

STRESS TEST FOR RISK ASSESSMENT UNDER BASEL FRAMEWORK APPLIED IN BANKING INDUSTRY

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Abstract

Current paper provides the analysis of the Basel accords and regulatory measures, especially paying attention to stress test approaches. Authors show regulatory milestones for Indian banks and their risk management framework. Risk Analytical Methodology in banks and macro economic stress testing are also described. Future focus of further research needs to assess Indian banks' risk model among the existing stress test framework and analytical preparedness.

Keywords: Stress Tests, Risk Assessment, Basel Framework, Banking Industry

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1. Background

Stress testing in Banks is crucial for risk mitigation both from regulatory and managerial standpoint. The U.S. sub-prime crisis of 2008 triggered economic recession across the globe and various agencies like financial institutions, regulators, credit agencies, government policies, and consumers, among others (Phil Angelides et al 2012) were collectively seen a part of systemic breakdown. Across the globe, the Central Banks have been advocating Stress Tests from the macro-prudential view point and created advanced risk analytical framework to predict scenarios impacting capital adequacy.

1.1 Basel Accords and Regulatory Measures

Historically, a formal global level risk and capital framework was first created by Basel Committee on Banking Supervision (BCBS) in 1988 under "International Convergence of Capital Measurement and Capital Standards" and popularly referred as Basel I. According to Basel I framework, banks were required to maintain 8% of capital adequacy against risk weighted assets (RWA).

In 2004 a developed framework was introduced as Basel II which comprehensively included three pillars such as minimum capital requirements, supervisory review process, and market discipline. Under this new framework, capital requirement of 8% under RWA which comprehensively covered three major risks namely credit, market, and operational risks. Capital requirement for credit risk and operational risk was estimated by a choice of approaches like standardised, foundation internal

ratings, and advanced internal ratings approach. But Operational risk continued to be measured by approaches using standardised and internal measurement model

The financial crises of 2007-09 proved that capital adequacy as per Basel II were not sufficient enough to assess credit risk in the trading book of a bank. BCBS issued Basel II.5 and followed it with series of documents in addressing market risk framework. A consolidated norms were thus christened under "Basel III: A Global Regulatory Framework for more Resilient Banks and Banking systems" in December 2010 (revised in June 2011).

1.2 Stress Test Approaches

IMF has been using stress tests since 1999 as part of Financial Sector Assessment Program (FSAP)—a joint effort by the IMF and the World Bank. FSAPs cover multiple risks in stress tests including credit risk, market risk liquidity risk, and contagion risk. (Marina Moretti et al 2008). IMF advocates multiple approaches to create stress as furnished below:

- i. Single-factor sensitivity tests by stress testing bank's balance sheet and studies the impact of macro economy over Non Performing Loans (NPL).
- ii. Advanced approach on NPLs or loan-loss provisions vis a vis multiple macroeconomic variables.
- iii. Portfolio credit risk stress test with models of Probability of Default (PD) and Loss Given Default (LGD) linked to macro-financial factors. This is similar to Basel II internal ratings-based (IRB) approach.

- iv. Application of nonparametric techniques to measure banks at an individual level as well as the institutional level across banks (Segoviano et al – 2006).

Besides approaches practiced by IMF, Banks across the world have created different Stress-Testing Methodologies. William compiled such approaches by studying practices across multiple banks and classified (William Nayda 2012) into following four categories.

- i. Benchmarking - Use external information and data to inform the level of stress
- ii. Historical - Apply historical loan experience of PD and LGD for various down cycles.
- iii. Factor Analysis - Shock loan factors such as economic stress, currency shock, property value – Loan to Value (LTV), to determine the impact on PD and LGD.
- iv. Grade Migration - Adjust all loans down 1 or 2 grades and observe the outcome.

1.3 Regulatory Milestones for Indian Banks

RBI implemented Basel I norms from 1992 and Indian Banks started maintaining qualitative equity capital as Tier I and others as Tier II capital. Since 2008-09, Indian banks started adopting Basel II by using standardised approach across all the three risks including credit, market and operation. Among various phases of Basel III implementation roadmap, the following two phases are important milestones as earmarked initially:

- i. April 1st, 2013 - The Basel III capital regulation gets implemented in India in phases
- ii. March 31st, 2018 – Banks to meet minimum Basel III capital ratios and full regulatory adjustments to the components of capital - Basel III capital regulations to be fully implemented.

RBI in its Guidelines on Stress Testing classifies banks into following three groups as per RWA for stress test.

