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Stability Mapping for Risk Management in Banking Companies

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Abstract

Assessment of financial stability is a crucial and challenging task for most banks. Numerous approaches are used to assess financial stability to determine the operation of the banks under stress conditions and to identify the indicators that affect the financial developments of the system. The relationship between the macroeconomic variables and financial markets can be assessed by performing stability mapping. Risk management can be performed by accurate identification of stability indicators, appropriate assessment of deterioration in asset quality, and other economic aspects. Financial stability reports (FSRs) and heat maps are used in several banks to assess risk factors that affect financial stability using minimal indicators. This paper provides a detailed study of the banking sector's stability mapping schemes used for risk management. Mapping schemes like banking stability map (BSM), Global financial stability map (GFSM), Self-Organizing Map (SOM), and construction of financial stability maps (FSM) are discussed. An overall evaluation of underlying parameters and inherent risk factors that affect the banking stability is performed using a banking stability map. The indicators involved in the profitability of the capital and banking sector and the financing and liquidity

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of the system are discussed thoroughly. Stability mapping enables appropriate risk management by identifying the crucial indicators for shock absorption in banking.

Keywords: Banking, Risk Management, Stability Map, Financial Stability, Stability Indicator

1. Introduction

In any financial system, banks play a major role. Understanding the liabilities on domestic as well as the global level is crucial to analyse the financial stability of banks. Early identification of the sources of these liabilities enables proper planning and implementation of action plans that improve the shock absorption capacity of the financial system.

Defining and measuring financial stability is challenging due to the complex interactions and interdependence of the various elements of the financial system. Cross-border dimensions and time factors further complicate these interactions. Several researchers have been working on means to capture the financial stability conditions using different indicators of vulnerabilities in the financial system. Financial stability reports (FSRs) and heat maps are used in several banks to assess risk factors that affect financial stability using minimal indicators in several central banks. Several researchers are working on developing a single aggregate measure for indicating the financial stress and fragility level. Efficient monitoring of the level of the system's financial stability, the anticipation of the causes and sources of financial stress in a system, and effective communication of the impact caused by these conditions are the major requirements of a system that enables financial system participants and policymakers to contribute more towards a better financial model.

Uncertainty, risk, loss probabilities, and such measures are compiled from equity markets debt, foreign exchange and banking. Pressure is exerted on the banking sector from other financial market segments in terms of economic parameters like gross domestic product (GDP), foreign capital flow, and imports and export that directly affect the banking business volume. However, the banking sector maintains resilience against all probabilities and

offers a sense of stability to the entire financial system and national economy.

The ability of an economy to withstand internal and external shocks can be determined based on banking stability. The economy, financial market, and banking sector contribute to national and global financial stability. Banking stability is the most crucial and vital element of the nation's financial stability. Parameters like cost and return on assets, capital, liquidity, asset quality, etc. are used to analyse banking stability. In this paper, we combine some of these indicators to analyse the banking sector's health based on stability mapping for risk management. Figure 1 offers a detailed strategy map for financial stability management in the banking sector.

