Credit Card Initial Limits: How much is too much?

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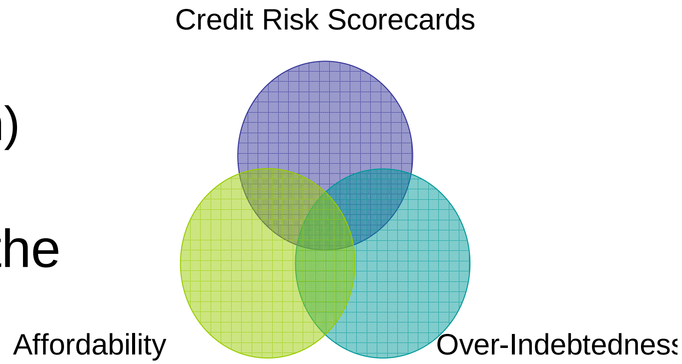
Risk Framework

- **Risk Scores** are built statistically and measure the individual level of credit risk.

- **Affordability:** ranks the capacity to absorb:
  - Increasing exposure
  - Increasing Price / Instalment amount
  - Financial Shocks (redundancy, marital break down)

- **Over-indebtedness:** those customers to whom the bank should not lend because:
  - It would be against FSA/BSBC rules and potentially incur reputational risks
  - It could not be in the customer's best interests



Credit Card Initial Limit Setting: Background

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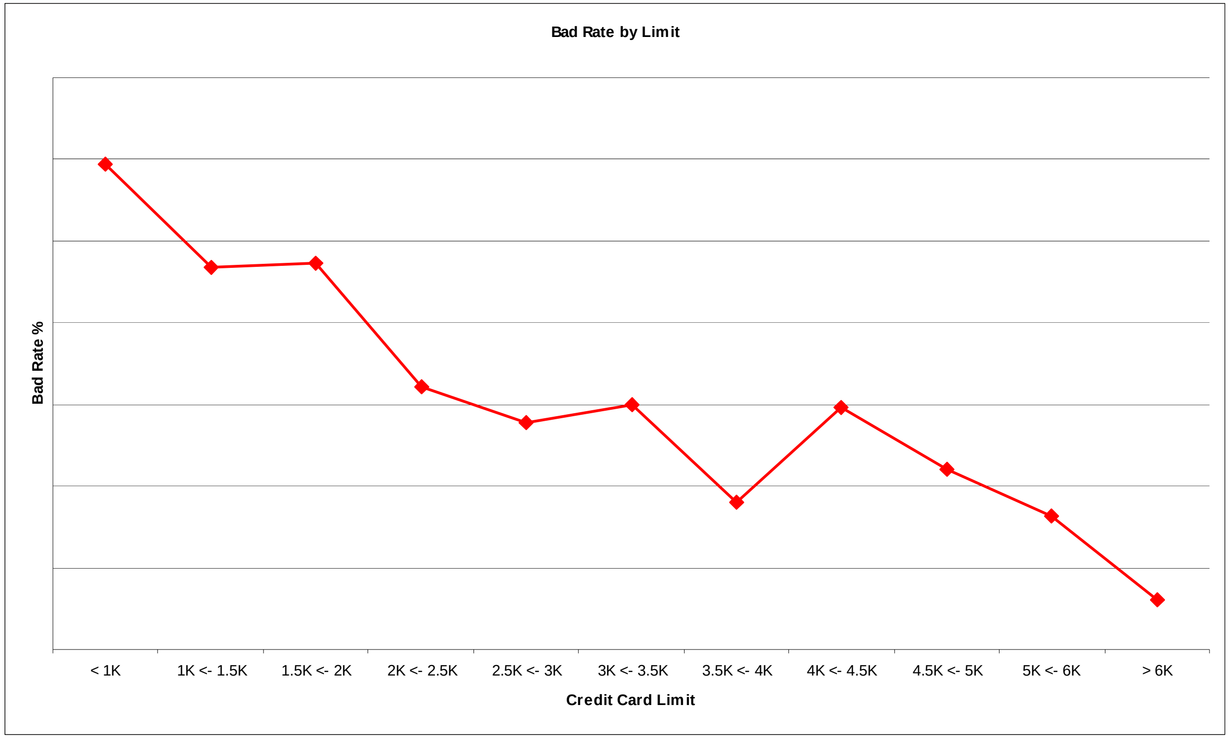
- Main drivers of profitability are:
  - Risk
  - Utilisation
  - Revolving Behaviour

