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ACTUARIAL ROLES IN BANK STRESS TESTING

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Section 1

STRESS TESTING OVERVIEW



Introduction to stress testing

What is Stress Testing?



An analysis or simulation designed to determine the ability of a given financial instrument or financial institution to deal with an economic crisis

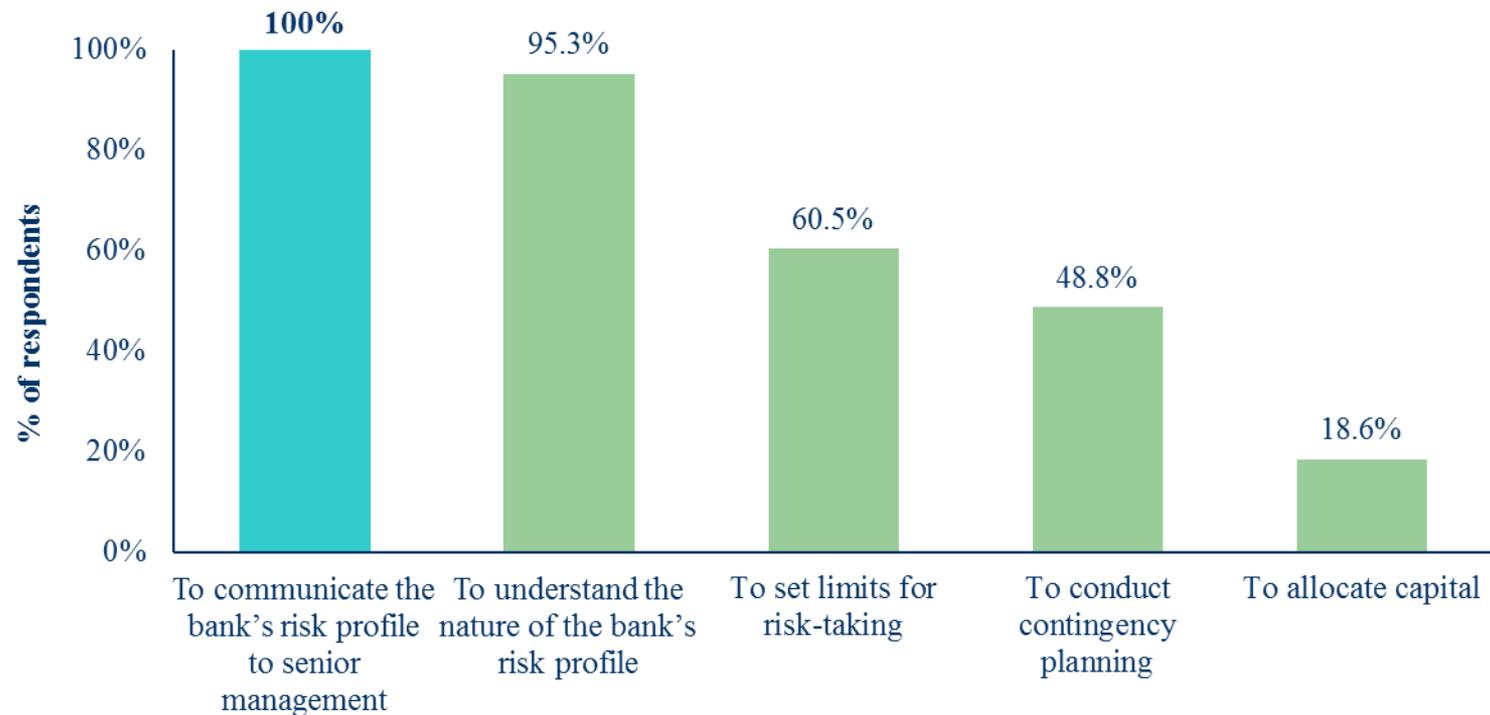


Why do people worry about it?

