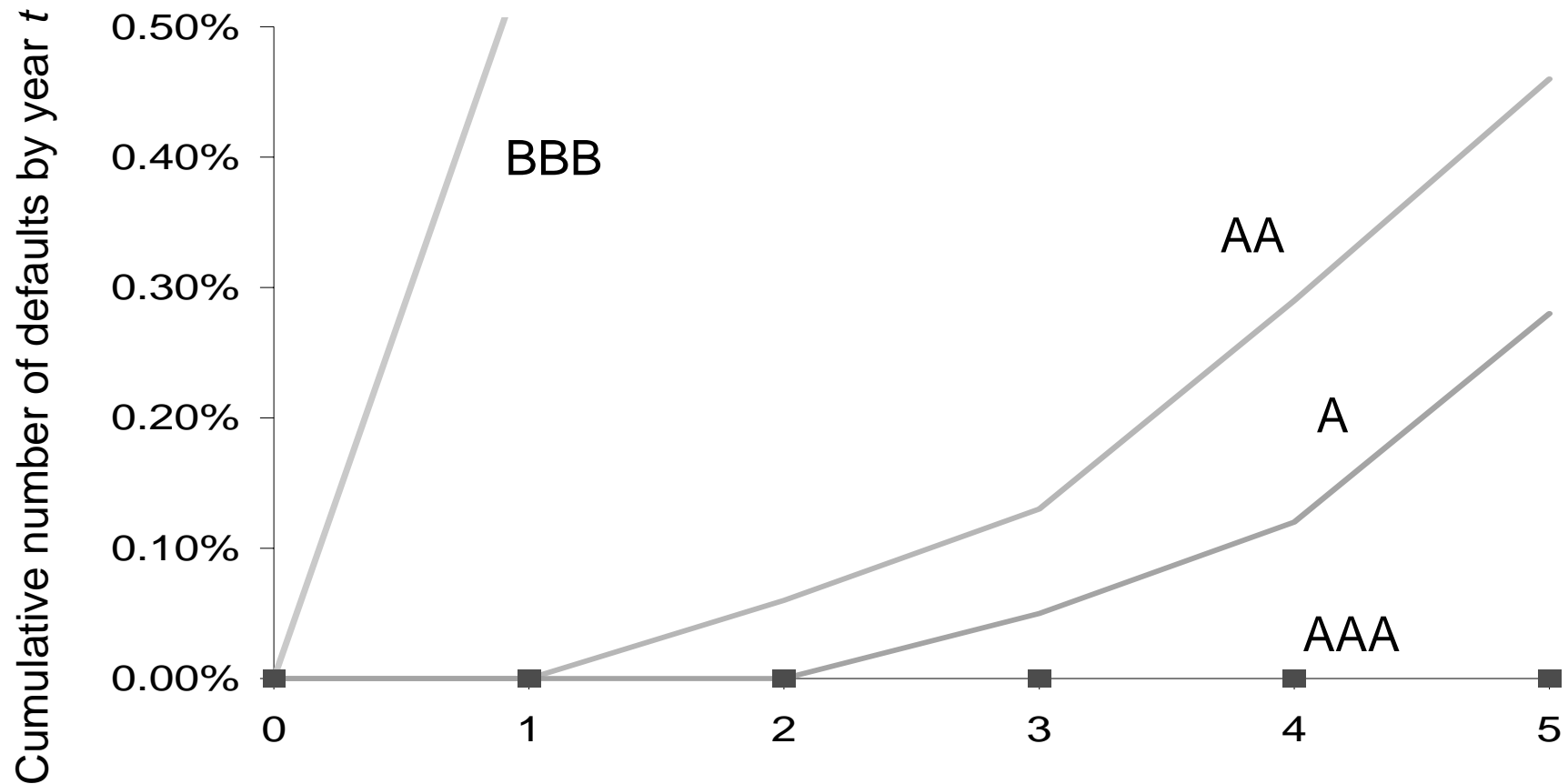


Source: Barclays capital

UK Corporate Bond Spreads: History



Historic Cumulative Default Rates