- The latter two are not fully reflected within the benchmark strategy

- To enhance the limit decision we have built two new models:
  - An affordability model to quantify the extent to which a customer's risk profile would change with an increase in limit.
  - A utilisation model to identify which customers are likely to use their card

- These models are then used to specify the parameters within a customer simulation that determines revenue, impairment, capital and allocates limits to provide an optimal trade-off given risk appetite constraints

Affordability Modelling: Initial Analysis



- If limits were assigned randomly then it is expected that the bad rate would increase as the limit increased. The impact of increasing limit could easily have then been calculated at a total level.
- Current limit assignment strategy is based largely on risk score, hence customers with higher limits have lower average bad rates.

Affordability Modelling: Forecasting Limit

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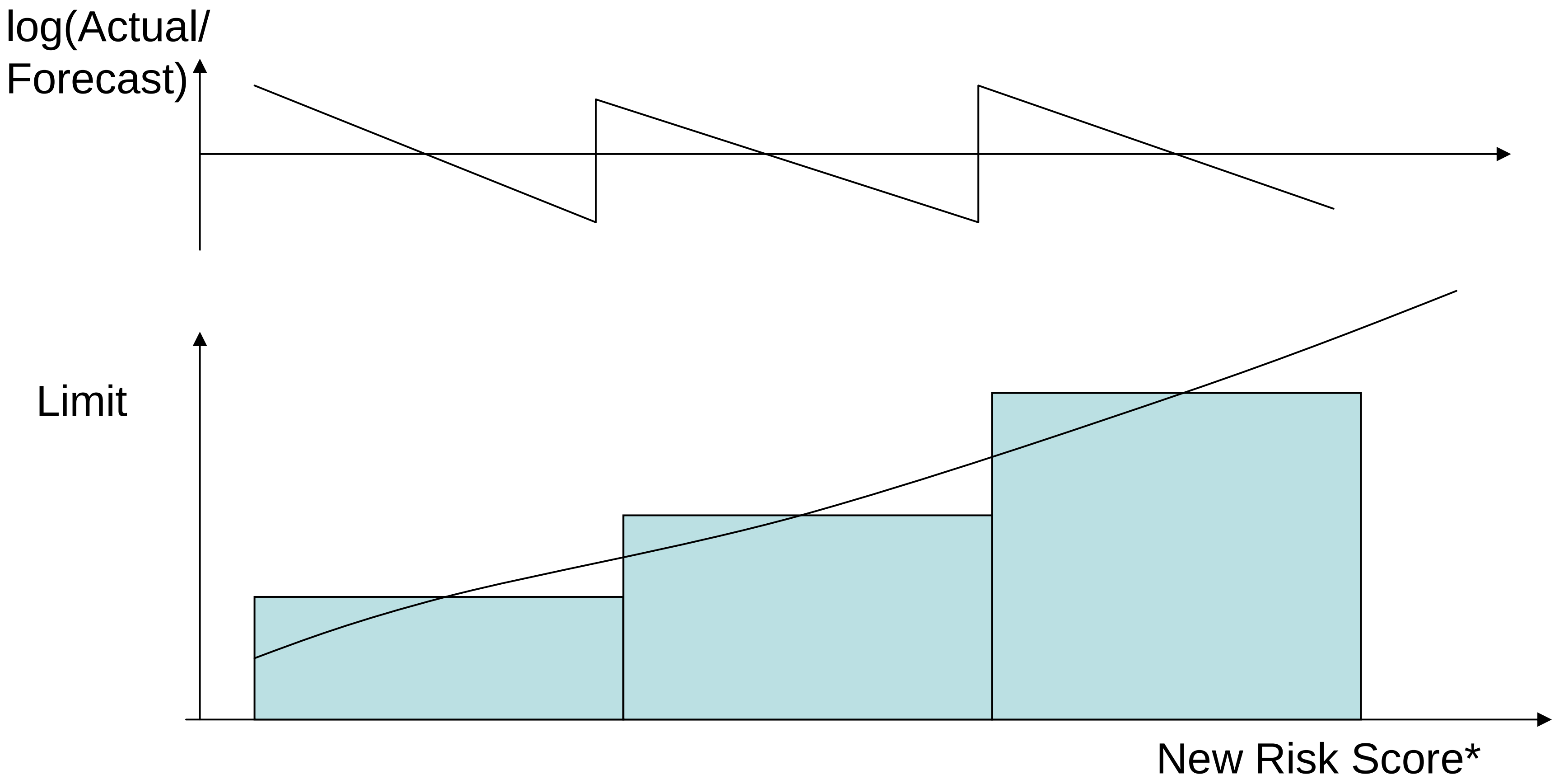
- Live strategy increases in incremental steps.
- Customers with very similar risk profiles can get different limits. This difference can be used to assess change in risk profile.
- Polynomial regression model developed to predict limit given risk profile. Risk score used as the only variable.
- Difference between the actual limit and forecasted limit based on risk score calculated as log(actual/forecast).
  - If actual < forecast then –ve value
  - if actual > forecast then +ve value
  - if actual = forecast then 0 value

