ABSTRACT

The present study is carried out with the main aim of identifying the potential warning indicators and hence, developing an Early Warning System (EWS) for predicting the probability of a financial crisis in Indian context. The study has been divided in two sections. First section deals with the identification of warning indicators and development of EWS using different techniques for the banking sector in India. The second section deals with the analysis of stock market crisis in terms of identification of warning indicators and development of EWS using different techniques in Indian context.

A quantitative approach has been adopted for carrying out the study. For the analysis of banking crisis in India, various potential leading indicators have been selected based on comprehensive literature review and logic. The identification of episodes of extreme stress/ fragility in banking sector has been carried out by constructing a banking sector fragility index composed of net bank reserves, credit, deposits, and foreign currency borrowings. The selected 15 warning indicators are then analyzed using signal extraction approach namely Logit approach and Machine Learning (ML) approach. For each of the techniques employed, significantvariables have been extracted which were found to have major bearing in predicting the probabilityof a banking crisis. For signal extraction, each indicator has been analyzed individually and in combination with other variables using composite indicators. The significance of variables in Logitmodels have been tested at various significance levels and for ML models, feature selection techniques like forward and backward stepwise techniques have been employed. The predictive power of different techniques has been tested for both in sample and out of sample using QuadraticProbability Score (QPS) and Global Squared Bias (GSB). The limited dependent variable approach

has also considered the evaluation of different estimated models for different probability cut-offs using Area under Receiver Operating Characteristic curves (AuROCs). The second sectionpertains to the analysis of predicting the probability of a stock market crisis. The identification ofepisodes of market crash has been carried out by constructing an index using monthly data of stockprices from Nifty 50 index. This index is then converted to a dummy binary variable on the basis of the selected threshold. This dummy variable has been used as the dependent variable for the analysis. Following this, selection of various warning indicators has been carried out based on comprehensive review of literature. This analysis has also examined the role of investor sentiment in predicting the probability of a stock market crisis. Both global and local sentiment variables have been examined for their contribution in improving the predictive power of the developed EWS. Various sentiment proxies like Michigan Consumer Survey for the U.S., Eurozone Consumer Confidence Index for the U.K. have been employed for analyzing the role of investor sentiment in predicting the probability of a stock market crisis. This section has utilized Principal Component Analysis (PCA) for constructing domestic and emerging market sentiment, which is then entered in the models to observe the predictive performance. The in sample and out of sample analysis has been carried out for different horizons using Quadratic Probability Score, Global Squared Bias and AuROCs for both Logit models and ML models.

The findings of the first section suggest that certain macroeconomic and financial variables such as inflation, credit expansion and interest rates help in predicting the banking crisis probability. It also indicates that ML techniques are superior to the conventional techniques in terms of fitting the data and forecasting the future events. Findings of second section show that investor sentiment does contribute to predicting a future crisis due to spillover of the expectations in an integrated global economy. It reveals that not only local but global sentiment also affects the probability of

an anticipated stock market crisis. This section also indicates the superior performance of ML models over conventional models like Logit models.

The thesis contributes to the EWS literature in many ways. Firstly, it sheds light on the potential indicators that could help in prediction of an approaching crisis, specifically in Indian economy, be it banking or stock market. Secondly, it fills a major gap by bringing in the behavioral aspect of market participants, which could play a major role in spread of a crisis from one economy to another. Thirdly, it explores models other than the ones that had already been employed in the existing studies, overcoming the possible biases that could have decreased the robustness of the results of previous studies.

The present study could help regulators and investors in predicting the crisis probability, thus enabling them in taking preventive actions to better prepare or avoid large financial and economic losses. It could help in understanding the relationships among different macroeconomic, financial and psychological factors and their impact on an anticipated crisis.

The limitations of the study include use of few potential warning indicators that have been adopted for both the analysis of banking and stock market crisis. The study is also limited in usage of techniques employed, as it only explores ANNs and Logit models to develop and EWS and examine the significant variables in predicting the crisis probability. This leaves scope for testing the predictive power of various new evolving techniques in predicting the probability of a crisis.

Keywords: Financial Crisis, Early Warning System, Artificial Neural Networks, Logit regression