



Stress Testing Retail Portfolios

Joseph L. Breeden
President & COO
Strategic Analytics Inc.
breeden@strategicanalytics.com

Stress Testing

LeMessurier was the architect of the Citibank Tower in Manhattan.

One year after construction, an architecture student conducting a stress test asked some probing questions.

LeMessurier's investigation led to some uncomfortable realizations...

... remedial action is usually much cheaper than disaster clean-up – just ask New Orleans.



Why Do We Stress-Test?

Regulatory Requirements:

- Basel II mandates stress-testing around low-probability events to validate economic capital estimates.
- US regulators want similar assurances that portfolios can withstand extended economic downturns.

Better Portfolio Management:

- Stresses will occur. Planning for them is profitable.
- Reactionary management to sudden stresses is costly.

Basel II Guidelines on Stress Testing

(v) Stress tests used in assessment of capital adequacy

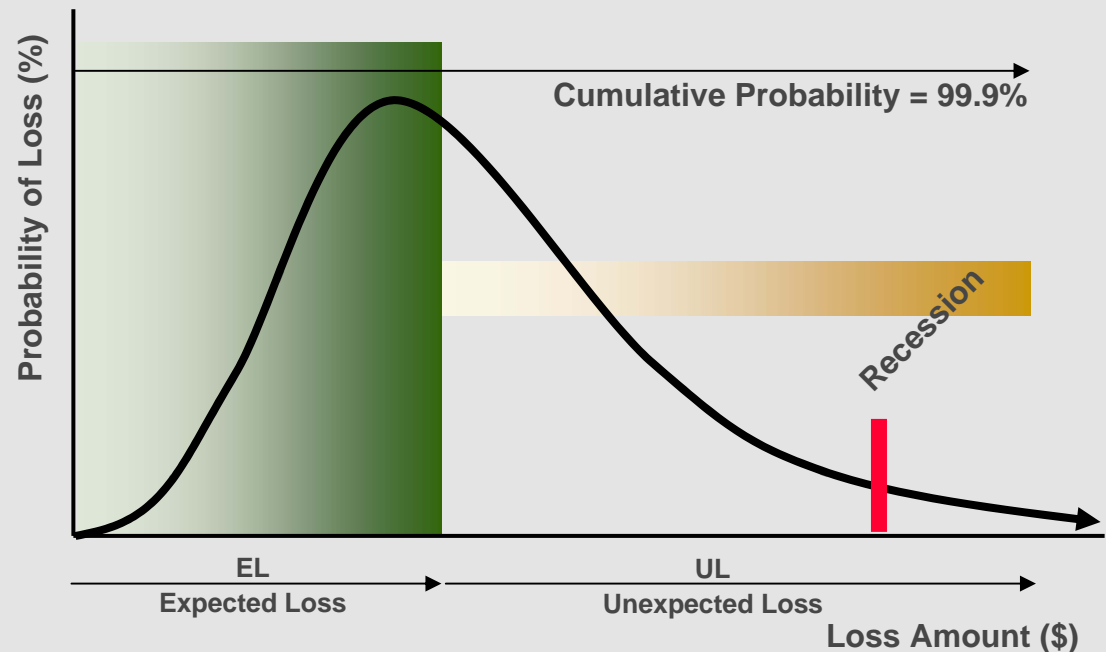
434. An IRB bank must have in place sound stress testing processes for use in the assessment of capital adequacy. **Stress testing must involve identifying possible events or future changes in economic conditions that could have unfavorable effects on a bank's credit exposures** and assessment of the bank's ability to withstand such changes. Examples of scenarios that could be used are **(i) economic or industry downturns**; (ii) market-risk events; and (iii) liquidity conditions.
435. In addition to the more general tests described above, the bank must perform a credit risk stress test to assess the effect of certain specific conditions on its IRB regulatory capital requirements. The test to be employed would be one chosen by the bank, subject to supervisory review. The test to be employed must be meaningful and reasonably conservative. Individual banks may develop different approaches to undertaking this stress test requirement, depending on their circumstances. **For this purpose, the objective is not to require banks to consider worst-case scenarios. The bank's stress test in this context should, however, consider at least the effect of mild recession scenarios. In this case, one example might be to use two consecutive quarters of zero growth to assess the effect on the bank's PDs, LGDs and EADs, taking account – on a conservative basis – of the bank's international diversification.**

Basel II Purpose for Stress Testing

Prove that the impact of a recession is less the computed capital level.

