March 3, 2016

Maximizing the Value from Stress Testing

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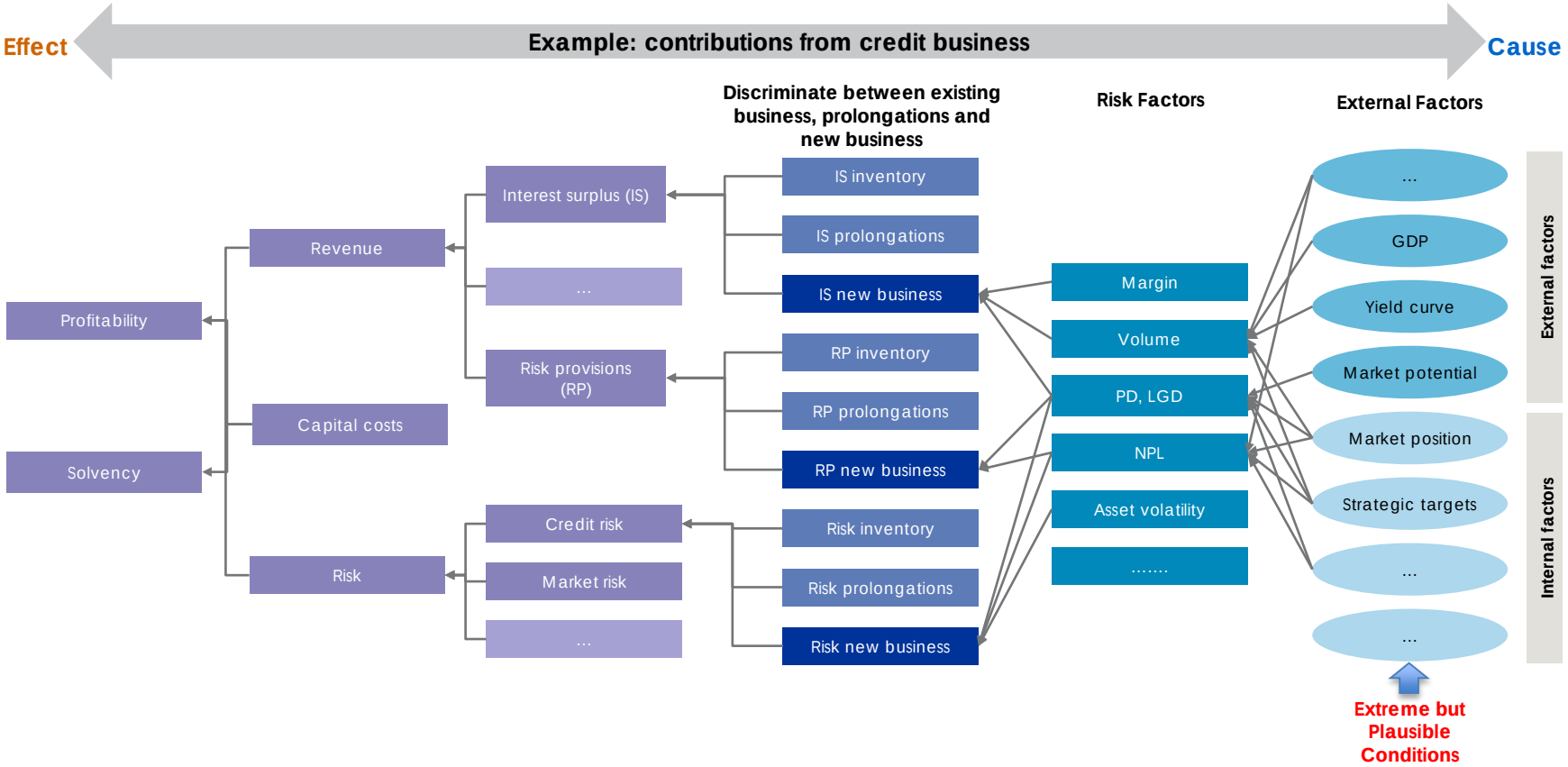
What is Stress Testing



What is the purpose of Stress Testing?