- **Board/ senior management** want to know if their current business strategy leaves them over exposed in a particular scenario (e.g. cyber attack)?
- **Heads of Business Units** want to know how robust their portfolio of financial instruments will be in a certain economic scenario (e.g. if interest rates rise by 250 bps)
- **Regulators** want to know if an institution has enough capital to withstand a severe economic downturn (e.g. another credit crunch)?
- Results of these simulations help financial institutions act pre-emptively to better prepare for extreme, yet plausible scenarios

Stress testing has become an important tool in risk management in terms of understanding and communicating risks

Roles of stress testing in risk management



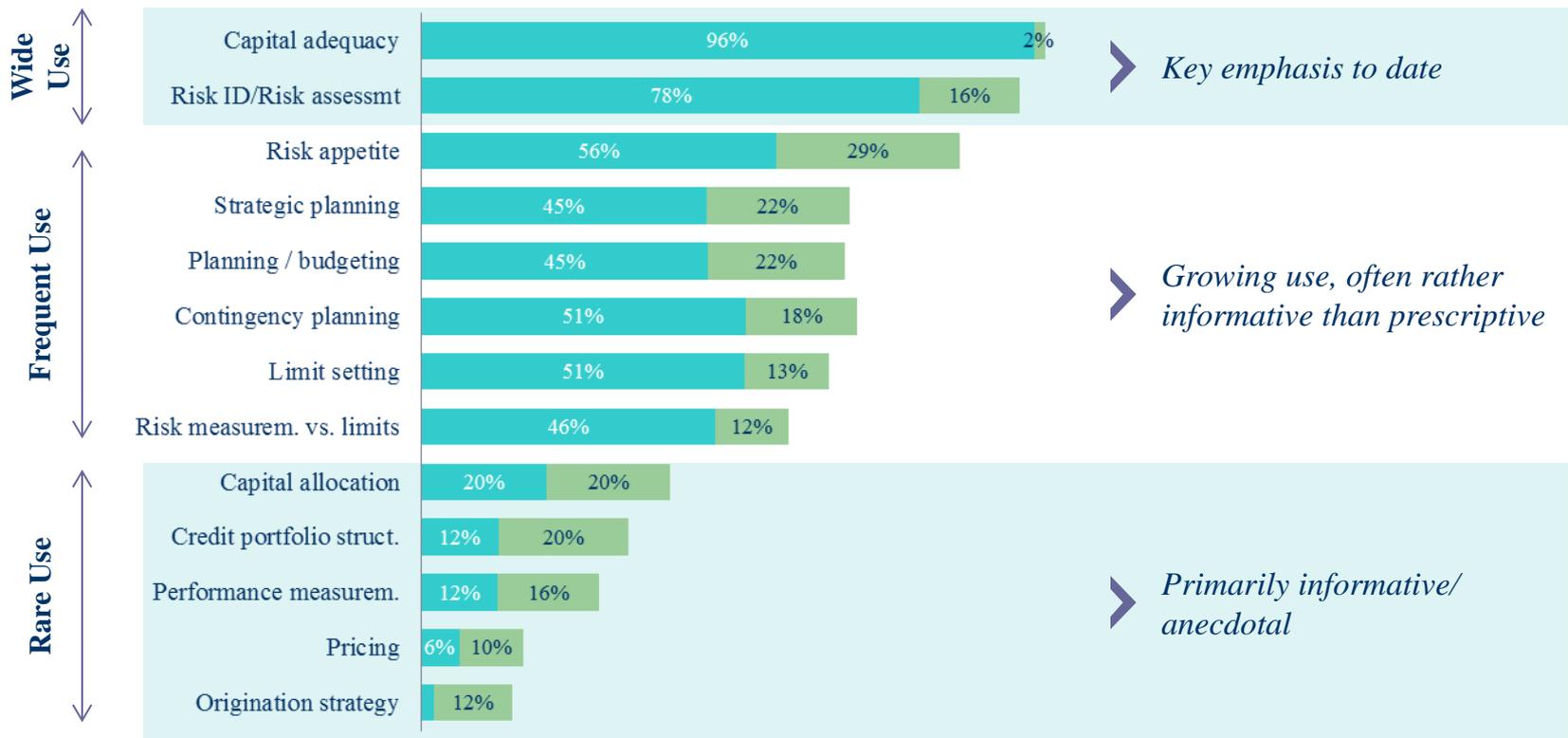
Source: Bank of International Settlements survey

Furthermore, stress testing is being increasingly embedded by banks into key business applications and management processes

Enterprise-wide stress testing

Current and planned use (% of respondents)