All known recessions should be within the bounds of a 99.9% calculation.

Capital is calculated with the Basel II formula assuming the shape of the distribution. Stress tests are scenario-based forecasts using an entirely different mathematical framework.



Hurricanes Katrina and Rita

A classic “Operational Risk” under Basel II. Exacerbates oil shock.

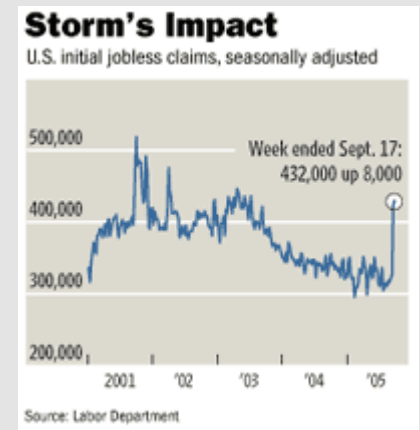
Abrupt relocation of banks; branch closures; inability to locate customers. Customers have lost jobs and property

Banks are responding by

- ***Suspending collections to affected consumers***
- ***Lengthening payment grace periods***

Portfolio Impacts:

- ***Immediate: reduced payments and reduced delinquency***
- ***Medium term: rising payments and delinquency***
- ***Longer term: losses will be impacted as consumers loose jobs or walk away from loans for lost autos and homes.***



The Housing Bubble

Many localized housing bubbles have developed across the country, driven by

- *mortgage income deductions*
- *easy financing*
- *low interest rates*

Bubbles in some markets (San Fran, Las Vegas), are bursting.

Portfolio Impacts:

- *Some mortgages could go underwater, causing homeowners to walk away – but not usually a major problem in retail*
- *Mortgage charge-off severity rises*
- *Delinquencies in all product categories rise as consumers can not cash-out their home equity*

Federal Reserve Raising Rates

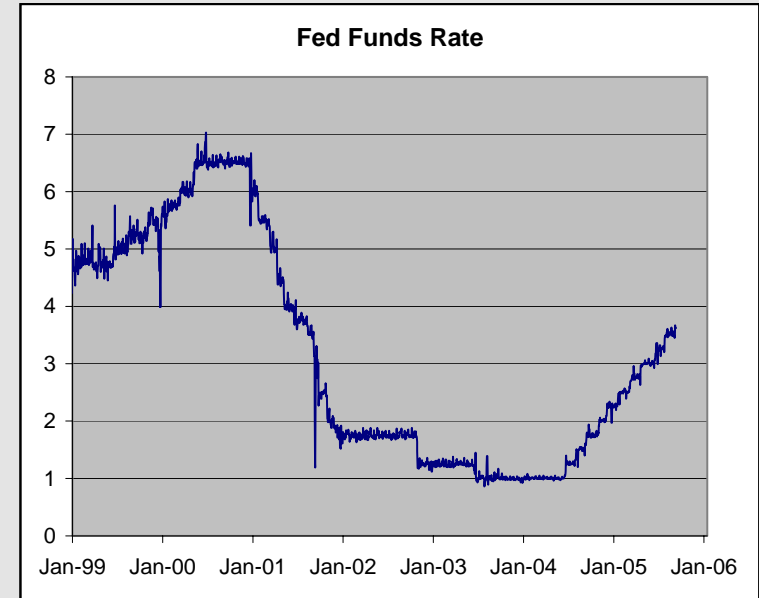
The Fed has raised rates 11 consecutive times.

In 2000, the Fed raised rates to stop the stock market exuberance.

In 2005, the rate increases are to return to normal levels and stop the housing bubble.

Portfolio Impact:

- *Ends the refinancing boom in mortgage.*
- *Increases payments on ARMS → increases delinquency*
- *Risks triggering a recession in 2006-2007.*



Bankruptcy Law Changes

Recent changes in bankruptcy laws will make it more difficult for consumers to erase their debts.