- Forward looking Assessment of Risk
- Early Warning Framework
- Sensitivity Analysis
- Contingency Planning
- Business Planning

Evolution of Stress Testing

Pre-Financial Crisis Issues

- **Siloed Approach:** Most banks did not have an enterprise wide stress testing framework that spanned all material risks.
- **Insufficient Data:** Most banks had limited data to model severe scenarios.
- **Lack of Awareness:** Neither regulators nor banks recognized how interconnected the system was.
- **Micro prudential:** Regulatory stress testing was done under Basel Pillar II and the objective was individual bank solvency
- **Principle Based Approach:** No proactive prescription to standardize stress testing.

Financial Crisis was the tipping Point for Stress Testing Practices

	Objective	Coverage (in 2014)	Scope	Methodology	Time window
US (CCAR)	■ Standardized Solvency test ■ Stressed Capital Planning ■ Macro prudential	■ CCAR : BHC with consolidated assets > $50 Billion. ■ Dodd Frank: BHC with consolidated assets > $10 Billion	Credit Risk, Market risk, Profitability, Capital Adequacy.	■ Dynamic balance sheet ■ Internal scenarios mandated. ■ Market shocks considered. ■ No Solvency-Liquidity – Funding Cost Interaction.	■ 2 year horizon with quarterly forecasts
EBA (EU Wide Stress Testing + AQR)	■ Solvency & Funding test ■ Macro prudential (Includes Contagion risk)	■ Covers 70% of Banking Assets ■ 51 Banks shortlisted for 2016.	Credit, Market, Sovereign risk, funding cost, RWA, Capital adequacy.	■ Static balance sheet ■ No Internal / bank specific scenarios. ■ Enhanced with Asset Quality Review ■ No Solvency –Liquidity – Funding Cost interaction.	■ 3 year horizon with annual forecast.
AUS	■ Scenario analysis to assess future vulnerabilities ■ Micro prudential	■ Top 13 Banks (90% of National Banking Assets).	Credit Risk, Loss rates. Capital Adequacy 2014 focus was on Housing Market downturn.	■ Principles based approach – No common methodology ■ APRA defines scenarios. ■ But APRA is working on streamlining methodologies & data requirements. ■ No Solvency Liquidity Interaction.	■ 5 Yr forecast horizon

So, how has Supervisory Stress Testing helped?

- Improve the resilience of banks and restore investor confidence in the banking system.
- Enhanced disclosures increased the transparency of risk management and capital planning process to supervisors.
- Informed Regulatory actions (both Micro Prudential & Macro Prudential)
- Improved Risk Management Governance & Internal Controls

Table 2: Positive Impact of Federal Reserve stress testing on US Banking system over a period of 3 years

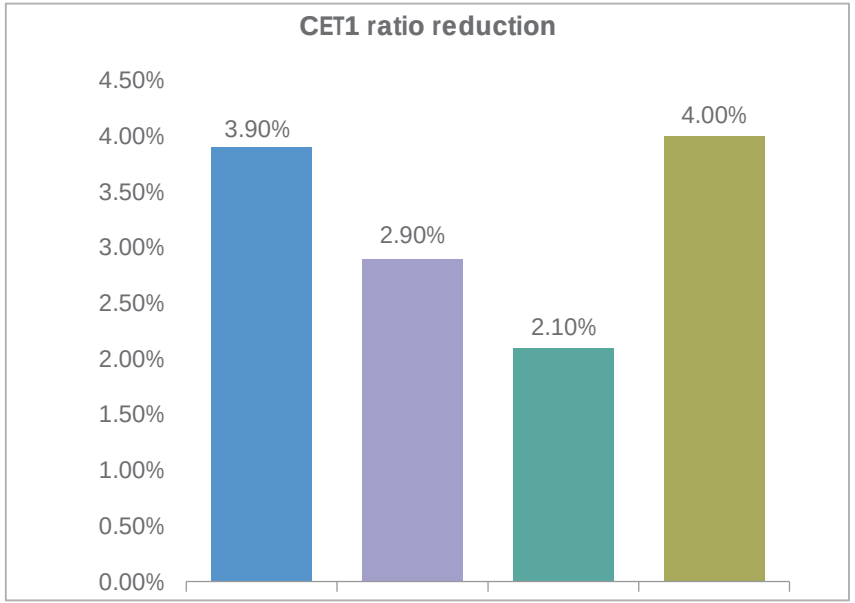
CCAR	2013	2014	2015
Failure Rate	2 / 18 BHCs failed for Capital shortfall 2 BHCs given conditional approval for qualitative issues.	1 / 30 BHCs failed for Capital shortfall. 4 out of 30 BHCs failed for qualitative reasons	No Capital Shortfall. 2 out of 30 BHCs failed for qualitative reasons
Avg Min CET1 Ratio	6.6%	7.5%	8.7%
Key Findings	Weaknesses in the risk measurement and capital planning process.	Weaknesses in governance, internal controls, MIS, estimation of stressed revenues, losses	weaknesses in governance, controls, MIS, estimation of stressed revenues, losses

