STRESS AND SCENARIO TESTING (SST) METHODOLOGY

Confidence in the reliability of mortgage portfolio stress tests, conducted at loan segment level, was shaken by the credit ratings given to those sub-prime bonds which subsequently failed.

Dr Stephen Satchell, Economics Fellow, Trinity College, Cambridge and Director of Research, MIAC | Acadametrics Ltd, developed our procedure for stressing residential mortgage portfolios at individual loan level. In his paper, *"Stress and Scenario Testing for UK Residential Mortgage-Backed Securities; A Methodology for Loan-by-Loan Testing"*, Dr Satchell explains how his Macro-Risk Model is used to calculate a risk weight appropriate to a set of macro-variables and how this weight, in turn, is used as input in our stress tests to enable our estimates to be made under a variety of macroeconomic scenarios. In this paper we explain the stress tests themselves.

The FSA 05/2 paper required lenders to consider a future "extreme event" e.g. a repeat of a "historical event". SST calculates losses under a repeat of 1991 when almost 1 in 10 of all loans taken out in 1989, with loan to value (LTV) ratios of 95% or more (but less than 100%), were the subject of repossession. This was a "historic worst case", the data from which we employ to estimate the Probability of Possession (PP) and the Loss in the Event of Possession (LIEP) for each individual loan in a current book, were future risk, as measured by the Macro-Risk Model, to equate to that in 1991. We also calculate the PPs and LIEPs likely under three additional scenarios, comprising our "historic severe case", another representing the "current" scenario and a "client" case, such as the FSA "anchor" scenario.

Accurate house price data are needed for accurate collateral valuations. As standard, SST employs the Land Registry-based "Acadametrics Residential Asset Calculator" (ARAC) prices yielding considerable accuracy at portfolio level and providing standard deviations for each property enabling use of costly AVM/surveyor valuations to be made only for specific loan cases.

Following our partnership agreement with MIAC Analytics from New York, SST methodology is now provided with their powerful DataRaptor database management and WinOAS cash flow tools, accessible through our UK based secure server, for desktop work.

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STRESS AND SCENARIO TESTING (SST) METHODOLOGY **26TH SEPTEMBER 2011**

1. PREAMBLE

1.1 Introduction. This Stress and Scenario Testing (SST) Methodology paper should be read in conjunction with Dr Satchell's paper *"*Stress and Scenario Testing for UK Residential Mortgage-Backed Securities; A Methodology for Loan-by-Loan Testing*".* In his paper, Dr Satchell explains his approach to stress testing and how the Macro-Risk Model, which he developed for us, calculates a risk weight appropriate to a set of macro-variables and how this weight, in turn, is used as input in our stress tests to enable estimates to be made under a variety of future macroeconomic scenarios. This Stress and Scenario Testing (SST) Methodology paper provides further detail.

1.2 Experience. Our combined UK/US team brings a wealth of experience and a "corporate memory" encompassing, as it does, experience from the UK 1989-1991 housing crisis including practical knowledge of the way in which the crisis impacted upon UK lenders and Mortgage Indemnity Guarantee (MIG) insurers, as then seen from within both sectors. From the US, we bring MIAC Analytics: long experience in working for numerous banks and government agencies; understanding of both secondary and capital markets, pricing, risk management and accounting issues for the mortgage and financial services; DataRaptor and WinOAS database management and cash flow platform.

1.2.1 In 1988, UK insurers regarded MIG as an almost claims-free business. Our 1988 forecast that £5 billion losses could ensue, for MIG insurers and lenders combined, as a result of the house price spike which followed the "Lawson boom" and the 1987 removal of double income tax relief on mortgage interest for property purchases by two people, was unprecedented. In fact, as our history of the crisis "*Mortgages in Shock*" (available upon request) describes, the subsequent loss was some £10 billion.