Portfolio Impacts:

- ***Near-term surge in bankruptcy filings. Sept 2005 is highest filing month on record.***
- ***Potentially higher loss recovery***
- ***Possibly shifts losses between products. Less ability to erase credit card debt in favor of mortgage debt.***

New Minimum Payment Regulations

New banking regulations are increasing minimum payments for credit cards.

Little historical data is available. Initial tests will be critical.

Portfolio Impacts:

- *Anecdotal evidence always shows that increasing minimum payments pushes more accounts into bankruptcy and charge-off.*
- *May impact demographic groups disproportionately.*

Types of Stress-Testing

- **Model parameters** – structural stresses
- **Outside environment** – macroeconomic impacts
- **Internal events** – systems failures, policy changes, etc.
- **Business strategy** – marketing plans, collections policies

We need to get away from “What if delinquencies rise 10%?” as the definition of stress-testing. Causality is essential because then the results become actionable.

No Established Best Practice

- There is almost nothing in the academic literature about retail lending stress testing.
- Practice varies widely because of the range of models.
- Any successful approach must start with a good portfolio forecasting model for retail lending and build in explicit use of scenarios.
- Models need to be uniform across product types so that equivalent or related scenarios can be applied throughout.

The Structure of Retail Lending

Stress-testing begins with scenario-based forecasting.

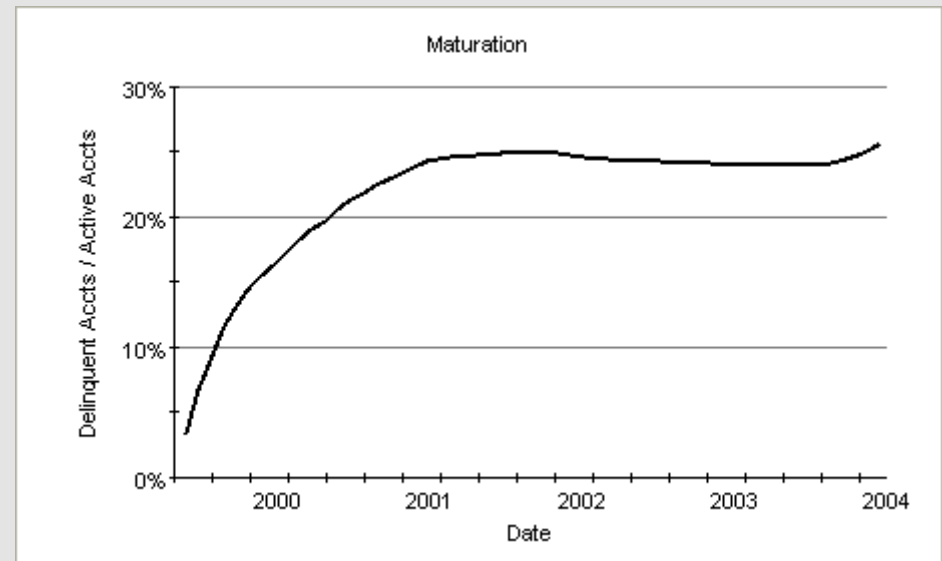
Introducing stresses requires creating models that accept scenarios.

One can only stress factors that appear explicitly in the models.

- Study key rates: account delinquency, balance per delinquent account, attrition, payment, fee generation.
- Study the performance components for each rate.