Source: Standard and Poor's EU 2003 Default Study



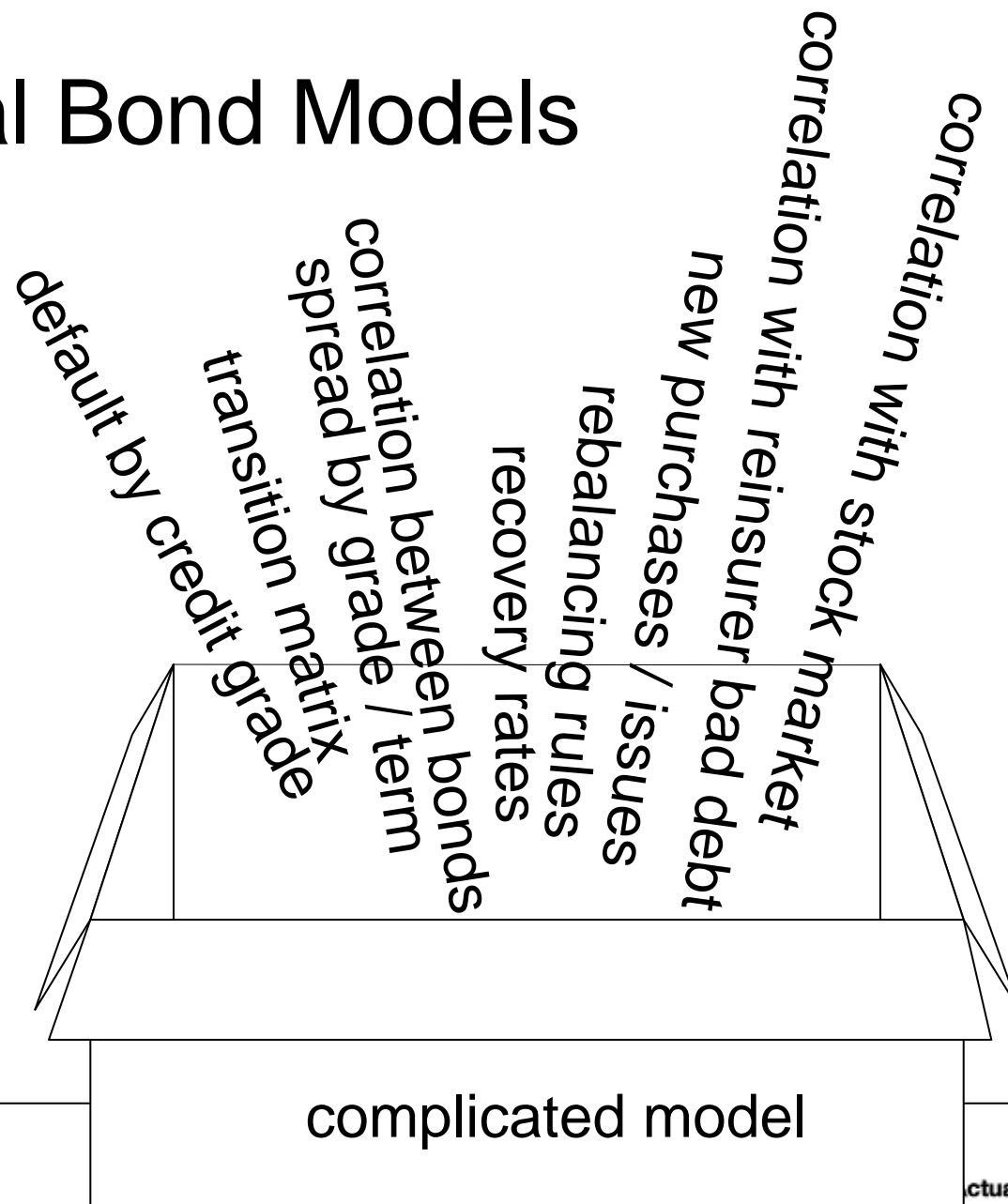
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Monte Carlo Models