Why use the log(actual/forecast limit)? Version 1

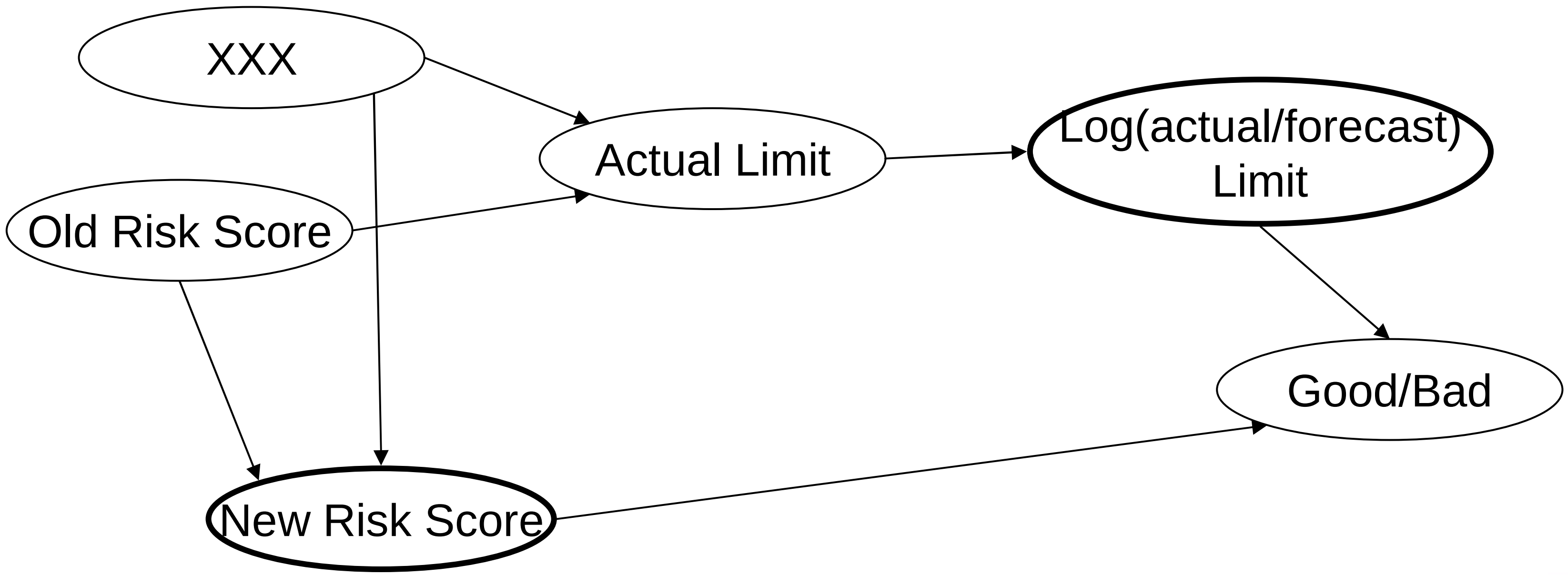
- Intuitively:
  - Assume that risk is a smooth function of limit
  - Measures the distance from the cut-off score