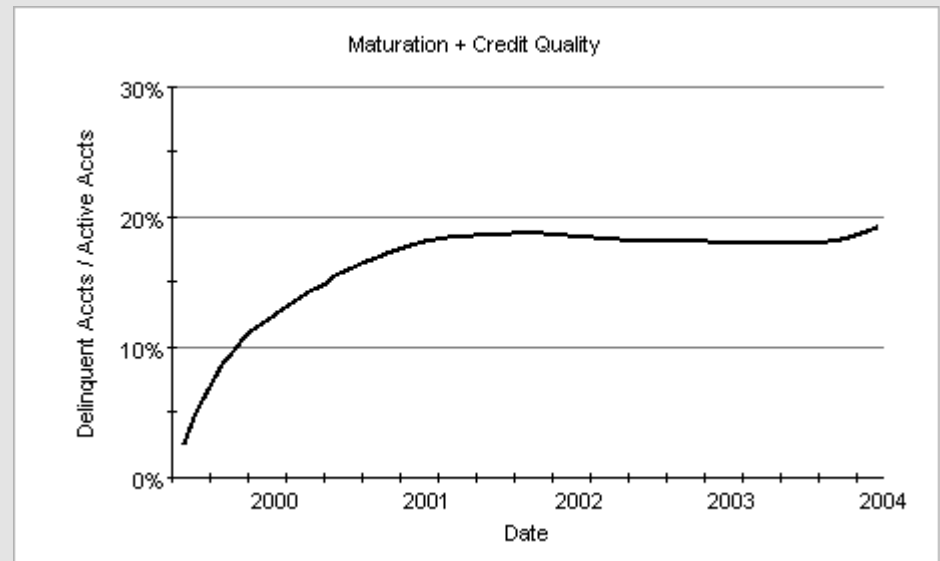
Components of Portfolio Performance

- Vintage Lifecycle



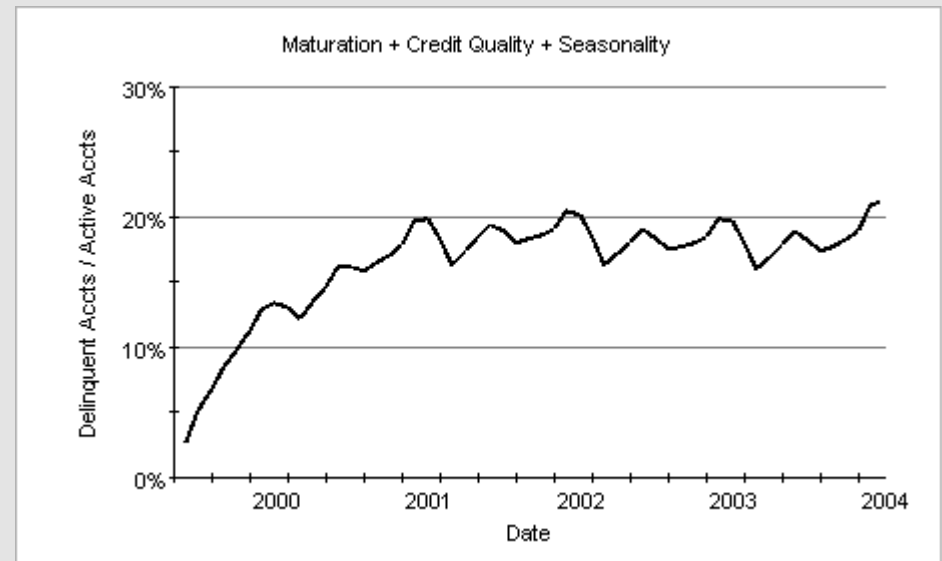
Components of Portfolio Performance

- Vintage Lifecycle
- Credit Quality



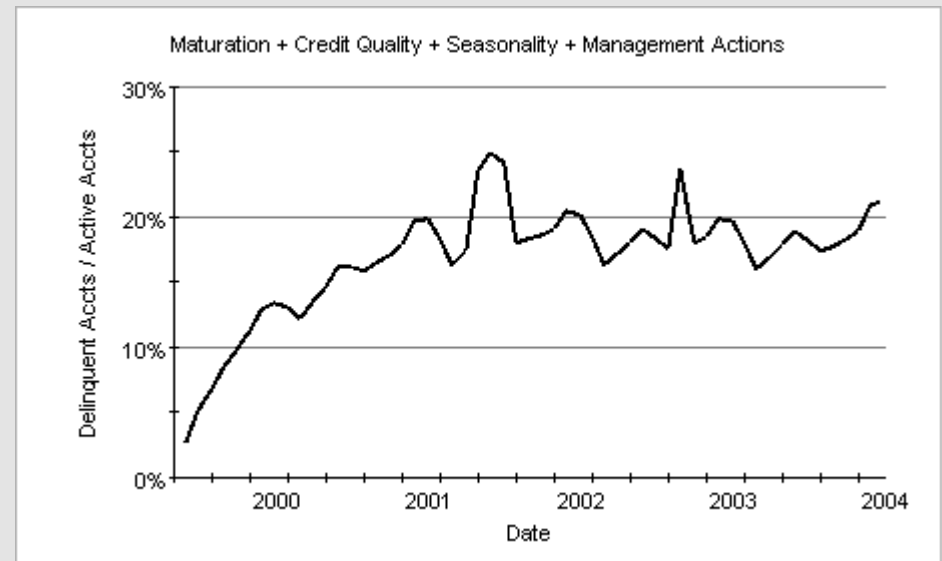
Components of Portfolio Performance

- Vintage Lifecycle
- Credit Quality
- Seasonality



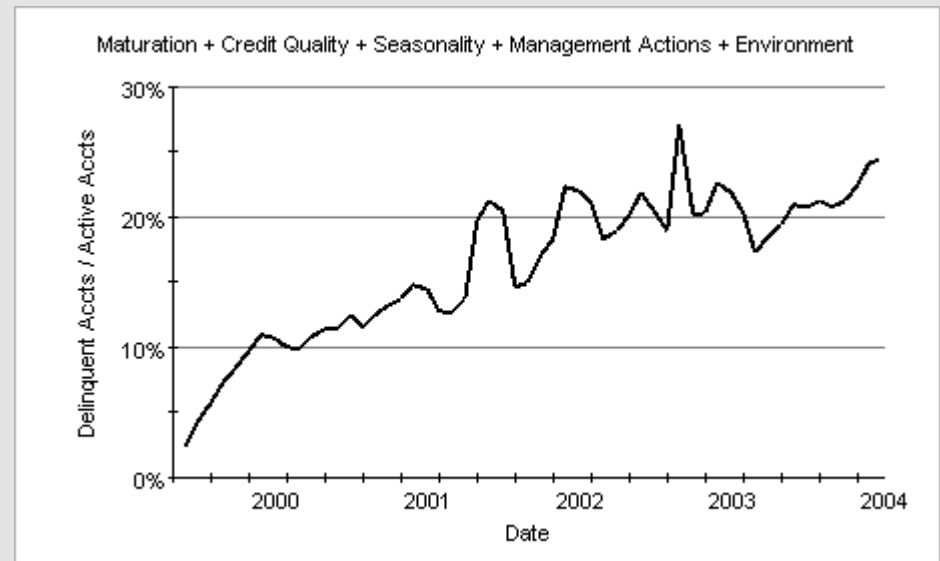
Components of Portfolio Performance

- Vintage Lifecycle
- Credit Quality
- Seasonality
- Management Actions

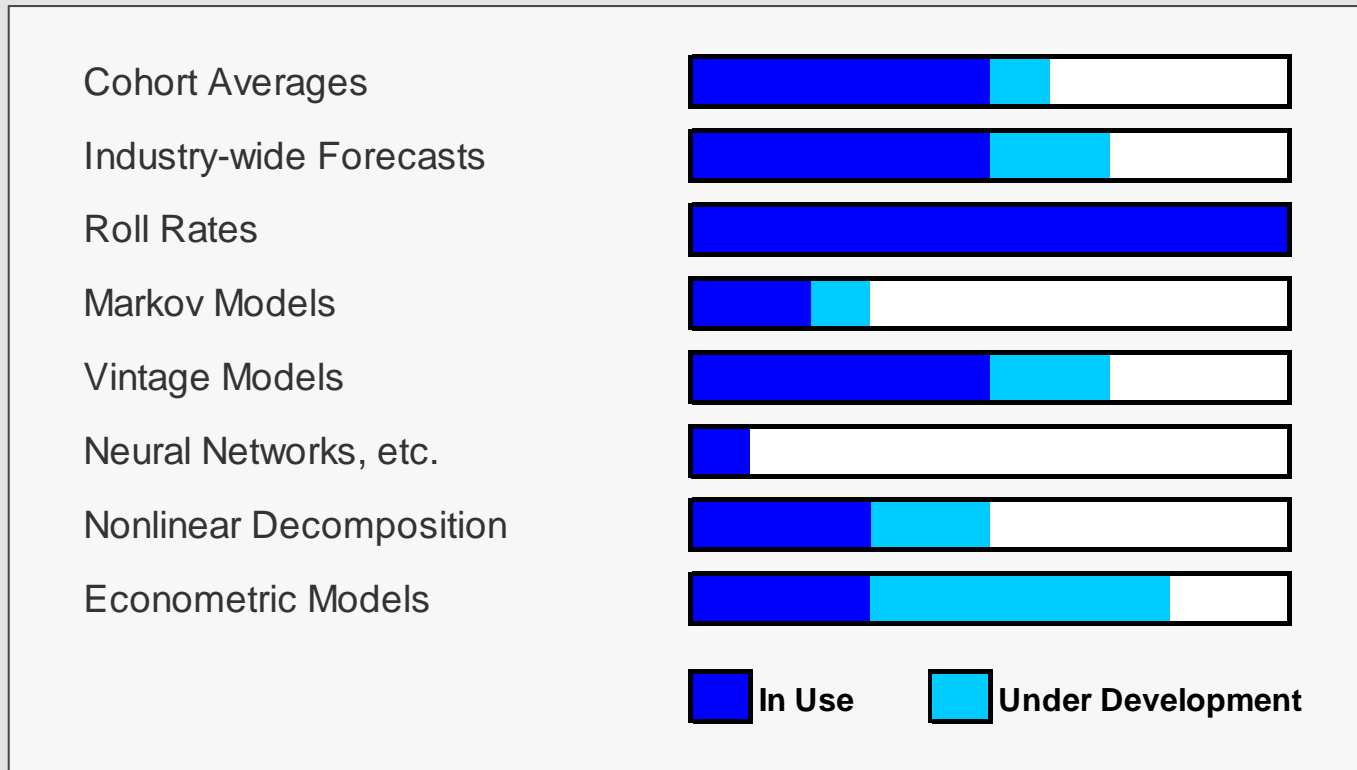


Components of Portfolio Performance

- Vintage Lifecycle
- Credit Quality
- Seasonality
- Management Actions
- Macroeconomic & Competitive Environment



Forecasting Techniques



Based upon personal observation, not a statistical survey.

Whichever model you choose, you must build in explicit dependence upon macroeconomic impacts.

Which Variables

Regulators have expressed an interest in seeing stress tests beyond PD, LGD, EAD.

Choices:

- *PD, LGD, EAD – each of these can be impacted by macroeconomic factors.*
- *Roll rates*