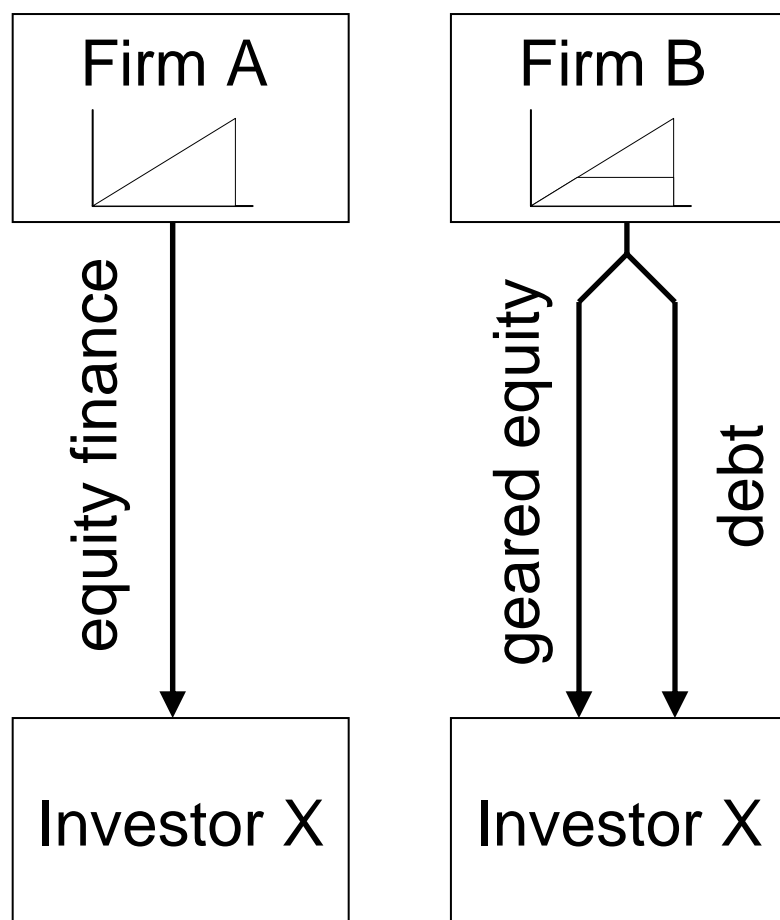
Individual Bond Models

Some complex individual bond models are now being used for capital modelling work.



Structural Model (Merton)

$$\text{Equity} = \text{Geared Equity} + \text{Debt}$$

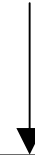


- Credit spreads reflect an option premium
 - Interest is expensed in accounting terms
 - but the option has cost and value
- Prestige ratings reflect lower option value
 - not “better” companies

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 and 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