* This explanation “fudges” the issue that the old limit strategy is set based on old score not new score

Why use the log(actual/forecast limit)? Version 2

- Based on "causal graph":
  - XXX and Old Risk Score are not significant in forecasting Bad debt given the value for new risk score is known (this is testable and is approx. true)
  - Based on this, the causal relationship between actual limit and Bad is identifiable if we control for New Risk Score
  - In practice New Risk Score has a strong and non-linear relationship with Actual Limit so we choose a two stage process of modelling Actual Limit=f(NewRiskScore) and then using "residual" [log(actual/forecast limit)] which is roughly independent of New Risk Score to estimate Bad.



Affordability Modelling: Methodology

- Stepwise logistic regression model developed to predict probability of bad
- Characteristics included risk score, log limit ratio and various judgementally selected predictive characteristics * log limit difference
- These additional characteristics allow expected bad rate based on CCS08 score to be adjusted for customers where the actual and expected limits are different

Affordability Modelling: Scorecard

Parameter
Intercept
Newscr2
lim
lim*Household Composition
lim*Outstanding Balances
lim*Income Measure
lim*Employment Status
lim*Current Account Use
lim*OI Measure

- Lim = Log (Actual Limit / Estimated Limit)

Utilisation Modelling: Background

- The utilisation model is another of the inputs into the initial limit optimisation simulation.
- Model was developed to predict the utilisation behaviour of a customer associated with their profile prior to application point. (Based on CDS data sources)
- Outcome window should be long enough to establish true spending behaviour but short enough to still be representative of application risk

Utilisation Modelling: Selecting the Outcome Window

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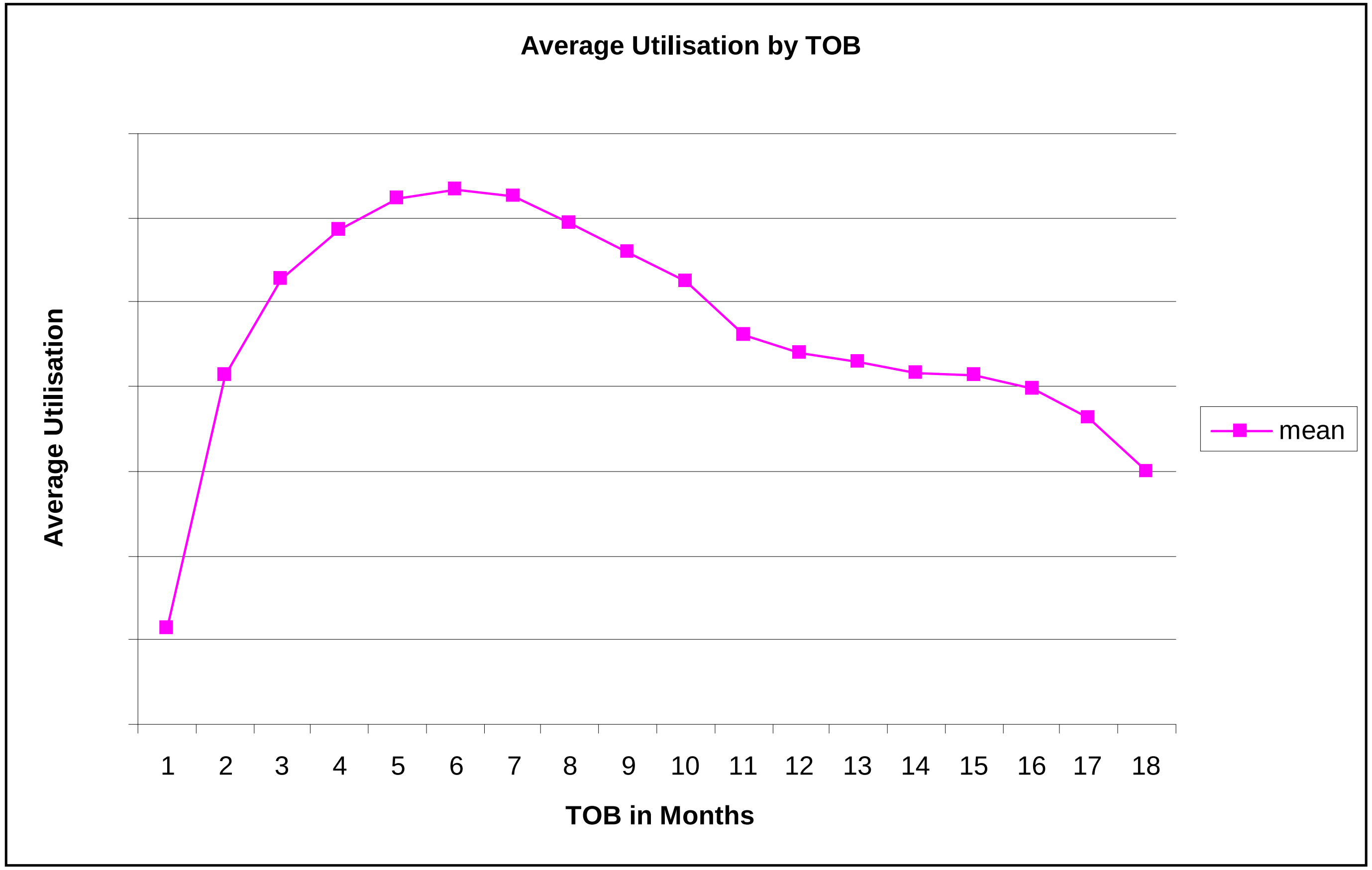