Legend: ■ Use stress tests today ■ Planned use over the next year



Source: IACPM/OW Survey, Perspectives on the evolving role of enterprise-wide stress-testing, November 2013. 55 participating institutions covering scope & process, business and risk applications, and organization & governance related aspects through 59 multiple choice and free-form questions



In best practice stress testing serves both regulatory and business objectives

Regulatory driven objectives

- Ensuring institution understands the risks it is holding
- Ensuring the institution is adequately capitalised today, in future under basic and in stressed conditions
- Ensuring Risk Appetite is linked into Capital Adequacy calculations and monitored
- Ensuring EC methodology is appropriately challenged
- Ensuring losses are appropriately forecasted
- Ensuring adequate support is provided for management decisions (on a regular and ad-hoc basis)



Stress testing is **not a standalone risk management activity** but always works in conjunction with other activities

Business objectives

- Ensuring annual business plans reflect not only a base case but also other potential scenarios
- Base strategic investment decisions on a multitude of planning scenarios
- Understand the overall risk profile of the business and communicate it to Senior management
- Set limits for risk-taking, i.e. redistributing risk-taking in order to decrease vulnerability
- Provide input into portfolio steering activities
- Perform loss forecasting and assess impacts on business
- Use as early warning signals and conduct contingency planning
- Support external communication to investors and other stakeholders



From a business perspective stress testing can **support decision making** by delivering better information

Section 2

STRESS TESTING REGULATORY REQUIREMENTS



The current regulatory stress testing started as a crisis response tool

Failure of the old regime

- The banks that failed during the crisis in the US and UK were all “well capitalized” based on the existing standards
- Regulators needed to do something different and big – and then show the results and how they got there – to regain the market’s and the public’s trust

Enter stress testing

- Scenario had to be easy to understand and credibly severe
- Importantly, Fed developed its own models to project losses and profits
 - This provided an extremely important ability to form your own view

Aftermath

- Stress test results produced new information about bank health and asset quality
- Information was new and credible; for example, the 2009 FED stress testing showed that 10 banks needed a total of \$75bn in capital

Examples of stress testing exercises applied by major Supervisory Authorities

	 FED	 EBA/ECB	 PRA
Year of start	2009	2009	2009
Frequency	Yearly (CCAR) Semi-annual (DFAST)	2009, 2010, 2011, 2014, 2016	Yearly
Approach	<ul style="list-style-type: none"> Based on a standardised data request Assessed under three supervisory developed scenarios (i.e. baseline, adverse, severely adverse) and two institution developed scenario (i.e. baseline, severely adverse) 	<ul style="list-style-type: none"> Based on a standardised data request Assessed under two scenarios: baseline and adverse Primarily bank led Join-up of Asset Quality Review (AQR) results 	<ul style="list-style-type: none"> Run alongside the EBA's EU-wide exercise Includes a number of additional UK layers to the EBA stress test (i.e. UK Variant)
Perimeter	All BHC with consolidated assets >50BN\$ (i.e. 31 in 2015)	128 EU banks which cover at least 50% of each national banking sector	8 major UK banks and building societies

The 2014 EBA stress test

- Timeframe in scope: 3 years, 2014-2016
- Two scenarios defined: baseline and adverse scenarios
 - The adverse scenario reflected increase in global bond yield, further deterioration of credit quality, stalling policy reform and lack of bank balance sheet repair
- The scope of the risk types include credit risk, market risk, sovereign risk, securitization risk, cost of funding and interest income and other
- Static balance sheet assumed – portfolio composition does not change from YE2013 through time horizon
- Hurdle rate
 - Baseline scenario: 8% Common Equity Tier 1 ratio
 - Adverse scenario: 5.5% Common Equity Tier 1 ratio