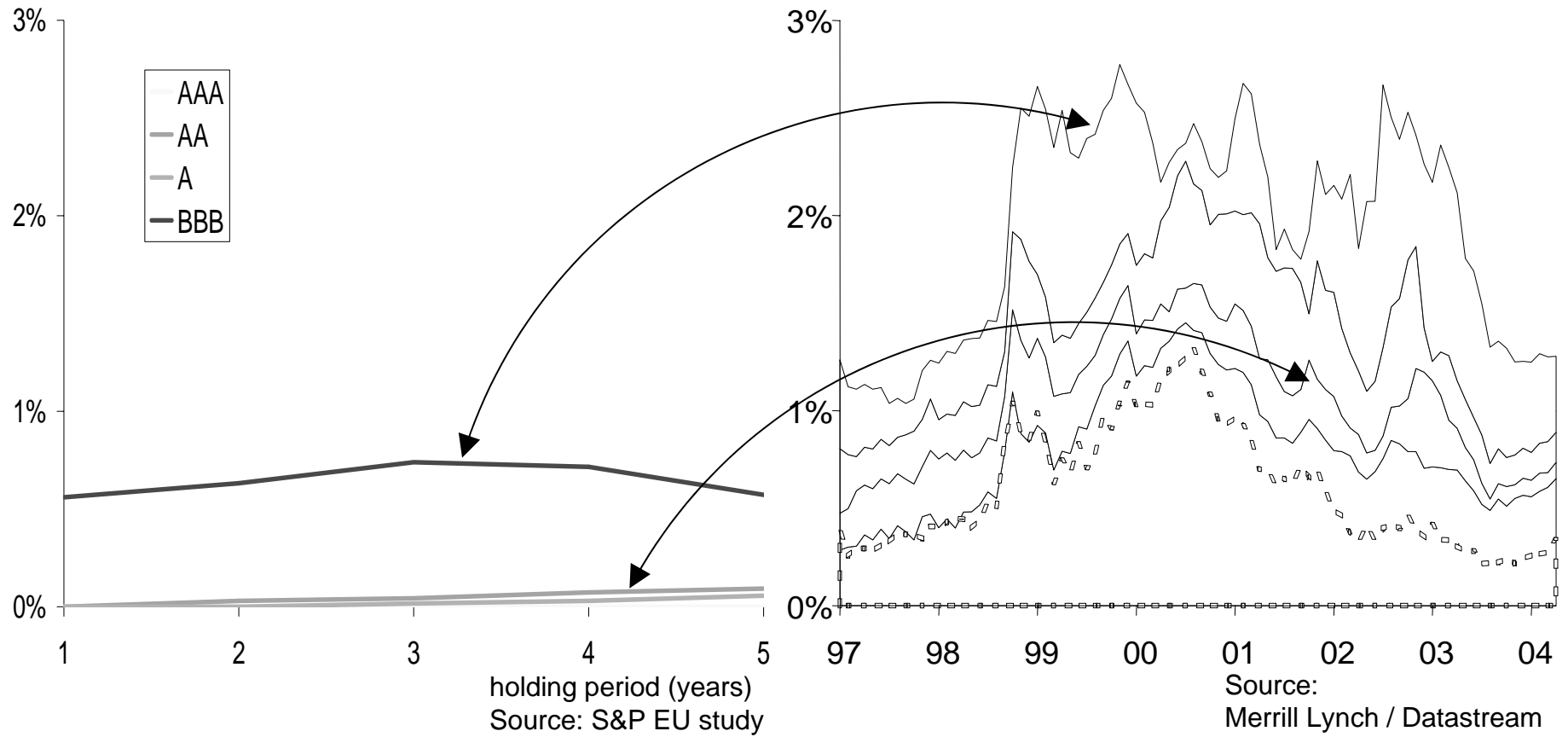


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Explaining Bond Spreads

Historic Default << Yield Spreads



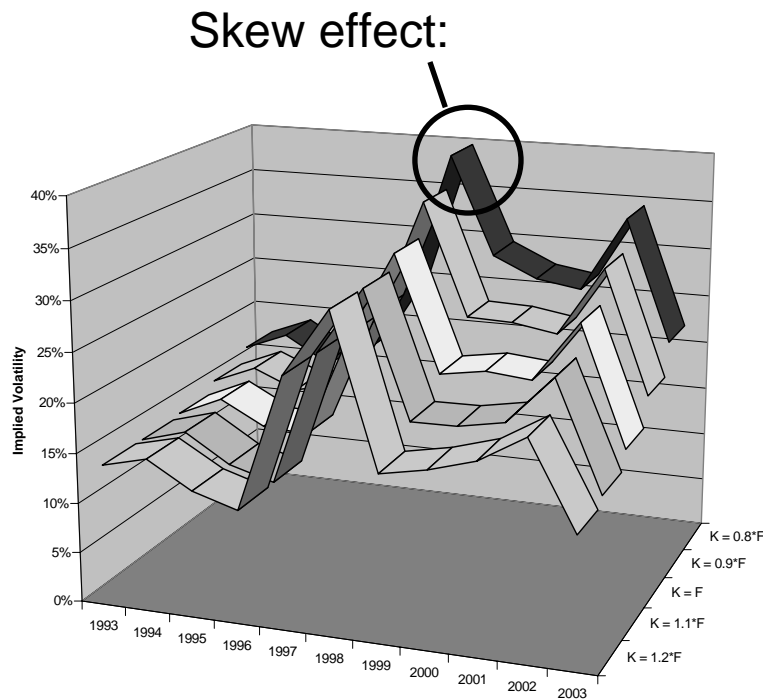
annualised historic defaults

yields vs gilts

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