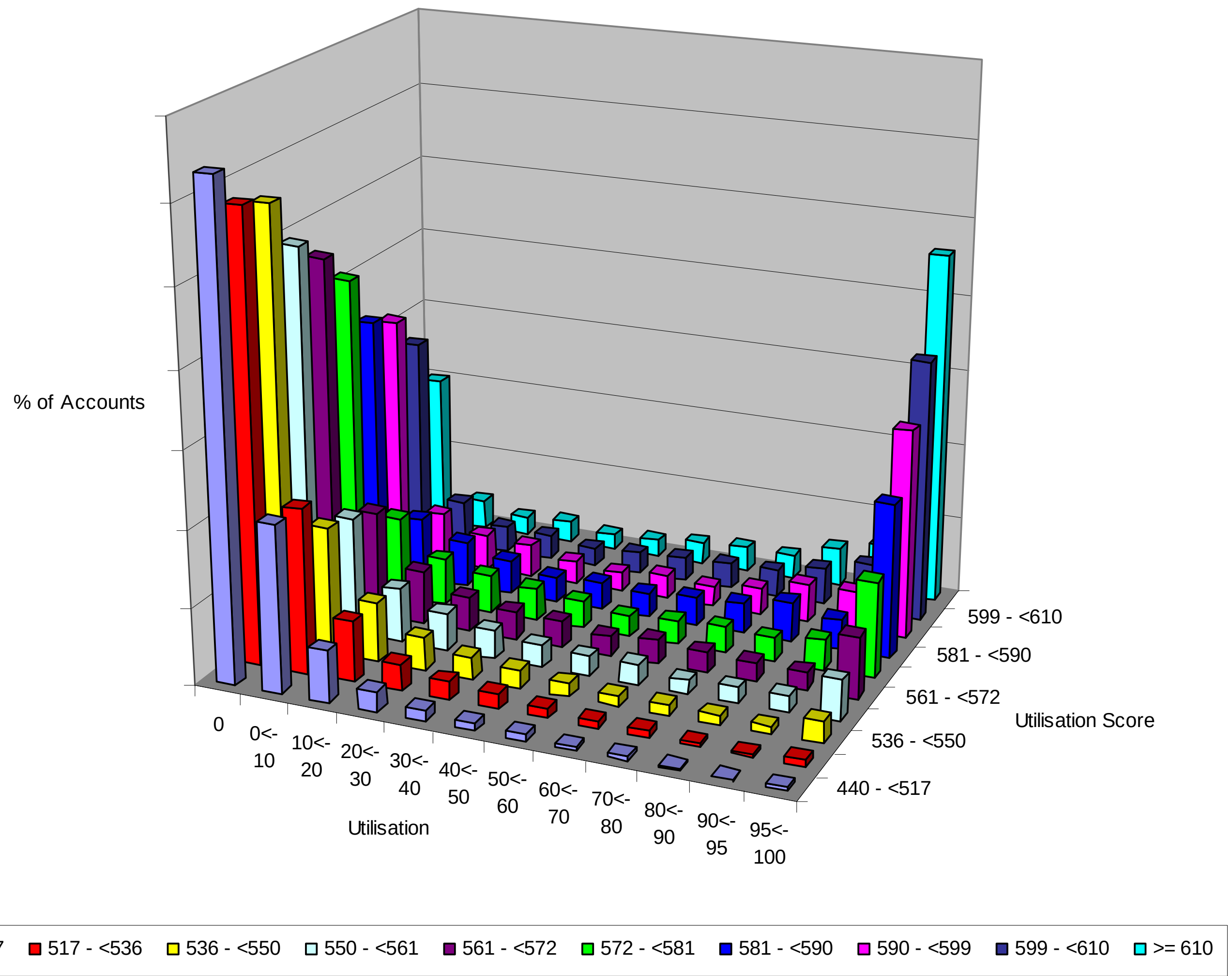
- Average utilisation by time on book graph suggests a 12m outcome should be selected.