So, how has Supervisory Stress Testing helped? (con't)

Table 3: Positive Impact of EBA stress testing on European Banking system over a period of 3 years

EBA	2010	2011	2014
Failure Rate	7 out of 91 banks failed* (7.7% failure rate)	20 out of 90 banks failed (22% Failure rate)	24 out of 123 banks failed (19.5% failure rate)
Average Stressed CET1 Ratio (or Tier 1 in 2010)	9.2%	7.4%	8.5%
Key Findings	Tier 1 shortfall of Eur 3.5 Bn	CET1 shortfall of Eur2.5 Bn.	CET1 shortfall Eur 9.5 Bn

Figure 1: Overall Capital Reduction Estimated Under Stressed Scenarios



Evolution of Stress Testing

Post-Financial Crisis Issues

- **Narrow Application:** Most banks just use it as a Regulatory Compliance & Capital planning tool.
- **Not Comprehensive:** Primary focus on Solvency.
- **Still Siloed Approach:** Enterprise wide but still **not Integrated**.
- **Organizationally not aligned** to conduct integrated stress testing or integrated risk management.
- Weak **internal controls and documentation protocols** lead to redundant effort and incoherent results.
- Banks still have **duplicate stress testing processes and infrastructure** for different purposes, i.e. supervisory stress tests, Pillar II, Recovery Resolution Planning etc.