1.2.2 In 1989, following requests from all of the "centralised" lenders, which had begun to operate in the UK using securitised funding, Dr Satchell replicated the seminal Green & Shoven redemption model employed in the USA. This redemption forecasting work was interrupted by the breaking arrears and repossession storm which led to our focus upon loss modelling. Dr Satchell assessed mortgage risk on our behalf for MIG insurers and lenders continuously from 1991 to 1999, when rising house prices convinced lenders that mortgage risk was something of the past and the one remaining active composite MIG insurer withdrew from the market. As examples, for one task, Dr Satchell employed option price theory to forecast repossessions and, for another, applied Markov Chain analysis to assess which loans would recover in a non-performing book being priced for sale. In a major project, Dr Satchell led our modelling of the reserving for the actuarial team of a top composite insurer.

1.2.3 From 1999, we resumed research into house prices (always a key issue in loss estimation), developing our FT House Price Index, launched in 2003 by the Financial Times, now widely published as the LSL Property Services/Acadametrics House Price Index and freely available upon request. As explained in 2.3, we use the data underlying the index within our collateral valuation procedure. Following the advent of Basel II, we resumed our work with lenders and maintained the on-going research and development which is a key driver of our consultancy. With mortgage risk currently one of the principal areas of management and regulatory attention, we believe that, as in 1988, our independent, research-based solutions are of significant value to all institutions exposed to or advising about residential mortgage risk.

1.2.4 Our downturn default data are derived mainly from the above work consequent upon the 1989-1991 housing crisis. Our downturn default database comprises well over ½ million loans originated during the period 1986-1996 and some 45,000 defaults with substantial loss detail. We also draw upon more recent data to assess e.g. the impact of arrears status on the probability of repossession. Our data provide detail as to each property which became subject to repossession and the amount of the loss incurred by the lender, with and without the effect of MIG cover. Sufficient geographic coverage exists to identify losses within different areas and the effect of the value of a property, relative to the regional average, on the sale price following repossession.

1.2.5 MIAC | ACADAMETRICS In 2008, Acadametrics and New York-based MIAC Analytics agreed to combine Acadametrics stress and scenario testing and collateral valuation data and software with the MIAC DataRaptor OLAP database management and WinOAS cash flow engine. In what was a substantial joint undertaking, MIAC adapted their software to match UK lending practice and data, including anglicising the MIAC terminology and redeveloping our software to sit on their platform. Our joint company MIAC | Acadametrics Ltd enables the MIAC platform, with collateral valuation and SST, to be accessed through our secure UK server. The platform equips lenders with a powerful solution to the need for loan-level mortgage risk analysis and clients may use SST in-house or upload their data to the server for analysis by MIAC | Acadametrics and return.

2. STRESS AND SCENARIO TESTING

2.1 Stress Testing. In 2005, the FSA provided a definition of stress and scenario testing[1], stating that *"Stress testing typically refers to shifting the values of individual parameters that affect the financial position of a firm and determining the effect".* Our Stress and Scenario Testing (SST) appropriately varies a group of parameters or coefficients used in modelling the Probability of Possession (PP), the Loss in the Event of Possession (LIEP) and the Expected Loss (EL) of individual mortgages to obtain an estimate of the aggregate EL for a portfolio.

2.1.1 The appropriate probability of possession, taken from our historic downturn default database and provided in the form of possession hazard rate tables, is used by the model to estimate the likelihood of possession for each individual mortgage in a current portfolio. Likewise, probabilities of prepayment/redemption, also derived from our historic data, are used to assess the number of loans that will still be on the books in future years which will affect future losses. Losses from our downturn default database are used to assess the loss that will be incurred for each loan should it go into repossession.

2.2 Scenario testing. The same FSA definition[1] states that *"Scenario analysis typically refers to a wider range of parameters being varied at the same time ... Scenarios ... could ... be those relating to extreme*

[1] Appendix 1 of the FSA Paper 05/2 "Feedback on DP05/2" December 2005 provides the following "Definition of stress testing". *"Stress testing typically refers to shifting the values of individual parameters that affect the financial position of a firm and determining the effect on the firm's business. Scenario analysis typically refers to a wider range of parameters being varied at the same time. Scenario analyses often examine the impact of catastrophic events on a firm's financial position, for example simultaneous movements in a number of risk categories affecting all of a firm's business operations - such as volumes, investment values and interest rate movements. Scenarios generally could also be considered under three broad categories. For example, changes to the firm's business plan, scenarios that involve changes in business cycles and those relating to extreme events. Firms can derive the scenarios in a variety of ways - by using stochastic models, analysing historic experience or repeating a historical event. Scenarios can be developed with varying degrees of precision and depth."*

events. Firms can derive the scenarios in a variety of ways – by ... analysing historic experience or repeating a historical event". As noted, our Macro-Risk Model enables a variety of macroeconomic parameters to be varied simultaneously and calculates a single risk measure which is used to vary the probability measures employed in our stress testing. As proposed by the FSA, our "historic worst case" models a repeat of the risk level last seen in the 1991 *"historical event".*