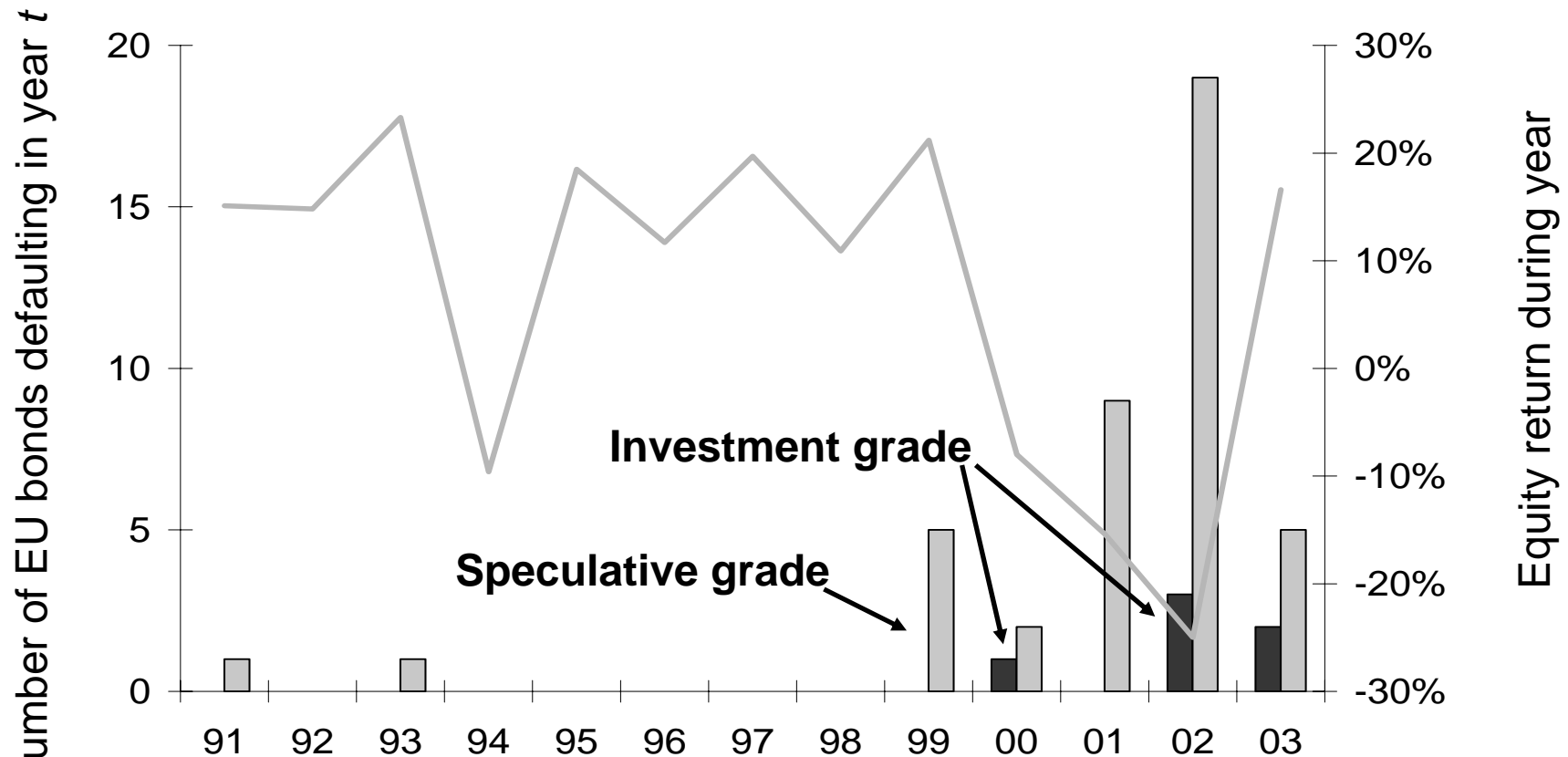


FTSE 100 implied vol
Source: LIFFE

- Default involves extreme downside events
- The existence of skews in volatilities is well known in out-of-the-money options
 - default equates with extreme out-of-the-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