- i. Group A – Bank with Total Risk Weighted Assets of more than Rs.2000 billion. These banks need to perform simple portfolio based sensitivity analyses to complex macro scenario driven firm-wide exercises besides reverse stress testing on a regular basis. All banks in this group need to commence stress testing not later than April 1, 2015.
- ii. Group B – Bank with Total Risk Weighted Assets between Rs.500 billion and Rs.2000 billion. Banks under this group should conduct multifactor sensitivity analysis and simple scenario analyses of the portfolios with respect to simultaneous movements in multiple risk factors caused by an event.
- iii. Group C – Bank with Total Risk Weighted Assets less than Rs.500 billion. These banks

need to do simple sensitivity analyses of the specific risk types to which it is most exposed.

In its latest directive, RBI has extended the deadline for implementation of Basel III norms by one year to March 2019. This extension is made to bring down the added burden on asset quality and consequential impact on the performance/profitability of the banks.

2 Risk Management Framework

It is observed across the globe, (Allan Kearns 2004), during recession, loan losses are likely to deteriorate as borrowers' ability to repay their debts would come down as well as value of collateral would also fall. Allen Kearns in his paper "A Framework for Stress Testing Credit Institutions' Financial Well-Being" verified the efficacy of 'top-down' stress testing and found empirical results that "providing the extra reserves required to fund the expected increase in loan losses would not pose a threat to the financial health of any of the institutions included in the test."

In an attempt to identify the risks faced by the banking industry and the process of risk management, (Thirupathi et al, 2013), the study titled "Risk Management In Banking Sector -An Empirical Study" it was suggested to take "risk more consciously, anticipates adverse changes and hedges accordingly, it becomes a source of competitive advantage, and efficient management of the banking industry."

IMF has published a white paper titled "A Framework for Macroprudential Bank Solvency Stress Testing: Application to S-25 and Other G-20 Country FSAPs", (Andreas et al, 2013), in which it articulates "the solvency stress testing framework that is being applied in the IMF's surveillance of member countries' banking systems, and discusses examples of its actual implementation in FSAPs to 18 countries which are in the group comprising the 25 most systemically important financial systems ("S-25") plus other G-20 countries". The paper further emphasised that Risk & Stress Test Framework need to be created keeping into account "different circumstances (e.g., normal or crisis times), systems (e.g., sophisticated or basic), regulatory regimes (e.g., Basel I or Basel II/III) as well as be sensitive to when and how the outcomes are presented and communicated."

3 Risk Analytical Methodology

Studies dating back to 1996 onwards, analysed numerous (Caprio and Klingebiel, 1996) episodes in which banks' portfolio credit losses (unexpected losses) have completely or nearly exhausted the banking system's capital. By scanning multiple risk analytical methodology in practices (Miguel Angel, 1996) it was pointed out that the proper measurement of financial institutions' credit risk should include

macroeconomic developments and consequently changes in risk through time. In their paper titled "Conditional Probability of Default Methodology", Miguel presented a methodology for the modelling of the empirical frequencies of loan defaults (PDs) with identifiable macroeconomic and financial variables.

For measuring delinquency and default, a fairly simple simulation model was applied (R Srinivasan, 2007) under a new term primitive collection rate (PCR). The PCR is the cumulative amount collected, in a given period, of loan amounts disbursed in a previous given period. Thus the PCR traces collection to the period of origin of the loan. In this model, parameters such as on-time collection rate, current collection rate and cumulative collection rate were used and seasonality, delinquency and loan loss reserve were simulated.

In a literature survey (Kalpataru and Kumar, 2010), a summary on various risk analytical methodology were summarised and following chronological developments were identified:

- i. Prior to 1970's risk management was largely based on experience and judgment.
- ii. Later techniques and models such as concept of standard deviation, concept of beta, option pricing models, credit link swap, interest swap, cross asset risk exposure were used to address risk related issues
- iii. During mid-1990's, J. P. Morgan Chase introduces value-at risk (VaR) to measure portfolio risk of its business entity.
- iv. By building quantitative monitoring from financial statements, Macdonald (1998) identified and concluded that bank supervision must respond to the challenge of additional risks to secure depositors.
- v. Option-pricing model (Robinovitch, 1989) applied and found low insolvency risk.
- vi. Kotrozo & Choi (2006) used Herfindahl Index (HHI) to measure diversification and found that total risk is increased for those banks that focused on their revenue activities.
- vii. Leverage model on different product mix and earning volatility of commercial banks were used by DeYoung & Roland (2001).
- viii. Morton et al. (2005) introduced Monte Carlo techniques to create a framework for asset allocation in managing risk.