Utilisation Modelling: Model

- Performance definition: Observations assigned to be either utilised/non-utilised
- Indeterminate group assigned for customers with a mid-utilisation (12.5% Indeterminate)
- Certain characteristics removed (e.g. characteristics which may change due to other LTSB product strategies). Also removed actual limit allocated as this will not be available in live.
- Gini: 67.2% (D), 65.55% (H), 65.26% (V)
- Correlation with Risk Score: -0.7926
- Gini using Risk score for utilisation performance definition: 62.45%

Utilisation Modelling: Model Results

Actual Utilisation by Utilisation Score



Optimisation: Performance over 24m

- Could aim to maximise a “profitability” function:

$$Objective = Max\left[\sum_{Month1-24}(\alpha.BalRvlv_{month} + \beta.Purchases_{month} - \gamma.Capital + \Delta I - Aquisition)\right]$$

  - Alpha=Net Interest Margin
  - Beta=Interchange Margin
  - Gamma=Av Cost of Capital
  - Delta I=Change in Impairment
  - Acquisition Cost

Simulation Structure

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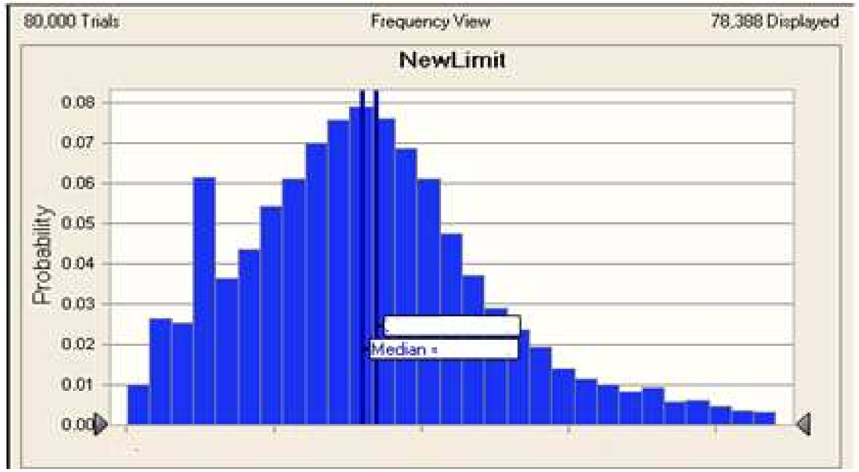
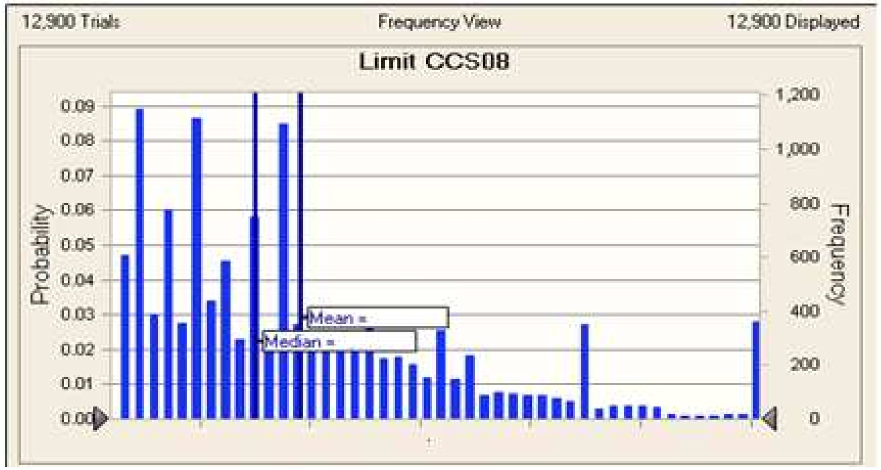
- Build customer simulation out to 24 months of:
  - Delinquency ☑
  - Utilisation Bands ☑
  - PD Band (based on single CARS calibration) ☑
  - Revolve / Transact / Attrite ☑
- From these parameters can calculate:
  - Revolving Balance (Limit x Utilisation x (Revolve=True))
  - Transacting Balance (MIN(Limit , Old Limit) x Utilisation x (Revolve=False, Attrite=False)
  - Capital (f(PD,LGD,EAD) – PD from risk band, LGD and EAD as at application point
  - EL = PD x LGD x EAD
  - Impairment = Based on Delinquency level, limit, balance, supplied provisioning rates
  - Return = Based on Revenue less variable costs (including capital)