2.2.1 Dr Satchell and colleagues at the University of Cambridge established that the key macroeconomic variables which affect loss are the mortgage interest rate, inflation rate, unemployment rate, affordability, house price and GDP growth. Hence, these are the macro-variables employed within the Macro-Risk Model to calculate a risk weight for the particular macroeconomic scenarios under which loss forecasts are required. In addition to providing forecasts based on specified macroeconomic scenarios, we provide, as standard, a forecast based upon a "historic severe case" as well as one based upon the "historic worst case".

2.2.2 Repossession cases arose in 1991 from almost 1 in 10 loans, taken out in 1989, in the 95-<100% LTV band with analogous levels in other bands. This "historic worst case" is risk weighted by the Macro-Risk Model at 2.5 times the long-term 20 year average. Our SST "historic worse case" forecast provides the PPs and LIEPs which we estimate will arise should an extreme event, with comparable risk, recur.

2.2.3 Whilst our "historic worst case" represents 1989 mortgages in shock, our "historic severe case" represents a smoothed outcome, using the repossessions which arose from mortgages incepted from 1988-1991 with repossessions mainly emerging over the period c.1991-1993. The Repossession Risk chart in Dr Satchell's above paper shows a weight of 2.5 for the "historic worst case". This compares with a risk weight of 1.0, for the UK mortgage book, shown in Dr Satchell's paper, measured using Council of Mortgages (CML) data earlier this year and equating to the 20 year average.

2.2.4 In order to forecast the PPs and LIEPs under a "current" scenario or one defined by the "client", the ideal model would directly relate the performance of each loan to a specified set of macro-variables. However, as Dr Satchell explains in his paper, the data required to build such a model do not exist. Instead, as noted, the Macro-Risk Model takes a set of specified macro-variables and calculates a corresponding risk weight. These risk weights, prepared for Dr. Satchell at Cambridge, are used to scale the historic possession hazard rates to assess the rates for the "current" and "client" scenarios. The latter are built into client-specific versions of SST for use either by ourselves or by the client. Such possession hazard rates can be supplied for a number of scenarios of interest to a client. Additionally, we can vary the Macro-Risk Model to employ particular macro-variables, not currently amongst those noted by Dr Satchell.

2.2.5 Dr Satchell explains in his paper how, as an example**,** we employ the FSA Pillar 2 "anchor"[2] macro-variables, if chosen as the "client" scenario. This involves assessing the appropriate annual rates, inputting these into the Macro-Risk Model and flexing the SST hazard rates according to the risk weight calculated by the Model.

2.2.6 For simplicity, we have referred to sets of possession hazard rates; sets of redemption/repayment rates are also supplied for our "historic worst case", our "severe" case and for "current" and "client-defined" scenarios.

[2] we quote the FSA Prudential Risk Outlook 2011 which specified the 'anchor scenario as: *"one of weak global growth"; "a decline in UK GDP of 4.3% from Q4 2010 to Q4 2012, with gradual recovery thereafter"; "a rise in the UK unemployment rate to a peak of 12.4% in Q1 2013"; "a 'double-dip' in UK property prices, with house prices falling by 20.7% from the beginning of the scenario to the trough."*

2.3 Collateral valuation. Lenders have gone from free use of the traditional regional house price indices to the employment of an Automatic Valuation Model (AVM) provider or the engagement of surveyors for portfolio revaluation. Use of the lender indices, with regional data available only on a quarterly basis, provided what was never more than an approximate valuation, but one which was quite acceptable when house prices rose year upon year and the collateral within a portfolio was not a risk issue. In today's financial climate the errors caused by use of quarterly data, let alone by use of data at regional level, result in valuations which our research shows to be significantly in error. A surveyor or an AVM provides the most accurate valuation but is expensive for regular use. Our solution is to employ our Acadametrics Residential Asset Calculator (ARAC) prices in our SST indexation procedure. ARAC prices are based upon the Land Registry (LR) data underlying our LSL Property Services/Acadametrics House Price Index, are updated monthly and provide average prices at county/London borough level by the four LR property types.