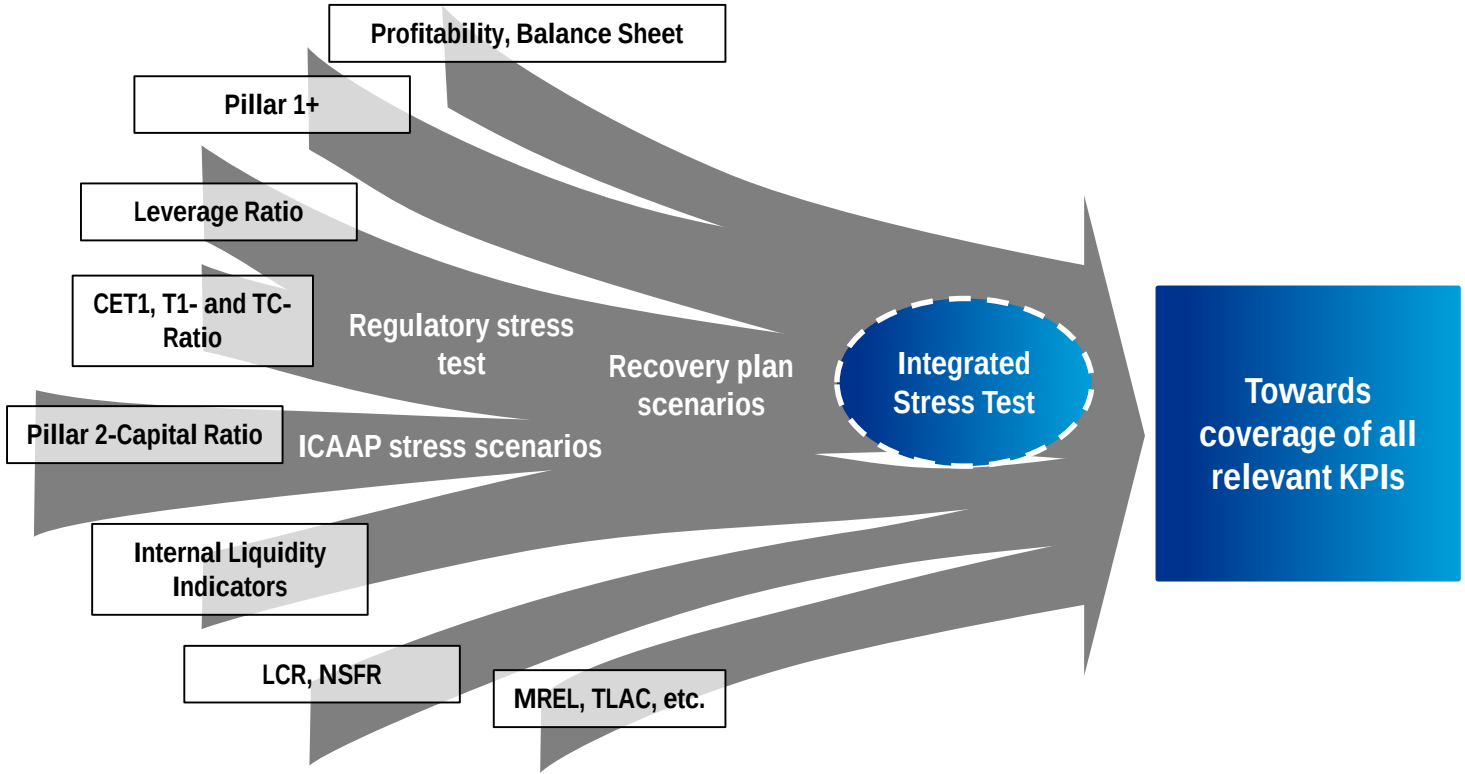
Expand the Utility of Stress Testing

Stress testing can be a useful tool to serve the agenda of multiple stakeholders:

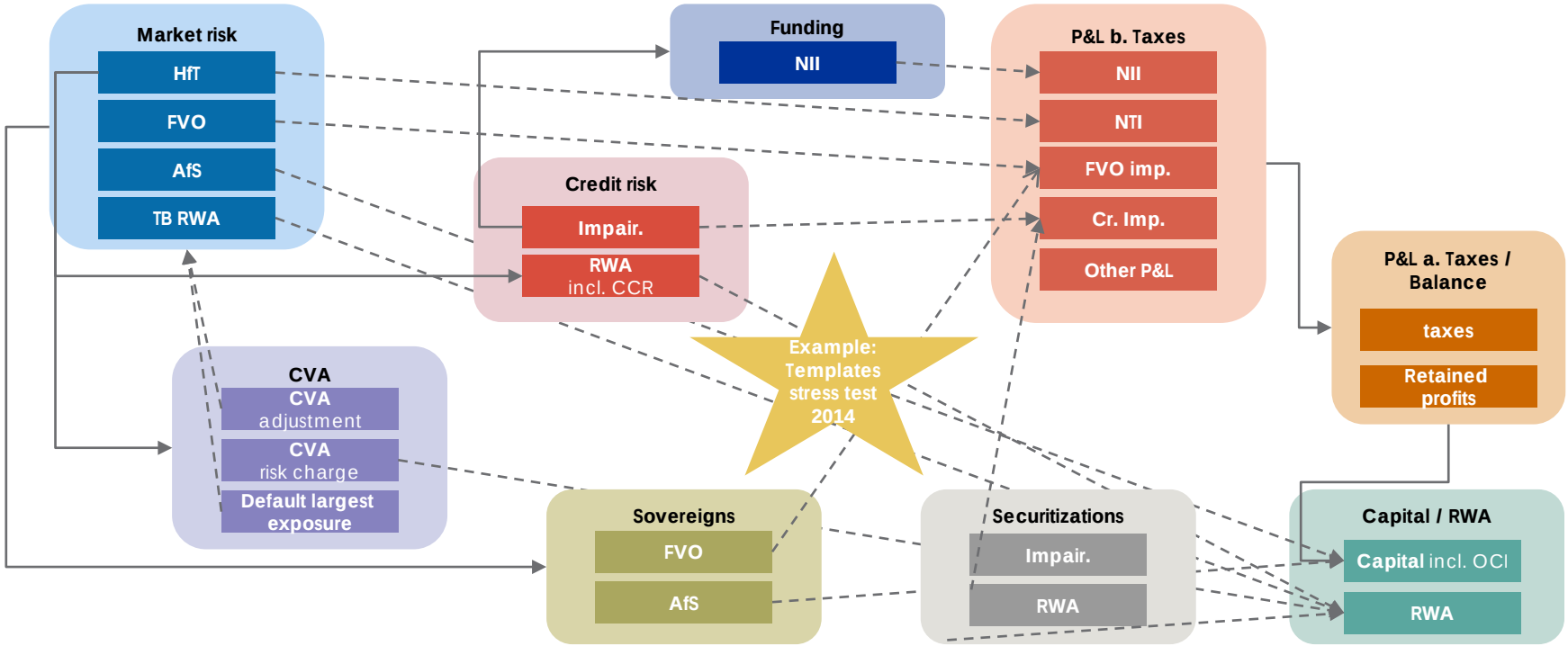
- Regulators already use it to manage financial stability of intuitions and broader financial system.
- CFO and CRO at banks use it for capital planning. They also need to use it for recovery and resolution planning, defining stressed limits and other internal controls.
- Board and senior management can use it to define the bank's risk appetite and strategic objectives conditioned on adverse scenarios.
- Business heads can use it for defining their business and product strategy. They can also use it as an early warning system.