Results

New Limit vs Current Limit

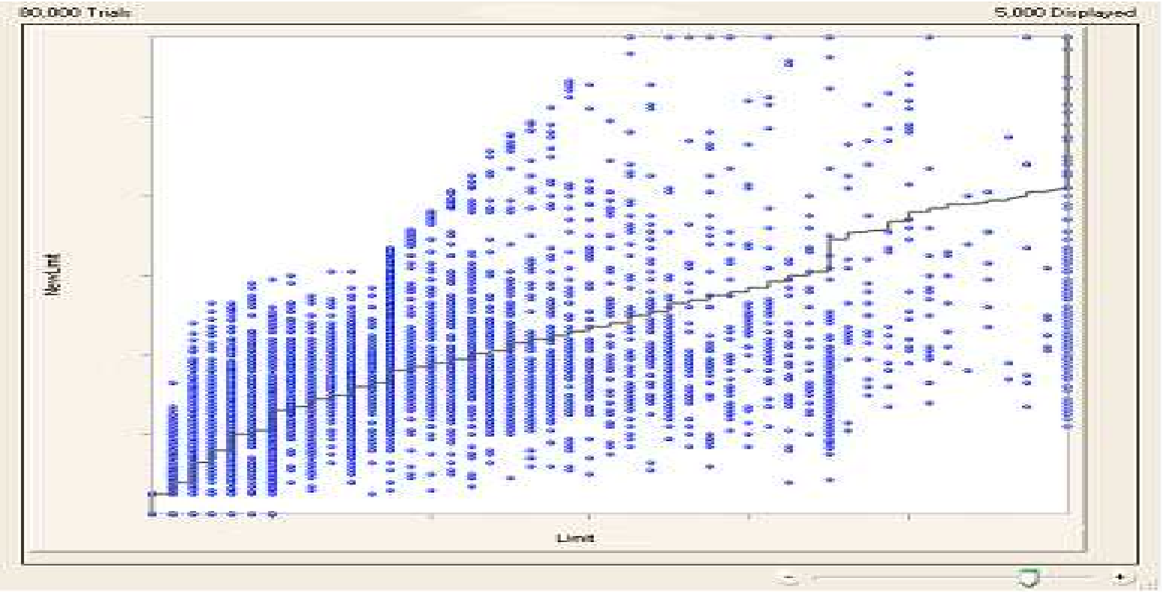




- On average the new limits will be lower than those previously assigned
- Median limit however increases
- Limit allocated is now adjusted to be optimal relative to the price point

New Limit vs Current Limit Scatter Plot

- Relatively wide variance between new limit and old limit allocations
- Higher correlation for those with low limits



Summary

- Benefits to capital and Impairment over current strategy for equivalent profit.
- New model is only very weakly dependent on Credit Turnover.
- Limit allocation is a function of Risk Based pricing
- Accounts for correlation between risk and propensity to revolve.