2.3.1 Our "Testing Indexation" paper describes what we believe to have been a pioneering test of indexation. We took a portfolio of 405,023 house prices, for which sale prices were recorded on the Land Register, together with an earlier recorded price, and revalued each property from its earlier to its most recent sale date using the Halifax, Nationwide, Communities and Local Government (CLG) indices and our early ARAC data. We constructed ratios of each indexed value to its corresponding recorded value; these ratios would ideally be close to one but differ by a substantial margin at individual property level. Averaging the results over the whole portfolio, however, demonstrated that using ARAC for revaluation provides an answer very close to one. Within the ARAC output, we provide a measure of the standard deviation of the above ratios for each property and for the whole portfolio.

2.3.2 ARAC. The standard deviations of the ratio for each individual property mentioned above allow lenders to apply a surveyor or AVM valuation only to each property for which the ARAC valuation is outside required limits. Such limits would become important e.g. for those high loan to value (LTV) loans which are under arrears management procedures, for which the level of collateral is an important factor. Accuracy measures are also important for properties for which a sale is being sought, following repossession, but for which an estate agent's suggested selling price falls below ARAC bounds. Where a lender possesses a prior set of surveyor or AVM house prices for a portfolio, use of ARAC for, say, quarterly or six-monthly revaluations would be an optimal procedure.

2.4 Results. SST provides lenders with a guide to future loss outcomes based upon repossession data arising from a past crisis, as opposed to data from the extended benign period experienced by lenders until quite recently. Our results have been validated against factual outcomes at portfolio level for a number of mortgage books By employing possession hazard rate tables, we provide an SST forecasting methodology which is quantitatively based; as such it comprises a more structured procedure than does e.g an Expert Judgement Model.

3. POSSESSION HAZARD RATE AND REDEMPTION/PREPAYMENT RATE MATRICES

3.1 Minimum mortgage book. In considering the minimum size of a mortgage book required for accuracy in modelling, Dr Satchell (2004)[3] assumes that, in an ideal world and for simplification, all individual mortgages have the same probability of default leading to repossession and states *"From this assumption, it is possible to assess how many loans we need to measure default with reasonable accuracy – a minimum number of 200,000. However, this can be mitigated if we impose some structure on the problem or use*

[3] "Data Pooling: a Necessity for the Majority of UK Mortgage Lenders". June 2004, Credit Risk International.

external information. We can model probability of possession for individual loans with some degree of accuracy using possession hazard rate functions and redemption/prepayment rate functions."

3.2 Loan Level Characteristics. As distinct from the macro-variables used in the Macro-Risk Model, Dr Satchell identified LTV and loan seasoning as key identifiers from a loan book of the probability that an individual loan will fall into possession (PP). In addition, arrears status acts as a multiplier up or down of the PP. Hence the SST model takes into account these loan characteristics with other required data, as specified in 4.1.

3.3 Matrices. In order to assign different probabilities to loans with differing initial LTVs and seasonings, we create matrices for a number of different years and combinations of years of origination, covering the period from 1988-1995 during which there was a significant level of and variation in default. These matrices provide the possession hazard rate h (t) and redemption rate r (t) according to LTV band and year of seasoning and according to whether a "historic worst case" or a "historic severe case" outcome is required.

3.3.1 As described in 2.2.4, our Macro-Risk Model[4] enables us to flex the historic possession hazard rates to take account of the specific macro-variables applicable to either the "current" scenario or one requested as "client". In addition the rates are flexed according to the arrears status.

3.3.2 Based upon past experience, development of a set of possession hazard rates continues from inception for ten years ahead or more whilst redemption/prepayment rates tend to increase in the first two years of seasoning and with higher LTV bands, whilst also being subject to commercial considerations such as the availability or otherwise of attractive alternative products. At durations greater than 144 months, we see little or no falling off with increasing seasoning and SST rates are set equal to those in the last column of the matrix, entitled ">144 months". It should be noted that the probabilities reflect only the macroeconomic variables which applied at the start of the projection period under the selected scenario.