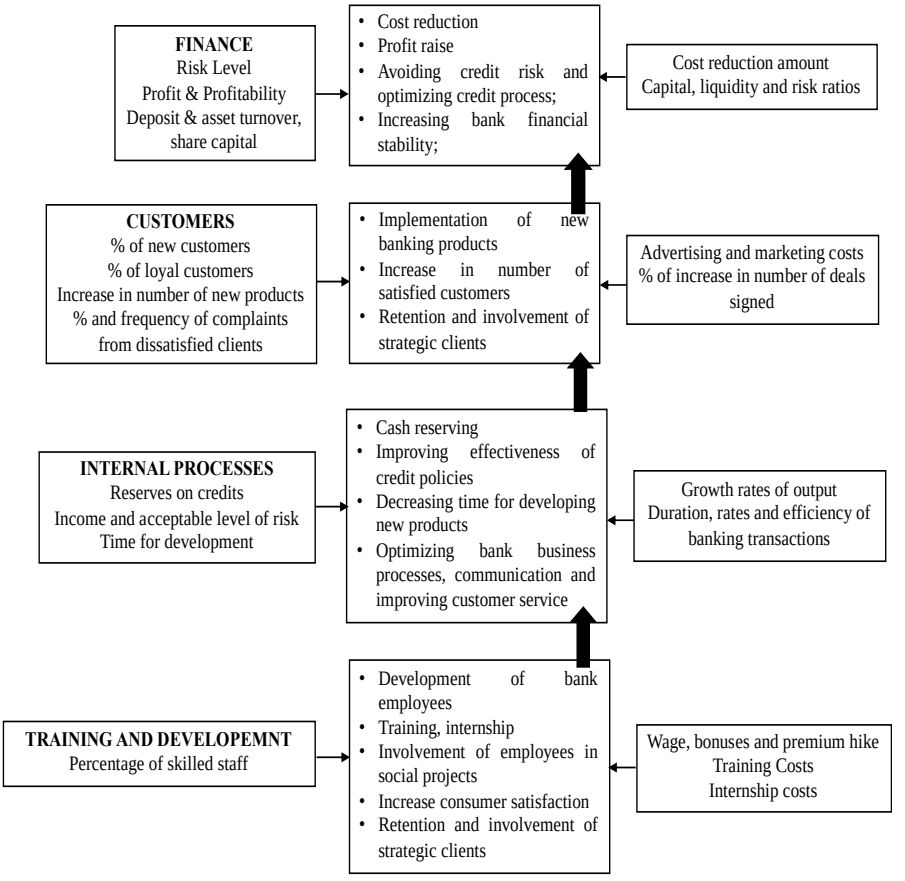

Fig. 1. Strategy map for financial stability management in banking sector

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2. Methodologies

2.1. Banking Stability Map (BSM)

An overall evaluation of underlying parameters and inherent risk factors that affect the banking stability is performed using a banking stability map. Five indices representing five dimensions are used in the map, namely efficiency (E), liquidity (L), profitability (P), asset quality (Q) and soundness (S). The banking institutions are evaluated by a distinguished international rating system CAMELS - Capital adequacy, Asset quality, Management, Earnings, Liquidity, and Sensitivity. Good financial institutions are required to obtain more than 3 points. BSM and indicator are used for the calculation of standardised ratios for analysing the weights on the basis of CAMEL rating.

Efficiency enables reducing the non-performing asset (NPA) in banking management. Asset quality enables the measurement of the financial health status of the bank. Liquidity refers to the credit-deposit ratio. Ideally, this ratio should be 65-75%. Profitability protects the economy from shocks and reduces vulnerabilities. Soundness deals with the Capital Adequacy Ratio (CAR) and Leverage Ratio. Table 1 summarises the ratios used for the construction of each composite index.

Table 1: Financial stability Ratio

Dimension	Ratio		
Efficiency	Staff	Cost/Income	Business
Liquidity		Credit deposit ratio	
Profitability	Profit	Return on Assets	Net interest margin
Asset quality	Gross NPA/ Sub-standard advances	Total advances/ Net NPA	Total Advances/ Gross NPA
Soundness	Leverage Ratio	Capital-to-risk weighted assets ratio (CRAR)	Tier1 Capital/ Tier 2Capital

2.2. Global Financial Stability Map (GFSM)

Parameters and sectors related to the financial stability, namely real economy, corporate sector, household sector, external sector, financial sector and financial markets, influence the financial stability. GFSM provides a graphical representation of the time-based progress or depreciation of global financial stability. GFSM is also called Spidergram. International Monitory Fund (IMF) identifies the indicators of GFSM as macro-economic risks, emerging market risks, credit risks, market and liquidity risks, monetary and financial conditions and risk appetite. The banking stability index can be evaluated, and risk management can be performed.

GFSM uses graphical representations to communicate the conditions and risks that affect financial stability in a quantitative manner. The global financial infrastructure can be monitored more systematically using the combination of financial surveillance tools coupled with GFSM. This can also be used for understanding and improving the conditions and risks that affect financial institutions and its intermediaries. The key financial stability risk sources like microstructure of asset market and operational risks are not considered in this technique. GFSM is built from 29 surveys, and market and economy based indicators.

The drawbacks of GFSM are that it identifies only small changes in risks, it reflects explicit judgement calls, lacks transparency and incorporates voluminous data, arbitrary allocation of variables to risk categories and mixing of relevant information from a wide range of frequencies.

