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A projection approach to understand credit risk drivers for illiquid collaterals

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Contents

Introduction

- In the wake of the GFC modelling delinquency and default drivers for retail models let alone less data-driven/less liquid specialised lending exposures has become a real challenge when considering how to 'tune' point in time (PIT), through the cycle (TTC) and downturn models.

- For specialised lending portfolios is made even more severe, though the problem can ultimately decompose itself to:

  - What is the underlying valuation of the asset when there may exist, limited or no secondary or tertiary sales markets to determine a reliable depreciated value?

  - How does the resultant value behave in times of market downturn?

- Thus this presentation provides a framework to assess the value for specialised and illiquid lending; namely Object Finance under current and possible stressed market scenarios and the effects on the underling LGDs and EADs; credit risk factors (CRF).

Understanding Specialised Lending

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Basel II November 2005 Revision to the international capital standard notes:

Paragraph *223.*

Object finance (OF) refers to a method of funding the acquisition of physical assets(e.g. ships, aircraft, satellites, railcars, and fleets) where the repayment of the exposure is dependent on the cash flows generated by the specific assets that have been financed and pledged or assigned to the lender.

A primary source of these cash flows might be rental or lease contracts with one or several third parties. In contrast, if the exposure is to a borrower whose financial condition and debt-servicing capacity enables it to repay the debt without undue reliance on the specifically pledged assets, the exposure should be treated as a collateralised corporate exposure.

Understanding Specialised Lending

Object Finance has a number of differing names

Object Finance	≡	Structured Asset Finance
		Specialised Leasing Assets

At its core though Object Finance Exposures (OFE) covers the following leased asset classes in practice:

–Rolling Stock
–Shipping
–Aircraft
–Yellow Goods

Issues in Risk Modelling for OFEs

Issues in Risk Modelling for OFEs

There are two primary classes of drivers for OFE risk models

Exposure : These are a class of drivers that relate to the underlying contractual and financial characteristics of on exposure (train, plane etc). This include but are not limited to:

- Income/ repayment pattern
- Term structure and loan term
- Contractual and repayment terms (this would also include the likely depreciation structure, guarantees and any accounting issues)

Structural : These are a class of drivers that relate to the underlying environmental and economic conditions that effect the collateral value:

- Market conditions (this relates to the underlying residual value (RV)* of the asset)
- Economic

* Residual Value is the fair market value of an asset at the end of its lease term.

Issues in Risk Modelling for OFEs

The GFC and its aftermath raise some important questions OFE risk modelling

Pre-GFC	Post-GFC
While its was difficult to get enough data to be able to model changes in RV and in turn understand credit risk associated with a OFE even in case of collateral where a limited or small re-sale market exists you could reasonably rely on: •Some pooled P&L collateral data •What resale data that was available •Publically and rating agency asset pay-outs	Now you given the borrower default and the trickle down of SME and corporate bankruptcy means that relying on the data from the past is of even less use, put simply the past needs to be modified and not just normalized for comparable economic conditions.

Data paucity on what amounts to illiquid traded/purchased collateral is the central issue in each case above, in a post GFC world though the data you thought you had from the past is even less use.

Directions in OFE Risk Modelling

Scenario based stochastic cashflow projection

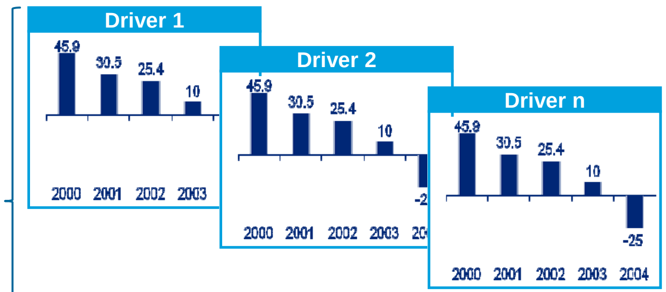
Directions in OFE Risk Modelling - Scenario based stochastic cashflow projection

At its basis OF risk modelling is a cashflow modelling problem…

The modelling of the cashflows can be deterministic, this is though a single realization/path of a stochastic cashflow projection, the question to consider for a moment then is can we use the stochastic cashflow modelling approach to frame what possible RVs could result?

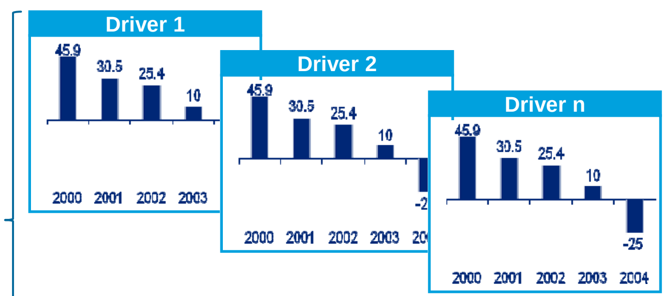
OF RV Drivers

Exposure

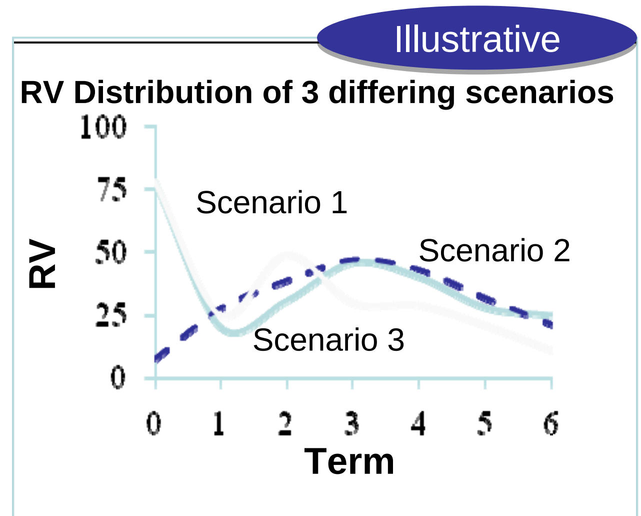


For each exposure driver there will be a distribution over time depending on the scenario