Historic Default Rates = Small Samples

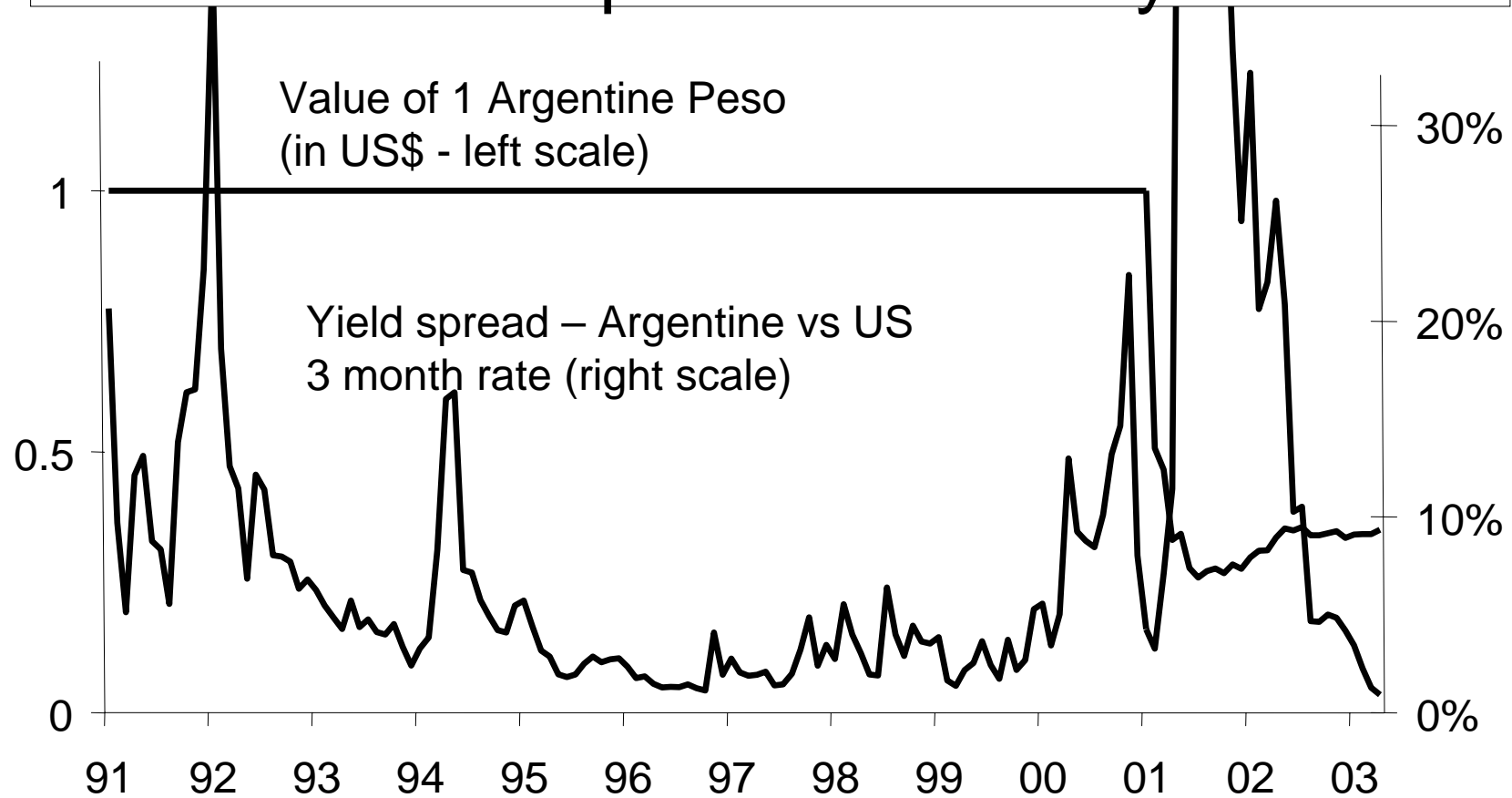
So true default rates very uncertain anyway