The U.S. CCAR program: brought to you by DFA and the Federal Reserve

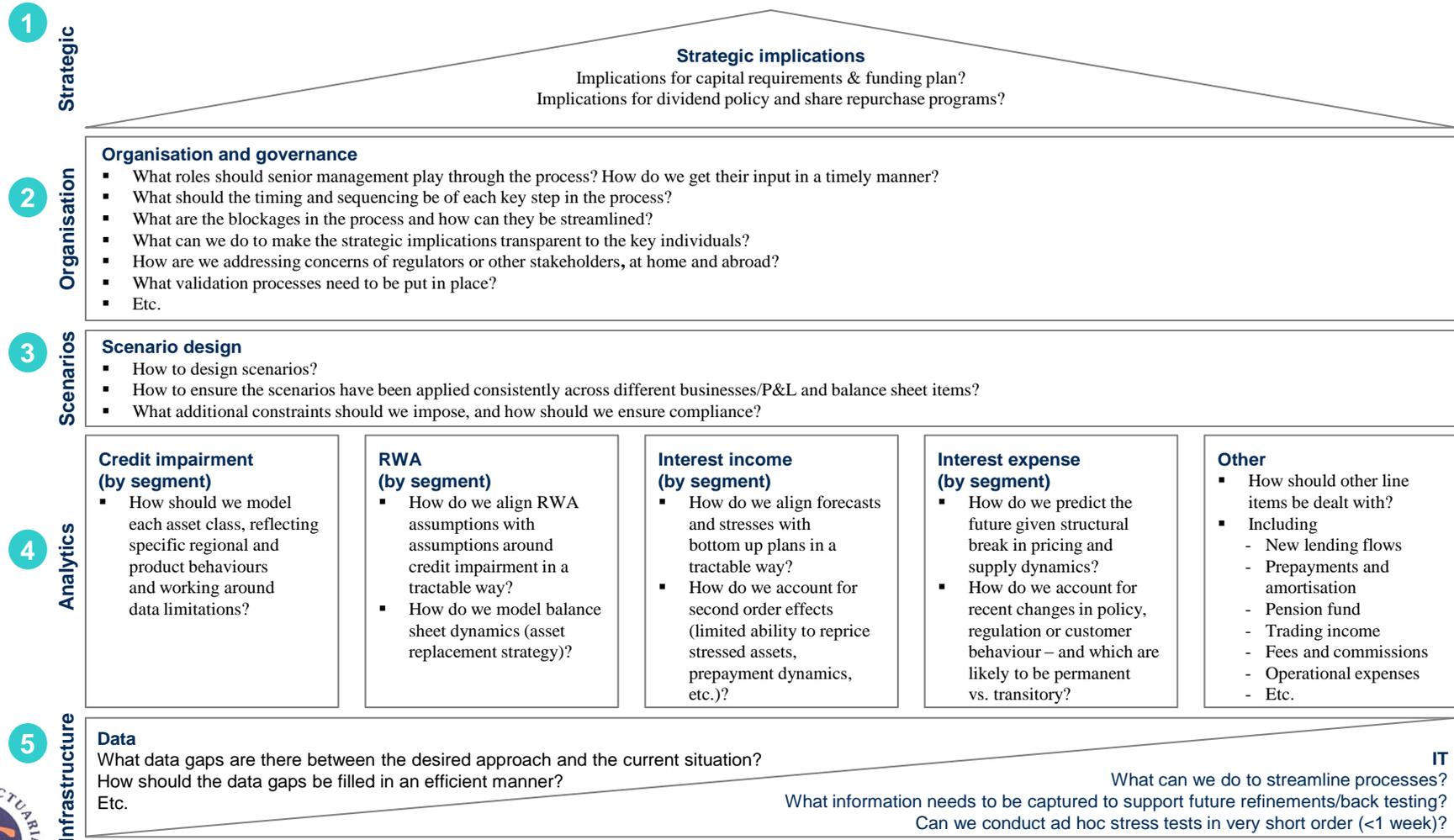
- CCAR: Comprehensive Capital Assessment and Review
 - Comprehensive: losses and revenues; balance sheet (on and off) and income statement; all risks!
- Timeframe in scope: 9 quarters
- Five scenarios: three supervisory developed scenarios and two institution developed scenario
 - The severely adverse scenario reflected substantial weakening in global economic activity and large reductions in asset prices; US corporates suffer financial distress of a severe recession, as spreads widen and equity prices fall; oil prices also rise to \$110 per barrel
- Multiple minimum capital ratios
 - Tier 1 common ratio, Common Equity Tier 1 ratio, etc.
 - 4.5% Common Equity Tier 1 ratio
- No significant capital action can be done without it
 - No increase in dividends, share repurchase programs
 - No M&A activity

Section 3

STRESS TESTING FRAMEWORK



Overview of stress testing framework



Strategic implications

Regulators expect banks to use stress testing results to inform business decisions



Stress testing programmes should be actionable and inform decision making at all appropriate management levels of an institution. The stress testing programme, as part of a range of risk management tools, supports different business decisions and processes including strategic decisions.