4. MODEL INPUT DATA

4.1 Input data fall into the following categories:

- loan level mortgage book data from the lender
- probability tables from Acadametrics
- macro-variables, taken from the Stress and Scenario Testing (SST) Parameters, for input to the Macro-Risk Model
- derived variables
- forecast variables

4.1.1 loan level mortgage book data from the lender

The minimum fields of mortgage book data required to conduct the stress test are as follows:

- development year of the mortgage
- purchase price/original valuation of the property
- original loan value

[4] The Macro-Risk Model was prepared by Dr. Satchell using macroeconomic data at quarterly intervals from 1992 to the present; the methodology is available for SST clients upon request .

- current balance of the loan
- initial mortgage rate (and date of reversion to standard variable or some LIBOR-related rate)
- monthly repayment
- arrears (in months or in monetary terms)
- Government Office Region or postcode[5]
  - North
  - North West
  - Yorkshire & Humberside
  - Wales
  - West Midlands
  - East Midlands
  - East Anglia
  - South West
  - South East
  - Greater London
  - not specified
- mortgage type (capital/interest, interest only or some intermediate formula)
- property type (Land Registry designation)[5]
  - detached
  - semi-detached
  - flat
  - terraced
  - not specified
- product type[6]

4.1.2 data checks. Prior to any modelling, a series of data-checking sense and integrity tests is applied and any records that fall outside pre-specified parameters are notified to the mortgage lender for correction, exclusion or unique treatment. Furthermore, if more than 5% of the records are excluded, we communicate with the lender to resolve any issues of interpretation and data analysis before the scenario analysis continues.

4.1.3 bucketing. If a mortgage lender wishes the results of the modelling to be "bucketed" or "represented", such characteristics need to be provided in the download. Where the required data integrity and bespoke output work may affect cost and timing, we will notify the client and seek agreement prior to proceeding with the additional data manipulation and processing involved.

4.2 probability tables from Acadametrics include the following:

- possession hazard rate matrix[7]
- redemption/prepayment rate matrix[8]

[5] provision of postcode data (enabling Acadametrics to identify the corresponding county or London borough) and property type data are required if the mortgage book is to undergo a full revaluation, using the lowest level ARAC house price data currently available.
[6] to establish the interest charging mechanism, including penalties for the purposes of accurate loss estimation.
[7] the hazard matrix represents the probability of possession in the following year of all loans extant at the beginning of the year. These data are extracted from our downturn default database (1.2.4)
[8] these data can be replaced with a separate prepayment modelling exercise or other available data if required.

4.3 macro-variable data for input to the Macro-Risk Model as criteria for the “current" and “client-defined” scenarios as follows

- mortgage interest rate
- inflation rate
- unemployment rate
- house price inflation (HPI)[9]
- GDP growth

4.4 derived variables viz

current valuation for every loan, calculated by indexing the original purchase price or known later value, using our Acadametrics Residential Asset Calculator (ARAC) data[10] (or client-nominated index) unless a revaluation is provided by the client

4.5 other variables used in calculating LIEP

- forecast valuation using the house price inflation
- costs of sale[11]
- depreciation factor[12]
- grossing up factor[13]
- discount rate[14]

5.0 MODELLING PROCESS

5.1 Loan book. For the purposes of stress and scenario testing, the loan book is divided as follows:

by LTV bands:

0 - 75
>=75 - <85
>=85 - <90
>=90 - <95
>=95 - <100
>=100 - <120
>=120

by seasoning:

0-12 months
12-24 months

[9] the Macro-Risk Model uses forecast growth in the LSL/ Acadametrics HPI but can accept growth in other specified indices: the Model also uses the Halifax measure of affordability sourced at Cambridge
[10] a link to ARAC is provided in 2.3.
[11] these factors are taken from our downturn default database and are represented as either fixed amount plus % of sale price. These factors may vary considerably dependent upon the management processes employed by individual mortgage lenders.
[12] this represents the amount by which the property will depreciate from the indexed value as a consequence of a forced sale in the event of possession. Whilst this is also contingent upon the length of time for which the property remains unsold (and is, therefore, linked to the arrears calculation) the standard model uses a factor or a range of factors taken from the downturn default database.
[13] an assumption derived from the downturn default database. These may be cross checked against lender policy to determine the level of arrears to be used given the level of arrears provided on the download. This “grossing up” factor is a multiple of monthly repayments and is a combination of arrears leading up to repossession and arrears arising between possession and eventual sale. The factor used is based upon Acadametrics data but may be checked against lender policy.
[14] to be agreed with the lender.