Source: Standard and Poor's EU 2003 Default Study

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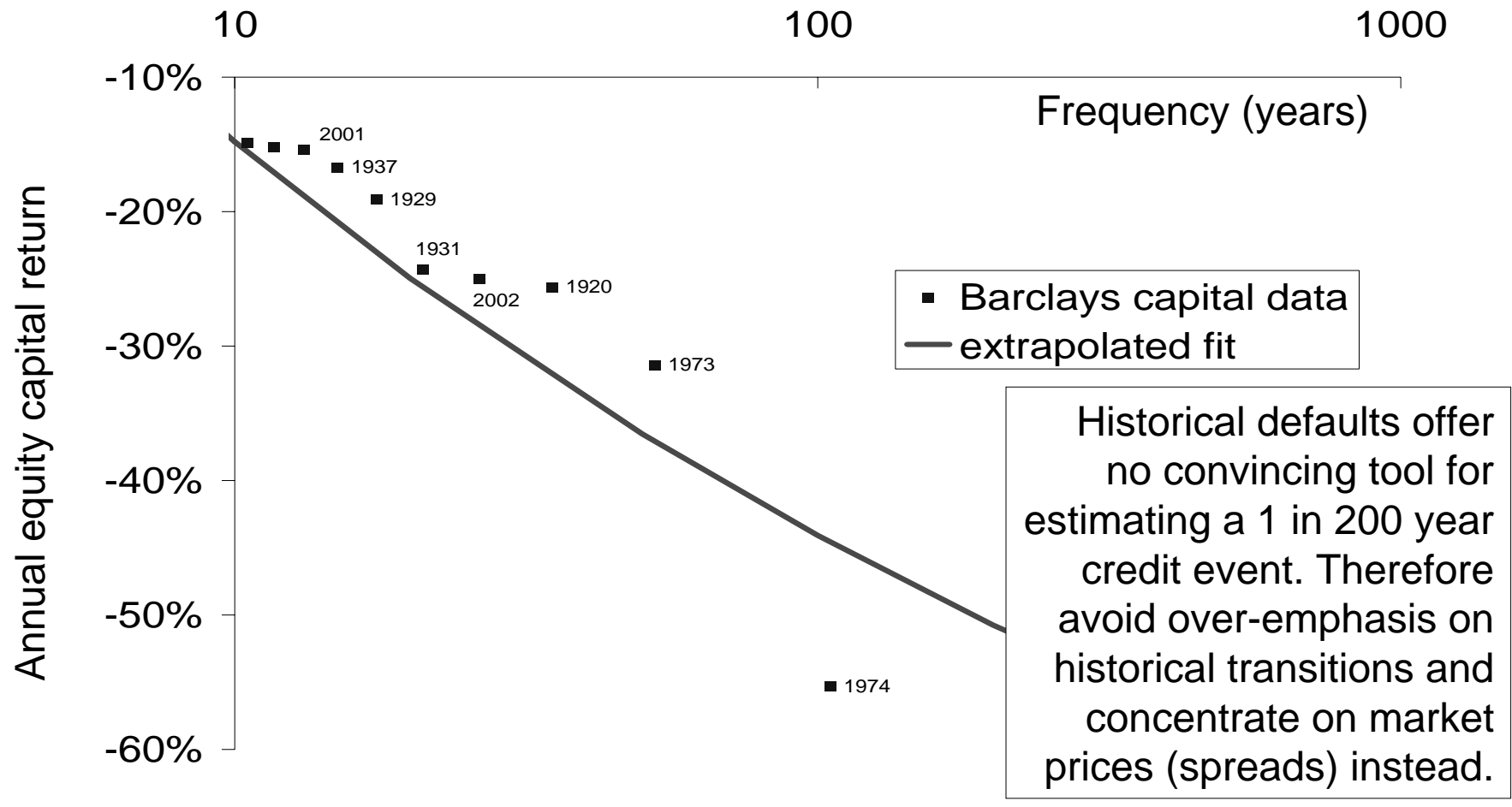
The Peso Effect: Rare default events are over-represented if they occur in the data set and under-represented if they do not.