– CEBS Guidelines on Stress Testing, Section 2, Guideline 3



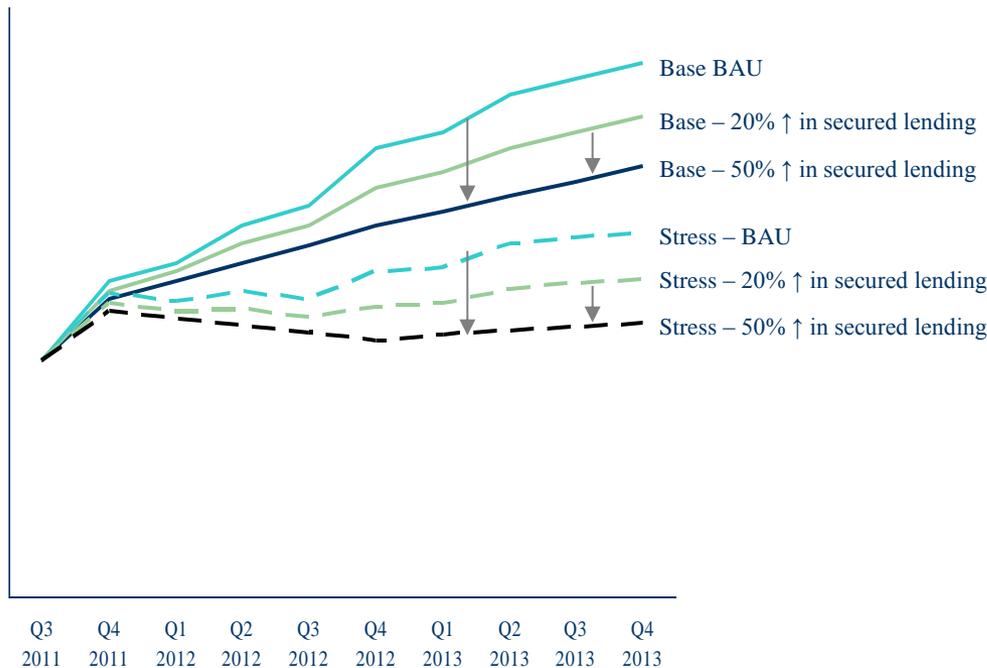
1 Strategic implications

Sensitivity analysis of strategic initiatives will enhance management understanding of potential deviation from planned course of action

Base and Stress regulatory ratios could consider impact of potential strategic actions under different scenarios

CET 1 ratio under different secured lending strategies

Illustrative



Comments

- For internal purposes, consider performing pro-forma analysis that uses as a “lever” the Bank’s strategic priorities
- Will allow the bank to better understand its likely performance under stress for a variety of strategic options (e.g. rebalancing of portfolios)
- In turn, improved understanding can inform decisions about potential range of capital actions given a strategic decision

Organisation and governance

Three typical models are observed, with larger banks moving towards an integrated bottom-up or dual approach

	Top-down only	Bottom-up	Full bottom-up/dual approach
Description	<ul style="list-style-type: none"> Stress testing done through centrally owned models Focused on Risk metrics (Capital, Liquidity, impairments) Liquidity, Credit, Market risk all done separately Used for regulatory requirements and Risk Appetite statements (in some cases) 	<ul style="list-style-type: none"> Business unit stress testing compiled at Group, with Group defined scenarios Focused on Risk metrics (impairments, RWA) with other aspects (P&L and balance sheet) receiving some attentions Liquidity, Credit, Market risk all done separately (liquidity generally done in the centre) Used for regulatory submissions and risk-aspects of planning (e.g. capital management) 	<ul style="list-style-type: none"> As with the Bottom-up, except with much greater involvement of Finance, Treasury and Strategy in the process Stress testing used to drive strategic decision making Linked directly to capital and funding allocation through risk appetite Integrated approach taken to all risk types, liquidity and P&L items Frequently has top-down model in conjunction as check/ for quick external exercises
Organization	<ul style="list-style-type: none"> Group Risk/Finance led 	<ul style="list-style-type: none"> Group Risk/Finance coordinated in centre BU teams take lead in stress testing, generally reporting into divisional management – often without being dedicated to stress testing 	<ul style="list-style-type: none"> Range of leadership models, with some institutions opting for cross-functional “Head of stress testing” organization BU staff either part of planning teams or dedicated staff
Calendar	<ul style="list-style-type: none"> Calculation exercise typically several weeks 	<ul style="list-style-type: none"> 1–4 months Depends critically on quality of process and analytics in BUs 	<ul style="list-style-type: none"> 1–4 months (with planning cycle) Depends critically on quality of process and analytics in BUs
Typical institutions	<ul style="list-style-type: none"> Smaller, credit-focused regionals 	<ul style="list-style-type: none"> Most larger, more complex institutions 	<ul style="list-style-type: none"> Some leading larger, complex groups