- *Attrition, account delinquency & charge-off, balance per account, recovery.*
- *Revenue and profitability*

Selecting Macroeconomic Variables

Good choices (stay close to the consumer):

- *Unemployment*
- *CPI*
- *Interest rates*
- *Real wages*

Poor choices (long delays or difficult-to-create scenarios)

- *Consumer sentiment (predictive but difficult to make scenarios)*
- *Exchange rates*
- *Balance of trade*
- *Government budget deficit*

Stress Test Model Suggestions

Consider lags between macroeconomic causes and portfolio impacts.

Consider cross-correlations between macroeconomic variables.

Use fewer macroeconomic variables that have intuitive explanations.

- ***For the typical portfolio with < 7 years of data, expect no more than 3 macroeconomic variables to be included.***
- ***Statistically possible to use more, but nearly impossible to manage against.***



Creating Scenarios

Stressing Environmental Impacts

The economy, legislation, and consumer attitudes can all experience long-term changes. These uncontrolled and largely unpredictable changes are what most people think of as stress-testing.

- From peak to trough, the last recession caused a 40% swing in delinquency for many portfolios.
- Consumers have become more relaxed about bankruptcy over the last couple of decades. Possible changes in bankruptcy law in 2002 caused a dramatic increase in bankruptcy.

Start with the Predictable

When creating a forecasting algorithm, explicitly identify those things that are predictable and those that are not.

Predictable:

- Maturation
- Quality of existing accounts
- Seasonality

Set Internal Scenario

Known by other internal groups (management scenario):

- Volume of new bookings
- Mix of new bookings by product type, channel, segment
- Expected quality of new bookings
- Changes in policies (collections, line increase, etc.)

Be realistic—or at least make unrealistic assumptions explicitly.

For Basel II purposes, the existing book is of primary interest, so new bookings can be set to zero.

Add Environmental Scenario

Unknown elements (environmental scenario):

- Macroeconomic environment
- Competitive changes

Creating internally consistent macroeconomic scenarios is not trivial.