(at 12 month intervals)
120-132 months
133-144 months
>144 months

This produces a matrix of 7 x 13 cells. If M is the universe of mortgages, a sub-book (i.e. a set of mortgages of development year i and LTV j) will be denoted as M (i,j,) and, typically, we will have $N_{i,j,}$ mortgages in sub-books M(i,j,); $\sum_i \sum_j N_{i,j} = N$ will then be the total number of mortgages in the loan book.

6. COMPUTATION

6.1 Computation of Probability of Possession (PP)

Probability of Possession (PP) for the n^{th} individual mortgage in year 1, year 2 and year 3:

$PP_n(year1) = h_n(year1)$

$PP_n(year2) = (1-h_n(year1)-r_n(year1)) * h_n(year2)$

$PP_n(year3) = (1-h_n(year1)-r_n(year1)) * (1-h_n(year2)-r_n(year2)) * h_n(year3)$

where:

PP is the Probability of Possession, and

h is the possession hazard rate

r is the redemption/prepayment rate

6.2 Computation of Current Balance (CB)

The current balances are computed from the balances provided by the mortgage lender.

Computation of Current Balance[15] (CB) for the n^{th} individual mortgage is as follows:

CB_n (year0) is provided in the mortgage books

CB_n (year1) = CB_n (year0) + annually accrued interest – 12 * monthly repayments[16])

CB_n (year2) = CB_n (year1) + annually accrued interest – 12 * monthly repayments)

etc, until year 10. In the event of possession in, say, year t and expected sale in year u the current balance developed to the end of year u would be the same as the Exposure at Possession described in the next paragraph.

6.3 Computation of Exposure at Possession (EAP)

This represents the likely debt at the point of sale and constitutes the current balance plus payment arrears.

EAP_n (year1) = CB_n (year1) + ARRposs (year1) + ARRpost (year1)

EAP_n (year2) = CB_n (year2) + ARRposs (year2) + ARRpost (year2)

where:

[15] it should be noted that arrears are a separate element and are not included in the current balance.

[16] monthly repayment is calculated by our model dependent upon interest rate and product type.

ARRposs is the number of monthly repayments in arrears at possession calculated at the interest rate prevailing in year of possession and earlier (if greater than 12 months).

ARRpost is the number of monthly repayments accrued in the period from possession to sale calculated at the interest rate prevailing in the year immediately following possession and in the year after that (if greater than 12 months).

6.4 Computation of Loss in the Event of Possession (LIEP)

Computation of Loss in the Event of Possession (LIEP) for the n^{th} individual mortgage is thus:

LIEP = sales proceeds from disposal of the property - outstanding debt value including arrears unpaid

$LIEP_n$ (year1) = (1 - depreciation factor[17] - variable selling/legal cost[18]) * (indexed house price) - fixed selling/legal cost – EAP (year1)

$LIEP_n$ (year2) = (1 - depreciation factor - variable selling/legal cost) * (indexed house price) * (1 + forecast HP growth rate in year1) - fixed selling / legal cost – EAP_n (year2)

etc, where:

indexed house price = original purchase price * (1 + accumulated growth of house price since the inception of loan)

original purchase price/valuation can be read in from the mortgage lender's book and percentage growth of house price can be calculated from the Acadametrics Residential Asset Calculator prices; alternatively, the client's own current valuation may be used.