4 Macro Economic Stress Testing

A multivariate scenario to assess banks' credit and interest rate risks were built using deterministic and stochastic simulations which formed a tool kit for scenario analysis and macro stress-testing (Jan Willem et al, 2006). In this paper, separate models were built for probability of default and loss given default for both domestic and foreign portfolios.

An asymmetric response of credit risk between deep recession and subsequent economic recovery

was built by Akira Otani (2009). Akira used a mix of borrowers' shift between rating classes and its sensitivity to economic fluctuations across PD rating. This created a framework by estimating the shifts in borrowers' creditworthiness across business cycle.

Dietske Simons and Ferdinand Rolwes (2009) applied a macroeconomic-based model for estimating PD by focusing on analysing the relation between macroeconomic variables and the default behavior. This study built models using GDP growth, oil price, interest and exchange rate. This paper built a stress scenario on default behavior of two quarters of zero GDP growth as per Basel II framework.

As Indian banks are moving towards Full Capital Account Convertibility, Tanima Niyogi et al (2011) estimated that the exchange rate volatility would have an adverse impact on interest rates and bank default rates. This paper made a macro prudential analysis of credit risk among Public Sector Banks by using Vector Autoregression methodology. It used macroeconomic variables such as default rate, financial stability indicator of banks and simulated interactions to estimate the stress.

5 Future Research Focus

Basel norms as well as RBI also mandate stress testing around low probability events to validate regulatory economic capital estimates and for a more general purpose of assessing the impact of changes in the economic scenarios on the portfolio.

Future focus of further research needs to assess Indian banks' risk model among the existing stress test framework and analytical preparedness. Such research can explore on the following areas:

- i. Build credit risk model for Indian Banks to measure the impact on credit quality to macroeconomic variations.
- ii. Compare multiple Stress-Testing Frameworks for Macro Stress-Testing practices across Indian banks.
- iii. Develop a Stress Test Analytical Framework for multiple RWAs across Group A, Group B, and Group C banks and measure exposures as follows;
 - a. Small exposures with homogenous risks.
 - b. Large Exposures with heterogeneous risks.
- iv. Develop Stress Early Warning Model on multiple scenarios to flag any impending increases in the losses of the portfolio based on Macroeconomic variables and relevant internal variables among Balance Sheet specific attributes.
- v. Assessment of Credit Risk Analytical Maturity of select banks and comparing with global banks having their captives.
- vi. Basel III Roadmap and challenges faced by Indian banks in its preparedness.

6 Guideline for a Quantitative Computation of Stress Test

Future focus need to validate the empirical relationship between Asset Quality, NPAs and Capital Adequacy of Indian banks in the light of changes in economic activity. Secondary data from RBI, bank's disclosure as well as from banks Annual Report need to be compiled for data on advances

Rajveer Rawlin et al (2012) used Curve Estimation routine to fit linear, logarithmic, inverse, quadratic, cubic, power, compound, S-curve, logistic, growth, and exponential models to data based on their relative goodness of fit. A similar approach by Statistical Analysis on curve estimation function could be explored by using statistical packages.

By using interview method and meeting credit risk stakeholders of banks, qualitative data pertaining to Risk Framework, Model Attributes and Risk Analytical maturity could be derived. From the qualitative inputs, appropriate economic and modeling framework on stress test can be arrived at. From the data compiled from stakeholders using secondary data, quantified economic model is planned to be built. This effort is to help to build a multivariate model and arrive at key macro economic variables which could create a stress test framework.

7 Significance of Further Research

By measuring the impact on credit quality of Indian banks, the stability of Indian banking system and a range of plausible adverse events can be estimated. By assessing India specific and bank segment specific sensitivities to economic cycles, a common framework can be of help for ease of use and comparison. As more and more of challenges are being foreseen by both Indian and global regulators, a maturity assessment can open up an avenue to address the challenge if any and lay down a road map for smoother Basel III implementation.

Further study on practice of stress tests in Indian Banks need to provide the following critical outcome:

- i. Basic hypothesis about model segments.
- ii. Codified knowledge about variables that are potentially predictive.
- iii. Industry practices prevalent in credit risk assessment and stress test.
- iv. Syndicated list of variables that are potentially predictive.
- v. Common challenges, if any, for RBI's Basel III Roadmap.
- vi. Risk Analytical Maturity in Indian Banks.

Thus future work is planned to assess risk appetite of Indian banks under extreme scenarios. By estimating scenarios of stressed events, current and future capital requirements under baseline and stressed conditions can create the needed buffer to address any eventualities.

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