- Scenarios for interest rates, inflation, unemployment, etc. must be created in concert.
- Proper macroeconomic scenario design requires a significant level of expertise. Seek advice.
- Scenarios must be intuitively explainable in order to be actionable.



Considering Many Possible Futures

The Range of Possibilities

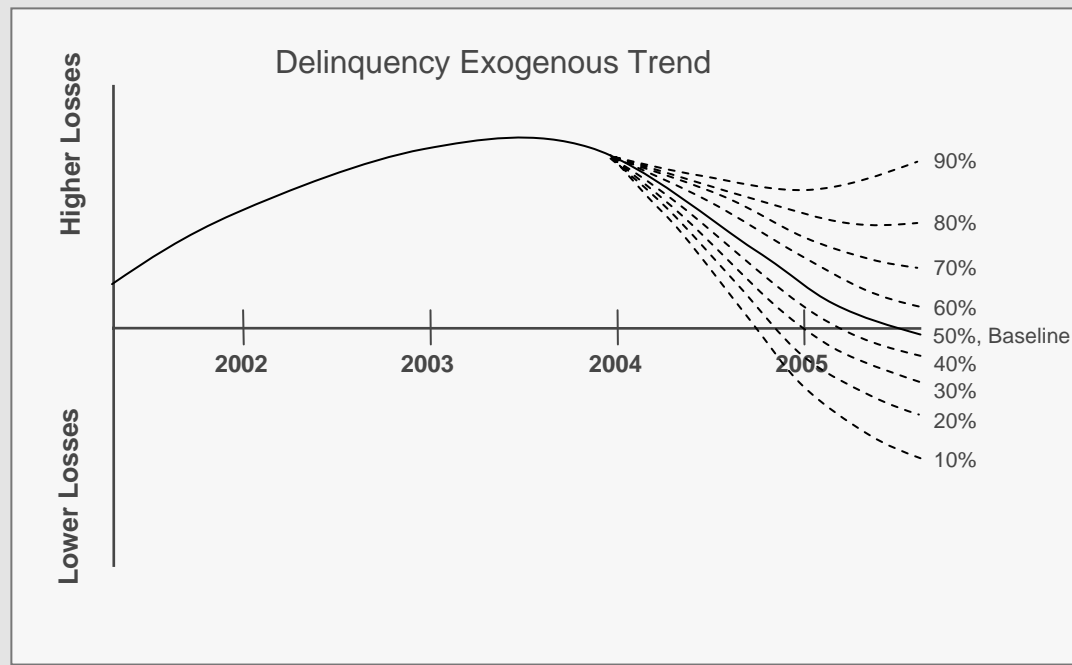
Few if any macroeconomic scenarios have probabilities of occurrence attached. If available, would they represent severity of impact on a retail loan portfolio?

Best case / worst case scenarios need to be quantified more precisely to become actionable.

Statistically generating scenarios provides a way of calibrating these possibilities.