How do you get there?

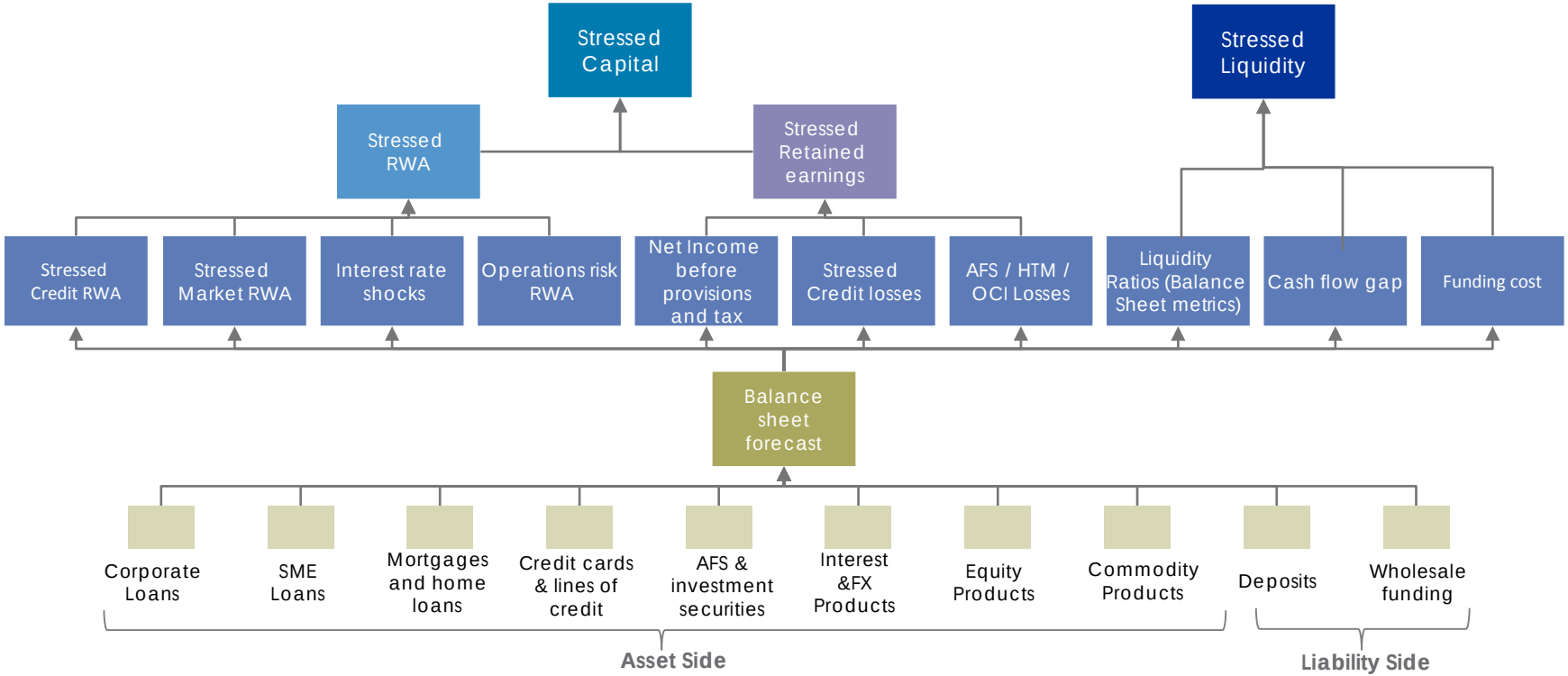
Integrated stress testing



Key Challenges Complex Links & Dependencies



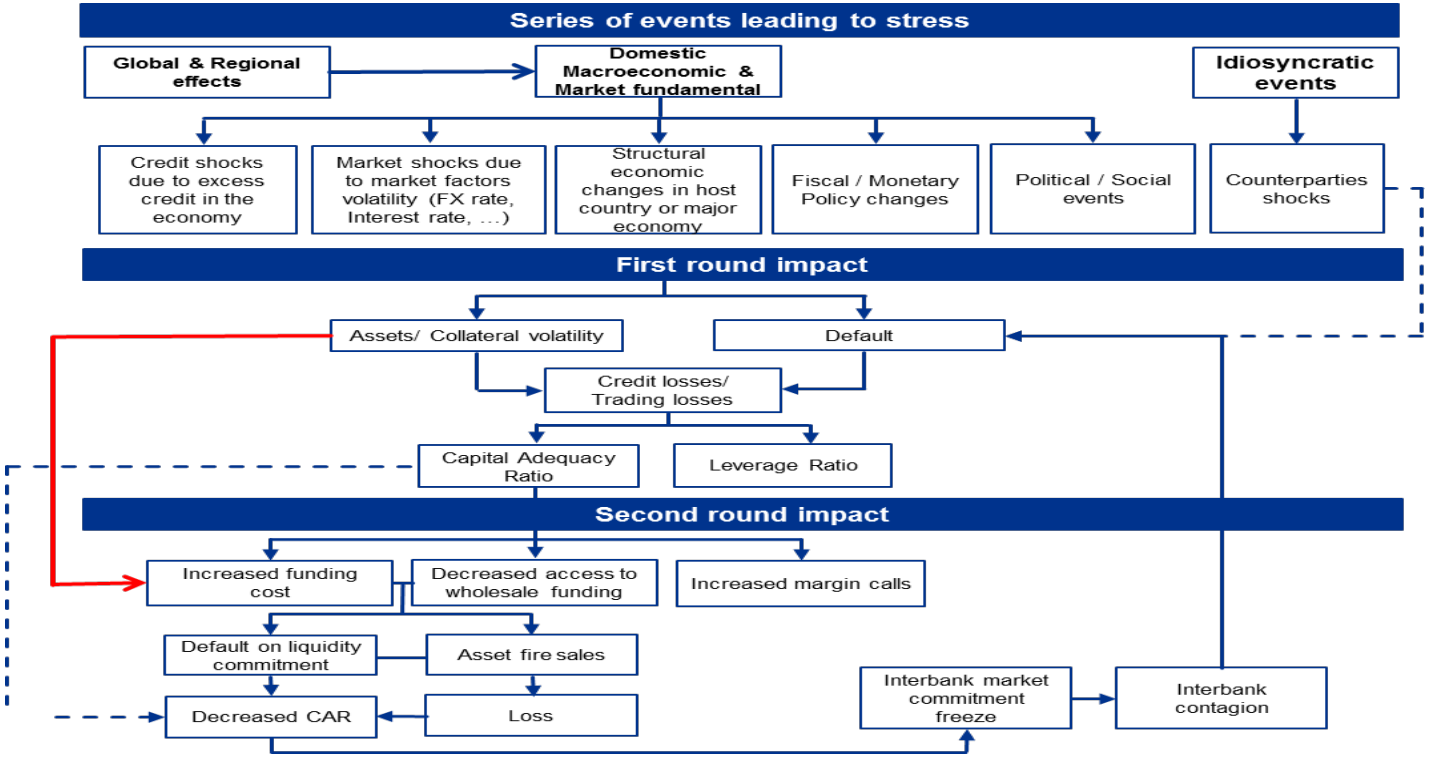
A Framework for Integrated Stress Testing