2.3. Self Organizing Map (SOM)

Dimensionality and data reduction can be performed while analysing exploratory data. Data can be grouped into clusters or profiles for easy interpretation and evaluation. The clustering schemes and aims of projection can be combined using a Self-Organising Map (SOM). It enables summarization or static visualisation of voluminous data. This technique is applied for monitoring financial performance, economic functioning and debt crisis on a global level. Financial indices like equity basic, real

estate, strategy, swiss reference rates, shares, bonds, and so on are analysed. While keeping track of the individual indicators, the multidimensional data can be distributed in a linear manner on a two dimensional plane for easy interpretability. Voluminous data can be summarised and visualised statistically on a two-dimensional plane using SOM.

SOM uses an unsupervised learning technique. Topographic error, distortion measure and quantisation error are some of the parameters used for measuring the quality of the map. Self-Organising Financial Stability Map (SOFSM) enables disentanglement of the individual sources that influence risks in multidimensional spaces and represents them on a two-dimensional plane. The financial stability cycle of a nation can be located, and the macro-financial vulnerabilities can be monitored using the SOFSM based on tranquil state, crisis, and pre and post-crisis scenarios. In the case of a global financial crisis, the sample data prediction and classification can be performed using the SOFSM model in an efficient manner. Forecasting horizons, preferences of policymakers and the model threshold can be varied to test the robustness of the model.

2.4. Construction of Financial Stability Maps (FSM)

The compounding indicators and categories of FSM are selected based on certain primary criteria:

The information regarding existing financial stability is aggregated into a single instrument along with multiple risk indicators. The stability status of the financial system is determined by promoting discussions on threats to financial stability. FSM can be used in alignment with other financial stability assessment tools without overlapping. Forecasting elements and periodic update is essential in FSM with frequent data inclusion. Diagnostic data with respect to the financial and economic developments, inclusive of expert judgement and relevant techniques, are to be provided by the FSM.

Adequate and appropriate data in limited volume must be available in the map under the indicators of each category. Data inadequacy may occur on various risks if lesser number of indicators are included. However, the data that is fed may overlap if the number of indicators is large. This leads to offsetting of the

indicators. Hence, each category can have an optimal number of 4 to 8 indicators.

Data regarding risks that are related to financial stability, measurable and distinguishable, must be present in the FSM composing categories. Categorisation of variables into various sub-indicators may be challenging as a single data may belong to multiple sub-indicators simultaneously. This overlap may be justified by the relevance of data specified by the sub-indicator.

2.5. Profitability of Capital and Banking Sector

The resilience of banks towards various shocks is related to their financial stability. The ability of the banking sector to absorb probable losses is termed capital, and the ability to improve the capital is termed profitability. The capital is increased with an increase in profits. Five sub-indicators are discussed here that help in the assessment of the risks in the banking sector derived from the capital of the banks.

Difference between regulatory minimum and capital adequacy ratio (CAR) - The financial soundness of the banks can be indicated using the capital adequacy ratio. It is essential to maintain this ratio above the safe level to avoid a financial crisis. The banking sector is less vulnerable if the buffers against shocks are large and the difference between the required minimum and CAR is high. High risk and low coverage are the outcomes of less difference.

The ratio of non-performing loans (NPL) - The quality of the portfolio of a bank can be indicated accurately using this parameter. The banking system is exposed to higher risk due to the exposure to a higher vulnerability that is caused by erosion of the bank capital with the increasing NLP ratio.

Equity of total assets to shareholders - The equity of shareholders finances a certain share of assets that are measured by this indicator. The absorption capacity can be improved against possible losses by increasing this ratio to a higher level as the primary barrier against the losses of the bank is the capital.

Income through net interest to total assets - The difference between the interest income and expenses is termed net interest income. In most banking sectors, this factor contributes to the major share of

income of the bank. The profit of the bank increases with an increase in the share of total assets. The decline of this indicator value implies increased risk for the banking sector.

Earnings before taxes against total assets - The capital of a bank can be strengthened through a positive financial result. The interest income and loss obtained from the non-performing loans contribute to the net profit/loss result of a bank. Operating income and expenses such as personnel expenses, income from commissions and such valuable data are included in this indicator. The taxation policy variations that lead to changes in profit and loss are avoided if the former is used rather than the after-tax earnings. On reversal of this indicator, the earnings before tax to total assets ratio decline, leading to an increase in the banking sector's vulnerability. The rank score is assigned using the standard scheme.