Structural



For each structural driver there will be a distribution over time in some cases they may be be structural economic drivers a clear asset projection model



RV → **CRFs**

Stage 1 | **Stage 2** | **Stage 3**

Directions in OFE Risk Modelling - Scenario based stochastic cashflow projection

Walking through the process for a moment

Stage 1 – Driver Models

- For each class and sub-class of exposure and structural driver model a statistical/expert driven model is need to determined to range the driver can take.
- In the case of economic models a structural econometric model as an example is stochastically driven
- There is need for for all of the driver models to be linked to a single factor model so as determine the depreciation rate on the asset.7

Stage 2 – Cashflow modelling

- A cashflow model for each scenario is created it notes the lease repayments from which the RV can be determined.

Stage 3 – Scenario Selection

- From the cashflow model stage a range of RVs are presented as a function of the facility term.
- From the range of RVs a minimum margin for RV can be determined.

Directions in OFE Risk Modelling - Scenario based stochastic cashflow projection

So looking at a simplified case for a moment – Single period case

Assume we have n rental payments for the object (plane, train etc) and a payment of L for each payment. Now we further assume that the payments are due at equal periods and for simplicity sake ignore any guarantees as part of the rental payments.

Unlike the classic models of McConnell and Schallheim (1983) or Miller and Upton (1976) we assume:

1.The distribution of the rate of economic depreciation on the asset is non-stationary as a function of time.

2.Returns on the asset are <u>not</u> lognormally distributed.

Directions in OFE Risk Modelling - Scenario based stochastic cashflow projection

So looking at a simplified case for a moment – Single period case (cont'd)

Using the single period valuation model as per Wang (2008) we arrive at

$$L = A_{t-1} - \frac{[1-\mu_{1/2}(A_t d)]\exp[\mathrm{cov}(\frac{A_t d}{A_{t-1}}, y)]A_{t-1}}{(1+r_f)} \qquad (1)$$

A_i is the value of the asset at $i = (0,1,..,t)$, r_f is the risk-free rate, y is the market rate factor and importantly d is the driver-based depreciation rate and has the general form for

$$d = \sum_{j=1}^{k} w_j . dr_j \qquad (2)$$

Where for d_{r_j} is a scalar for the driver and w_j the weights (as determined as part of as business unit workshop/focus group) for each w_j. The d_{r_j} are either structural or exposure classes.

Hence to determine the RV ignoring any costs we have for RV anytime within in n payments, for all $i = (0,1,..,t)$

$$RV_i = d.A_i \qquad (3)$$

Directions in OFE Risk Modelling - Scenario based stochastic cashflow projection

So looking at a simplified case for a moment – Single period case (cont'd)

It is important to note that we have described an extremely simplified case here with one payment and have ignored a range of guarantees and 'frictional' costs.

This is also one realisation/scenario of d, in the case of calculating this for real life case it d would in fact become the vector $\boldsymbol{D}$ s.t

$$D = \begin{bmatrix} d_1 \\ d_2 \\ . \\ d_m \end{bmatrix} \quad (4)$$

Where $\boldsymbol{D}$ is the m scenarios for each of the drivers that ultimately provide a distribution for each $dr_{j.}$ From this is it then possible to determine a s over the different scenarios for an asset an in turn determine a minimum RV margin that aligns with a confidence interval that is the same as an ADIs credit rate ($\sigma_{0.005}$ equates to a 99.95%*)

Outcomes for Credit Risk Factor Models for OFEs

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Relating the revised framework as described in the previous section has a clear follow on effect for determining CRF for an OF portfolio.

By having a vector ***D*** of scenarios to provide distributions of dr_j we thus have means of determining the asset depreciation under different scenarios and can in turn determine the LGD and EAD under each of these different scenarios.

Range of scenarios

LGD

Determine a range of asset values and thus have more control over the LGD rather than point estimate based on a measure of standard deviation of the OFE class.

EAD

Possible range of CCFs/ haircuts can be determined as a function differing asset values by determining

Outcomes for Credit Risk Factor Models for OFEs

The benefits of using the framework outlined for determining CRF

–Allows for a distribution of OFE collateral values that help to inform LGD and EAD under each of these different scenarios.

–Means for a down-turn LGD, it can be calculated, and depending upon the stress-testing regime employed by an ADI it canbe consistent with it, yet at the sametime tailored to the underlying OFE type (plane, train etc).

–Can be used to assess the quality of current standard deviation methods for determining CRFs.

–Can be incorporated as part of an 'early warning' triggers program when looking at the underlying 'health' of a OF portfolio and its underlying assets.

References

Bellalah, Mondher, Thema, and Cereg, 2002, ‘Valuing lease contracts under incomplete information: A real-option approach,’ The Engineering Economist, 47:2, 194-212.

McConnell, John J. and Schallheim, James S., 1983, ‘Valuation of asset leasing contracts’, Journal of Financial Economics 12,237-261.

Miller, Merton H. and Upton, Charles W., 1976,’Leasing, buying, and the cost of capital services’, The Journal of Finance, Vol. 31,No.3, pp. 761-786.

Wang, Z., 2008, ‘Valuation of Lease Contract and Credit Risk’, IAM, MSc Thesis