Methodology

Factor Category	Risk Factors (Input)	Output	Methodology
Macroeconomic Factors	Scenarios	Macroeconomic factors	▪ Structural econometric models ▪ Vector Auto Regressive Models ▪ Marginal distribution
Credit Risk	▪ NPL ▪ PD, LGD, EAD	▪ Provision, Expected Credit Loss ▪ Credit RWA	▪ Structural Models ▪ Reduced Form Models
Market risk	▪ Volatility of market factors (IR, Fx, Commodity, Equity etc..) ▪ Volatility of Net trading income ▪ Fair Value Haircuts	▪ Net Trading Income ▪ FVO impairments ▪ OCI ▪ CVA Fair value adjustment ▪ Stressed VaR ▪ Market RWA	▪ Based on Volatility of NTI ▪ Full Revaluation ▪ Stressed VaR (Parametric, Historical)
Liquidity Risk	▪ Run off rates ▪ Roll over rates	▪ Loan to deposit ratio, Wholesale funding ratio ▪ Cash flow gap	▪ Balance sheet approach to forecast deposit run-offs, wholesale funding impact and impact on off-balance sheet commitments ▪ If granular data available, implement cash flow gap.
Operations Risk	▪ Frequency of Loss ▪ Severity of Loss	▪ Operations risk RWA ▪ Improve Controls	▪ Loss Distribution Approach ▪ Regression Models

How do you integrate Solvency & Liquidity



10 Strategies to get the Most out of your Stress Testing Framework

Scope	1.	Integrate stress testing to risk appetite setting, business planning, product planning, capital planning, recovery and resolution planning, limits setting and risk monitoring.
	2.	Leveraging stress testing framework to develop an early warning system.
Governance	3.	Establish Group Wide Stress Testing (GWST) function that cuts across risk type and business units.
	4.	Strong Governance & Internal Controls to ensure reliable results and decision
Methodology	5.	Establish group level KPM and KRM bands for baseline and stressed conditions.
	6.	Cascade these down to stressed limits and early warnings indicators at the business unit and product level.
	7.	Stress testing based on dynamic balance sheet.
Reporting	8.	Stressed forecasts and performance against stressed limits are reported in periodic management reports.
	9.	On-demand reporting for business unit heads as macroeconomic and sector specific events happen.
	10.	Invest in Data

Hurdles to Overcome

1. Target Stress Testing Capabilities

- **Increase of stress testing frequency, submission requirements and introduction of site visits;** without structural changes this can only be facilitated by excessive use of resources, temporary reprioritization of the project portfolio and partly postponing of line activities
- **Supervisors are demanding more sophisticated risk identification processes;** in the US CCAR institutions are expected to develop a comprehensive stress scenario that is explicitly designed to target its own vulnerabilities.
- **Internal and External Audit involvement and attestation;** Need for 3rd line Internal Audit to attest aspects of the Stress Testing and for External Audit to understand and review the stress testing undertaken by the organisation, already introduced within CCAR and PRA frameworks.

2. Data Architecture & Infrastructure

- **Need for advanced technical tools** to support data preparation, interfaces, simulation and analysis. Less reliance on spreadsheets and manual processes
- **Need for a process & tooling to support transparency and traceability**; Supervisors are increasingly focusing on traceability between line items included in submissions and risk inventory
- **Full alignment between risk data reporting and stress testing** in line with Risk Data Aggregation and Reporting principles (BCBS 239)

3. Target Operating Model

- **Integration of stress tests;** the increasing number of bank wide stress tests required by the regulator needs to be closely aligned; i.e. one version of the truth
- **Need for sophisticated organizational planning**; many institutes run planning and stress testing as processes which involve many departments with many manual interfaces. As a result the processes put a high work load on resources.
- **Integration of stress testing with planning and budgeting;** banks need to move from Siloed to integrated stress testing, planning and budgeting processes. In the US this is already a CCAR requirement.
- **Training**; Institutes need to think of how to best team up competencies from planning and risk control units

Structurally addressing these challenges will have significant implications on:

- The stress testing framework and its integration with planning processes
- Data architectures and infrastructure

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Thank You!