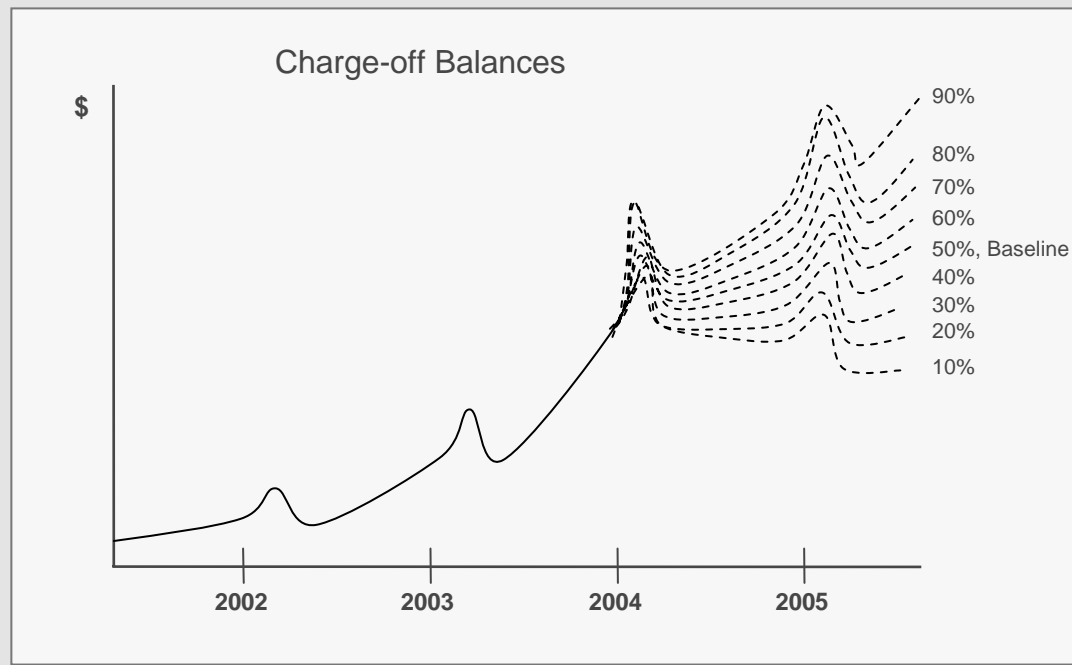
Possible Future Environments

- The cumulative probability numbers mean that all possible futures are no worse than the given level — e.g., 70% cumulative probability means that 70% of possible outcomes will be better than this.



Possible Future Losses

- Running each scenario through a scenario-based forecasting model gives a range of possible outcomes, shown below.
- We can now ask what range of possible outcomes preserves our profit margins.

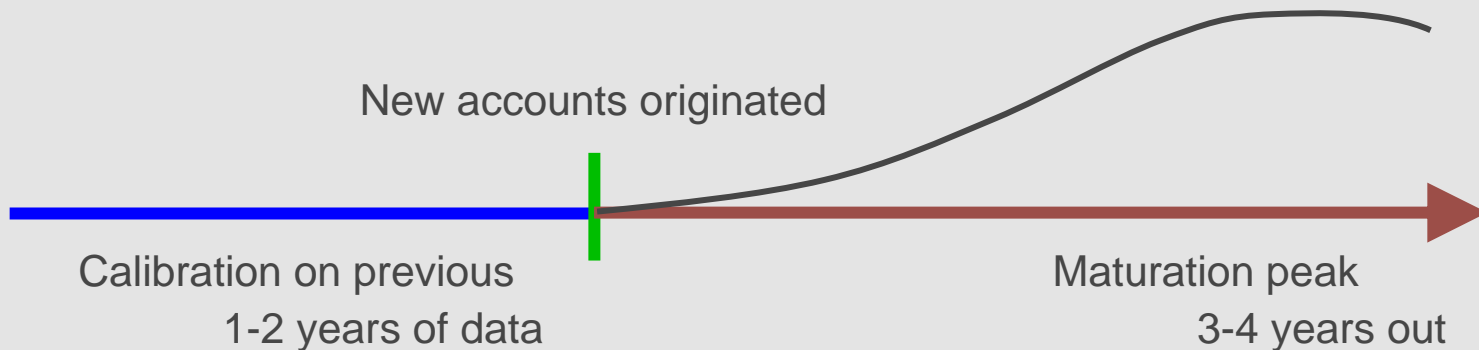


Stressing Business Strategy

- Business strategy usually refers to new originations volume and quality, account management (line increases), collections policies, etc.
- The greatest risk in setting strategy is that it gets implemented just before the environment changes. Optimizing policies to yesterday's environment is one of the greatest risks in retail lending today.
- Stress-testing business strategy amounts to asking how the proposed strategy will perform under a range of environmental stresses. “What percentage of possible futures meets our margin threshold?” All of the previous techniques are combined to measure strategic robustness.

Use Stress Testing to Plan Ahead

- The same accounts will perform differently tomorrow than they do today.
- Accounts booked today may have peak revenue or delinquency up to several years in the future. Changes in originations criteria today can dominate the portfolio years into the future under a different economic environment.



Return on Your Stress Testing Investment

To create business value, the stress testing approach created should also be used for

- *Regulatory Compliance*
- *Disaster planning*
- *Product pricing*
- *Portfolio optimization*

What will the 2007 environment be?

How sensitive is your portfolio / new loan pricing?

Are you prepared?