For each individual loan the LIEP is expressed as a proportion of the current balance in year 0 as follows:

$LIEP_n/CB_n$(year1) = $LIEP_n$(year1) / CB_n(year0)

$LIEP_n/CB_n$(year2) = $LIEP_n$(year2) / CB_n(year0)

$LIEP_n/CB_n$(year3) = $LIEP_n$(year3) / CB_n(year0)

Generating a forecast output for the entire mortgage book is achieved by averaging the results of the calculations described above to give the following estimates for year1, year2 and year3:

Average $CB_{i,j,}$

- Average $PP_{i,j,}$
- Average $LIEP_{i,j,}$
- Average $EL_{i,j,}$ =Average of ($PP_{i,j,}$ * $LIEP_{i,j}$) (Expected Loss)
- Average $EL\%_{i,j,}$ =Sum ($PP_{i,j,}$ * $LIEP_{i,j}$) / Sum $CB_{i,j,}$ (Expected Loss as % of CB)

7. ILLUSTRATION

7.1 Single-record illustration of stress testing mechanics

The following tables illustrate the steps taken to obtain results required from client data for our "historic worst case" scenario.

[17] depreciation factor is the movement in house price (usually negative) that occurs as a consequence of the property being subject to a "distressed sale".

[18] legal and selling costs charged to the mortgage account to facilitate sale of the property.

Cols A – U are data provided by the client. Before use a number of tests for errors and for general reasonableness are applied including the existence of the postcodes provided.

Cols W – AB (cyan background) are fields derived from the data provided that Acadametrics needs for revaluation of the underlying property.

Cols AC – AD show location and which of our three house-price series has been used in revaluation together with the resulting revaluation. We are happy to accept clients' own revaluations if preferred.

Cols AE – AT (terracotta background) are fields derived from client input that are needed in stress testing.

Cols AU – BN Stress test results for the worst-case scenario.

A	B	C	D	E	F	G
ACCOUNT NUMBER	REPAYMENT TYPE	REGION CODE	LATEST NET CUMULATIVE ADVANCE	DATE OF LATEST ADVANCE	VALUATION AT LATEST ADVANCE	MATURITY DATE
100000	Interest Only	HOME COUNTIES	£181,731.56	09/06/2006	£275,000.00	13/12/2031

H	I	J	K	L	M	N
LTV AT DATE OF LATEST ADVANCE	INDEMNITY COVER	TERM FROM LATEST ADVANCE	FIRST TIME BUYER	INITIAL PURCHASE PRICE	INITIAL ADVANCE	INITIAL VALUATION
57.5	0	25	N	£200,000.00	£185,387.00	£275,000.00

O	P	Q	R	S	T	U
CURRENT OUTSTANDING BALANCE	MONTHS IN ARREARS	ARREARS BALANCE	NEXT EXPECTED PAYMENT	CURRENT PROPERTY VALUATION	PROPERTY TYPE	FULL POSTCODE
£181,731.56	2	£3,055.74	£1,237.67	0	Detached Property	MK14 5HF

W	X	Y	Z	AA	AB
DATE OF VALUATION	YEAR OF VALUATION	MONTH OF VALUATION	ACADAMETRICS PROPERTY TYPE	POST CODE CLEANSED	CLIENT ORIGINAL VALUATION
09/06/2006	2006	6	Detached	MK14 5HF	£275,000

AC	AD
ACADAMETRICS HOUSE PRICE BASIS AND LOCATION	ACADAMETRICS HOUSE PRICE REVALUATION
County-based : MILTON KEYNES	£314,442

AE	AF	AG	AH	AI	AJ	AK	AL
ACCOUNT NUMBER	MORTGAGE TYPE	YEAR OF LATEST ADVANCE	FUTURE TERM MONTHS	CLIENT VALUATION AT DATE OF LATEST ADVANCE	LATEST NET CUMULATIVE ADVANCE	MONTHLY REPAYMENT	CURRENT BALANCE
100000	ILA	2006	252	£275,000	£181,732	£1,238	£181,732

AM	AN	AO	AP	AQ	AR	AS	AT
ARREARS IN MONTHS	INDEMNITY COVER	ACADAMETRICS REVALUATION	ACADAMETRICS REGION CODE	LTV% AT DATE OF LATEST ADVANCE	PROPERTY TYPE	FULL TERM	TERM FROM LAST ADVANCE
2	0	£314,442	8	57.5	Detached	0	300