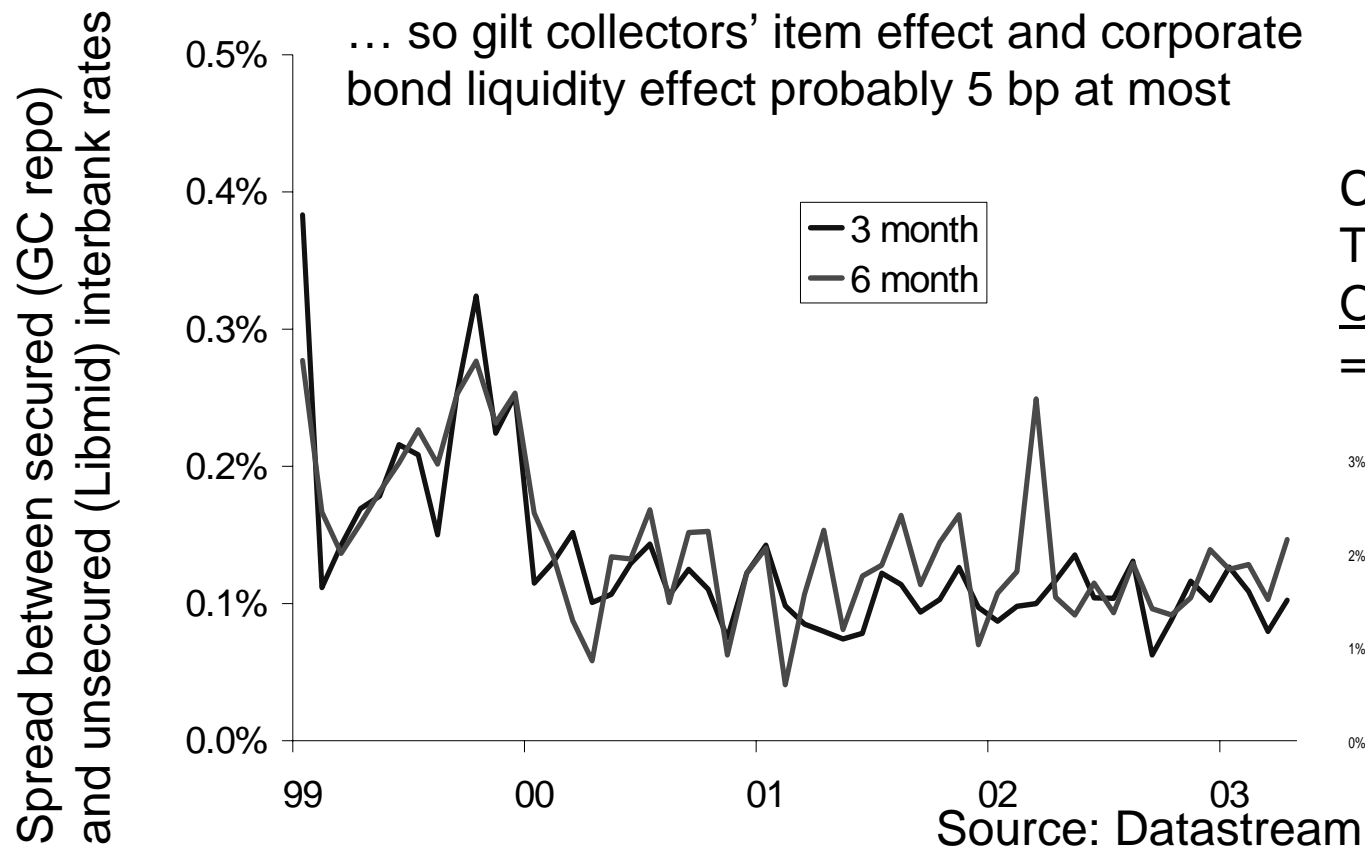
Source: DataStream

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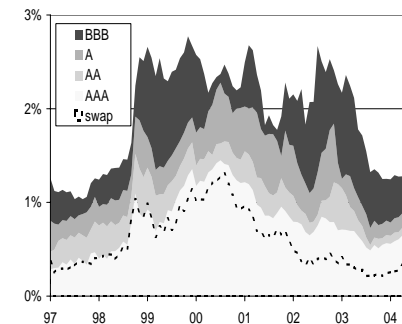
We can extrapolate equity returns but it is difficult to do the same for bond defaults



Swap / Gilt spread explained by: credit risk (repo vs libmid) and transaction costs (libor vs libmid)



Credit	15
TC's	10
<u>Others</u>	<u>0</u>
= Swap-Gilt	25 bp



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*



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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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