CHAPTER-5

5. FINDINGS, LIMITATIONS AND FUTURE SCOPE OF STUDY

This chapter begins with a brief summary of the study followed by detailed discussion of the findings from the previous chapter. After that the relevance of the study for policy planners and investors have been discussed. Finally, the limitations and future scope of the study have been listed.

5.1. Summary and Discussion

Section 1

The present study attempts to identify the early warning indicators for banking crisis in India and develop and compare the predictive performances of an EWS using Signals Approach, multivariate binomial logit modelling and ANNs. The comparison among the three approaches divulges the superior performance of ANNs in terms of accuracy and calibration. The Elman recurrent Neural Network performs better than the two traditional techniques both within sample and out of sample. The study reveals that the ERN performs better than the MLFN in terms of accuracy, depicted by QPS score for both in the sample and out of sample. However, in terms of calibration, ERN is better only for out of sample relative to MLFN. It can be concluded that the ERN's performance is better as it also considers the previous values of the input variables and their impact on the fragility of banks. As expected, the indicators start showing the signs of a vulnerability prior to financial turmoil. Thus, including lags of variables makes sense and helps to improve the prediction of a financial turmoil.

The outcomes of the study reveal the critical variables found that contribute to increasinglikelihood of a banking fragility are – growth in inflation, growth in oil prices, deviation from

the Real Effective Exchange Rate, call money rate, growth in credit, growth in prices, and spread between bank rate and yield to maturity on 91-days T-bills.

The study concludes that ANNs proved to be a promising alternative in predicting banking fragility as it gauges the complex behaviors among variables. However, combining it with other techniques will provide a more holistic view of the situation as ANNs suffer with black box critique which limits the underplaying relationships among different variables.

Section 2

The present study in its second part attempts to identify the early warning indicators of a stock market crisis in India using a logit model. It also examines the role of Investor sentiment, domestic and foreign, in predicting an approaching of stock market crisis.

Two variables namely real interest rates, and net inflows of Foreign Institutional investors are found to be contributing significantly in identifying a stock market crisis. Further, the investor sentiment is also found to be a significant predictors of a stock market crisis. The in sample and out of sample ROC curves and their comparison confirms the superior prediction power of the models including sentiment variables.

The study relies on the past occurrences of stress/fragility in the banking and stock market sectors. The specific pertinent indicators used for indices construction for identifying the crisis episodes were able to capture the past crises incidences efficiently. However, they may undergo a change with dynamics of interrelationships among the variables which may require incorporating the necessary changes

5.2. Novelty of Research and Contribution to Knowledge

This study

- Adopts to develop an EWS for predicting the probability of a banking crisis or a stock market crisis in Indian context.
- Delves into identifying the indicators of a crisis in Indian banking system and stock markets to be able to take proactive measures or prevent happening of an anticipated crisis.
- Explores the domain of Artificial Intelligence, specifically Machine Learning models as an alternative tool to improve upon the existing traditional models, particularly in context to Indian economy.

Some of the key contributions of the study are as follows:

- As against the existing studies, this study attempts to examine the role of sentiment in predicting an approaching crisis. It examines the developing and emerging economy sentiment to compare the predictive ability in predicting the probability of fragility in Indian context.
- The thesis also explores models such as ANNs to improve upon the predictive ability of the traditional models like Logit and Signal approach in a single country context.
- Apart from extending the work to ML techniques, the study also examines new variables like investor sentiment and FIIs flows as early warning indicators and test the incremental predictive power of various sentiment variables in improving upon the performance of EWSs.

5.3. Relevance of the Study for Policy Makers and Investors

The study showcases the role of investor behavior in Indian stock markets. It shows that sentiment can be used to predict sudden shifts in stock markets. This study attempts to study the relevance of new techniques and their utility in identifying early warning signals for probable occurrence of crisis, be it banking or stock markets. The need for improvement in the conventional models, which should be used in tandem with new evolving techniques like Machine Learning approaches has been found to be apt for better predictive power. It also examines relevance of different macroeconomic and financial variables and attempts to identify critical variables which contributes in anticipating the probability of a brewing banking/stock market crisis in Indian context. These findings offer significance for the policy makers as well as investors as discussed below:

- Regulators and investors could better predict, if any, sudden shifts in the market thus being able to take preventive actions in a timely manner to avoid large financial and economic losses to the investors and economy as a whole.
- Understanding the relationships among different macroeconomic, financial and psychological variables that could help policy planners in designing and developing effective and robust policies to avert or moderate the adverse impact of an approaching crisis.
- The development of EWS models and their improved accuracy in providing the estimates of the probability of occurrence of a crisis could provide the policy makers an idea on adjusting the controllable variables to achieve the goal of financial stability and soundness.
- It is evident from this study that continuous monitoring of financial system stability with respect to structural and macroeconomic aspects is necessary in ensuring strong macroeconomic performance and effective implementation of policies at the national level.

5.4. Limitations of the Research

Some of the key limitations of the study are as follows:

- Qualitative factors like banking supervision, political stability, and other institutional qualities, have not been included in this study, which may contribute the occurrence of a crisis.
- The study does not take into account the "post crisis bias", which refers to taking into account the effect of the recovery period post crisis.
- The study has not taken the presence of structural breaks into account.

5.5. Future Scope of Research

- Study can be extended to a panel of countries and can further focus on the similarities and differences between the emerging and developed economies.
- Qualitative variables can be included in the study and different macroeconomic, political and institutional variables can be examined as Early Warning Indicators.
- New deep learning techniques and hybrid models can be employed to study their relevance to economic modeling and improve upon the prediction ability of the EWSs.
- The investor sentiment can be measured using a primary survey or sentiment analysis techniques which might help in capturing the sentiment more accurately.
- The models can also be estimated using multinomial approach to the crisis indicator which take care of the post crisis bias.