2.6. Financing and liquidity of the banking system

Assessment of risk level to financial stability derived from the liquidity and fund structure of the banking sector can be performed based on this category. The ability of the sector to withstand possible shocks is less if the structure is vulnerable. 4 sub-indicators are available under the financing and liquidity category. The risk scores are assigned by applying standard methods to each sub-indicator.

Loan to deposit ratio - The extent to which the total deposits made to the bank covers the bank loans is measured using this ratio. This acts as the main financial source for the bank. The vulnerability of the banking sector is less if the loan to deposit ratio is high. It offers increased protection against funding and credit risk. On reversing the indicator, a lower risk score is assigned to a higher indicator value.

Household deposits growth rate - The sensitivity of household deposits to the financial system shocks is high despite being the major source of funds for the bank. Panic and negative news may lead to a reduction in this value that exposes the banks to the risk of liquidity and even failure. The confidence and liquidity of the banking system is indicated by the increase in the deposit rate.

Higher the value, higher the liquidity levels and confidence in the bank.

Financing from non-residents - Banks obtains financing through non-residents who are substantially sensitive to possible shocks in the banking sector. The total funding to the share of funding from non-residents is used for constructing this indicator. With the increase in banks' exposure to the risk of funding, these values increase correspondingly. Standard schemes are used for the evaluation of risk on reversal of the indicator.

Asset- liabilities difference – It takes a minimum of 3 months for the occurrence of changes in the difference between short-term assets and liabilities. The liquidity sub-indicator can be used for the assessment of short term risks in financing. It can be measured as the difference between short-term assets and liabilities, which lasts between 3 to 14 months. Over time, it is noted that short-time liabilities exceed the assets, and negative values are obtained in this series. Liquid assets cover lesser short term liabilities as this gap gets deeper. Thus the banking sector becomes more vulnerable in terms of financing.

3. Structure of Banking Sector

The structure of the banking sector in terms of diversification of financing sources, lending to businesses, level of capitalisation and distribution of assets within a sector are prone to risk due to potential systemic shocks. Five sub-indicators are used for categorising the stricture of the banking sector, namely bank asset shares, ending rate to the business sector, deviation from banking sector loan portfolio, deviation of the sector to fund structure of the bank and deviation of the average rate of capitalisation of the banking sector.

When compared to lending to households, lending to the business sector is heterogeneous and more specialised. In the case of banking issues, replacement is difficult as the total portfolio of the banking sector is occupied by a huge share of the business loan portfolio. The distribution of lending and its vulnerabilities are captured in this sub-indicator. The banking sector risk increases with the increase in the concentration of lending.

The bank's loan portfolio can be categorised into three buckets: household loans, business loans, and public sector loans. The deviation between the market and the bank credit structure is constructed as a series. Deviation variance of the total banking sector lending to the share of the individual bank is calculated. Higher diversification of lending causes an increase in the variance. This increases the resilience of the banking sector to shocks. The sector to fund structure deviation in banks is constructed similar to the loan structure. The sources of total debt funding are categorised into six levels: security and other liabilities, general public and private sector administration, time deposits, demand deposits, current accounts and treasury, and interbank transactions. The fund structure differences are calculated based on the difference between the fund structure of the overall banking sector to that of the individual banks. Each bank's share in the total fund is used for the calculation of the variance of differences. An increase in variance represents a diversification of the banking sector that improves the elasticity of the sector against shocks. A higher value of deviation from an average rate of capitalisation of the banking sector increases the sensitivity of the banking sector to shocks. Construction and weighing of variance are done with the share of every individual bank to the total assets is done in this sub-indicator.

4. Conclusion

Financial stability plays a major role in the banking sector for identification and resolving discrepancies, risk management, and policymaking. The situation or phase where maximum efficiency is attained by the banking system and economic shock-absorbing capacity is developed termed financial stability. Several techniques are proposed for creating a transparent, broad, and strong banking system and policies. Mapping schemes like BAM, GFSM, SOM, and FSM are discussed. Soundness, asset quality, profitability, liquidity, and stability parameters may be measured for analysis of the banking sector. The indicators involved in the profitability of the capital and banking sector, as well as the financing and liquidity of the system, are discussed thoroughly. Stability mapping enables

appropriate risk management by identifying the crucial indicators for shock absorption in banking.

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