AU	AV	AW	AX	AY	AZ	BA	BB
PROBABILITY OF POSSESSION				**CURRENT BALANCE**			
Historic Worst Case				**Historic Worst Case**			
Yr.1	Yr.2	Yr.3	Yr.1-10 Avge.	Yr.1	Yr.2	Yr.3	Yr.1-10 Avge.
0.008739	0.007090	0.006209	0.003621	193,140.17	181,151.58	163,433.63	143,124.94

BC	BD	BE	BF	BG	BH	BI	BJ
LIEP				**PP*LIEP**			
Historic Worst Case				**Historic Worst Case**			
Yr.1	Yr.2	Yr.3	Yr.1-10 Avge.	Yr.1	Yr.2	Yr.3	Yr.1-10 Avge.
31,241.95	42,755.92	47,093.62	30,863.19	273.03	303.15	292.41	146.21

BK	BL	BM	BN
PP*LIEP as % of CB			
Historic Worst Case			
Yr.1	Yr.2	Yr.3	Yr.1-10 Avge.
0.1500%	0.1700%	0.1600%	0.0800%

ABOUT ACADAMETRICS

Acadametrics is an analytics consultancy focussed upon house prices and property portfolio risk. We conduct research, led by Dr Stephen Satchell, Economics Fellow, Trinity College, University of Cambridge, develop solutions to assist lenders and are expert in the measurement of house prices, preparing our own house price index launched in 2003 by the Financial Times as FTHPI. In a step to expand coverage, LSL Property Services PLC agreed to support the index, known from June 2010 and widely published as the LSL Property Services/Acadametrics House Price Index (LSL Acad HPI). Whilst backed by LSL, the index retains its authority as independently prepared and providing an independent News Release commentary. As FTHPI, the index was chosen by the Chicago Mercantile Exchange for a possible future residential house price derivative.

Our past work has included the analysis of pre-payment risk, the pricing of mortgage books and the assessment of the performance of credit score models for mortgages, credit cards and unsecured loans under changing macroeconomic scenarios. Much of our early work involved forecasting the mortgage and MIG losses arising from the 1989-1991 housing crisis. As a result, we hold what we believe to be the largest available downturn default database, which enables our stress and scenario testing methodologies, developed by Dr Satchell.

Since early in 2009, we have worked closely with MIAC Analytics from New York. Our joint company, **MIAC | Acadametrics** Limited, provides our data and models on the MIAC DataRaptor data management platform with the WinOAS cash flow tool. These can now be downloaded from our secure UK server, for use in-house. Our models assist on-balance sheet lenders, together with participants in securitisations and in the sale and purchase of loan portfolios. We offer:

- **House Price Data Series** entitled Acadametrics Prices and Transactions (APAT) providing monthly house price trends from 1995 at national, county, unitary district and London borough level, based upon Land Registry data, with interactive charts for every participant in the housing sector; we offer expertise and data for all those investing in or advising on house prices and extensive analytical capability
- **Collateral Valuation** using our Acadametrics Residential Asset Calculator (ARAC) based upon APAT, incorporating data entry and calculation software to provide loan level confidence measures used in our Residential Property Portfolio Revaluation service and SST (below). The house price data are also available as a series for use by lenders and owners of residential property portfolios for their in-house revaluation use
- **Loan Level Stress and Scenario Testing** comprising our:
    - **Arrears and Possessions Forecasting** (UKAPF) using our Satchell Wongwachara model to forecast at UK level, accounting for forbearance; for benchmarking purposes and economists; our related Macro-Risk Model assesses national risk levels
    - **Stress and Scenario Testing (SST)** with ARAC revaluation as standard, or AVM revaluation, to provide forecasts of loan by loan possessions and losses, employing Macro-Risk Model output to reflect alternative scenarios
- **Custom Data and Model Development** which includes the provision of loss data from our downturn default database for client LGD benchmarking, model validation and model development, by Dr Satchell, bespoke to customers' needs. We have considerable expertise in index construction, available for clients

Our website includes numerous descriptive papers. Acadametrics services have an academic foundation in econometrics, statistics and decision theory and are developed from our own resources under our "research first" policy. Further detail is provided on our website www.acadametrics.co.uk.