Scenario design

Best practice scenario design is an iterative process, including a range of scenarios that are aligned to business and economic uncertainties

- Scenarios taxonomy must cover relevant threats and opportunities
 - “Ad hoc” investigation of specific current concerns
 - Constant issues (to allow through-time comparison)
 - Confidence interval based (reg. requirement)
 - Reverse stress tests
 - Etc.
- Scenario discovery should include feedback from regular processes (e.g. planning/ budgeting rounds, risk appetite setting, etc..)
- Numerous stakeholders included (Group economics, Risk, Finance, Business leaders, etc.)
- Scenarios reconsidered/re-designed after each round



**Aim is not to “predict the future”.
Instead to highlight a set of issues through
risk and financial forecasting and facilitate
preparation for the unexpected**



Scenario taxonomy and examples

Economic scenarios

- Macro economic possibilities
 - Economic “shock” impacts
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- Deflation/hyper inflation
- Currency collapse

External changes

- Regulatory initiatives
 - Market/competitive changes
-



- Capital increase
- Ban on short selling

Market events

- Key markets shut down
 - Volatility in specific areas
-



- FX market halts
- Gold market

Internal sensitivities

- Known concentrations, issues and sensitivities
- One off events



- Default of largest name
- Drop in real estate market

Analytics

There is a wide spectrum of methodologies for both wholesale and retail credit risk stress testing

Wholesale portfolio stress testing methodologies

ECAP approach

- Use the same model as for ECAP (e.g. Merton model)
- Stress to a 1 in X confidence level, as opposed to a particular macro scenario (1 in X set based on judgment around overall severity of scenario)

Econometric macro approach

- Internal and/or external default series used to derive relationships to macroeconomic factors

Conditional transition approach

- Transition matrices conditional on specific economic scenarios
- Summarize transition matrix into default index used for regression on macro factors

Bottom-up loan level approach

- Model relationship between macro and micro economic factors; stress tests based on macro scenarios
- Rules-based prediction of default (e.g. LTV/DSC thresholds)

Laggard

Best Practice

Retail portfolio stress testing methodologies

Simple transition matrix approach

- Use historical roll-rate data, but apply stress to base using judgment

Econometric macro approach

- Internal and/or external default series used to derive relationships to macroeconomic factors
- Regressions used to estimate forward

Macro-enhanced roll-rate approach

- Transition matrices conditional on specific economic scenarios
- Key roll-rates (i.e. Current-to-30; 60-to-90) regressed against macro factors

Conditional roll-rate approach

- Model relationship between macro and micro economic factors through a loan level roll rate
- Probabilities of payoff, default, migration estimated by regression

Infrastructure

Regulation BCBS239 is driving the medium term changes in IT and data infrastructure in financial institutions

Comments

- Data should be of the ‘appropriate’ quality and granularity for timely extraction and aggregation of risks at various dimensions (e.g. legal entity, lines of business)
- Market participants investing significant resources into upgrading legacy systems to meet BCBS239 expectations
- Systems will need to meet both internal and external expectations



Key areas for consideration

- Definition of appropriate level of granularity required for slicing and dicing of data along various dimensions
- Definition of acceptable amount of time for extracting and aggregating data for different reporting purposes
- Assessment of areas where manual sourcing might be appropriate
- Future-proofing the system design – sufficient level of flexibility required to handle an appropriate amount of process and/or methodology changes
- Entities/regions leveraging IT and/or data synergies with Group