Assessment on the effectiveness of stress testing in commercial bank in Ethiopia

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Statement of Declaration

I, Shemelis Assefa, declare that this thesis is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person, except where due acknowledgement has been made in the text. I confirm that no part of the material presented in this thesis has previously been submitted by me or any other person for a degree in this or any other institution.

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Certification

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This is to certify that the thesis entitled, "Assessment on the effectiveness of stress testing as an instrument of mitigating risk in commercial banks in Ethiopia" was carried out by Shemelis Assefa under the supervision of Ato Gebremedin Gebrehiwot submitted in partial fulfillment of the requirements for the degree of Master of Science in Accounting and Finance complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

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Abstract

The main objective of the study is to assess the effectiveness of stress testing as an instrument of risk mitigation in commercial banks in Ethiopia. To this end, the study adopts mixed research approach and descriptive methods to enable the researcher to describe current effectiveness of stress test practice as one of strategic means in mitigating risks in commercial banks. The type of data used was both primary and secondary as the research design employed was mixed-mode (qualitative and quantitative). As the study was conducted at institutional level purposive sampling technique was used to select the banks. Hence, 10 commercial banks have been selected and contacted, where the sample respondents, staffs of risk management section(risk experts and officers) were used. Besides, the study is interested in banks that have been operational and whose ages are 10 and above. As it is a qualitative research, the research was rely highly on primary data, therefore, appropriate instruments need to be employed, that has been included Interview, questionnaire analyzed . The findings of the study show that commercial banks conduct stress testing on historical data and conduct the extensive sensitivity analysis and very limited hypothetical scenario analysis used on institutional context. Even though stress test had found to be determinant tool in risk management, needed to be employed extensively and synergistically in all risk factors by considering macroeconomic variables. Furthermore, banks should have a written guideline governing the stress testing framework in place to enhance its effectiveness.

Keyword: Stress testing, sensitivity analysis, scenario analysis, Ethiopian commercial banks

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Abbreviations and Acronyms

AB	Abay Bank
AIB	Awash International Bank
AIB	Addis International Bank
BCBS	Basel Committee on Banking Supervision
BHC	Bank Holding Companies
BIB	Buna International Bank
BIS	Bank for international settlements
BOA	Bank of Abyssinia
CAR	Capital Adequacy Ratio
CBE	Commercial Bank of Ethiopia
CBR	Central Bank of Russia
CEBS	Committee of European Banking Supervisors
CGFS	Committee on the Global Financial System
CNB	Czech National Bank
DB	Dashen Bank
DGB	Debub Global Bank
DGEI	Directorate General Economics and International Relations
EB	Enat Bank
EBA	European Banking Authority
EVT	Extreme Value Theory
FSA	Financial Services Authority
GFC	Global financial crisis
GSCB	General Secretariat of the Commission Bancaire
ICAAP	Internal Capital Adequacy Assessment Process
IMF	International Monetary Fund
IRB	Internal Ratings-Based
LIB	Lion International Bank
NBE	National Bank of Ethiopia
NIB	Nib International Bank
NPL	Non-performing Loans

OIB	Oromia International Bank
PD	Probability of Default
RWA	Risk Weighted Assets
SCAP	Supervisory Capital Assessment Program
UB	United Bank
Var	Value at risk
WB	Wegagen Bank
ZB	Zemen Bank

CHAPTER ONE

1. Introduction

The research assesses the effectiveness of stress testing in commercial banks in Ethiopia. Stress testing is an important risk management tool, which alerts banks management to an adverse effect caused by unexpected shocks or outcome related to a variety of risks and provides an indication of how much capital might be needed to absorb losses should large shocks occur. It is a tool that supplements other risk measurement approaches and plays a particularly important role in providing forward-looking assessments of risk; supporting internal and external communication; feeding into capital and liquidity planning procedures. The main purpose of this chapter is to provide general information about the research and it is organized as follows. The first section presents the general background information of the research, the second section sets out statement of the problem, the third section puts the objective of the research of the study, and the fourth section outlines the research questions. The scope and limitation of the research presented in the fifth section, the sixth section outlines the significant of the research and it is followed by the seventh section about the organizations of the research

1.1 Background of the study

Stress testing has been adopted as a generic term describing various techniques used by financial firms to gauge their potential vulnerability to exceptional but plausible events. A stress test scenario contains simultaneous moves in a number of risk factors reflecting an event that the firms believe may occur in the foreseeable future (BIS 2001). Financial stress testing is defined as, „‟a risk management tool used to evaluate the potential impact on portfolio values of unlikely, although plausible, events or movements in a set of financial variables.‟‟(Christos, 2013)

Global financial turmoil emphasizes the importance of efficient monitoring of banking system stability and stress testing is one of the most widely used tools in this area, which enables to estimate the impact of macroeconomic shocks on financial sector. The recent economic crisis has clearly shown that financial stability can be significantly affected by macroeconomic environment in addition to bank-specific factors; hence, the importance

of efficient estimates of banking system vulnerability to real shocks is increasingly important.

System-wide stress tests can be broadly defined as a range of techniques used to assess the vulnerability of a financial system to exceptional but plausible' macroeconomic shocks (Blaschke et al., 2001).

Prior to the financial crisis that started in 2007, bank supervisors in the developed world had invested enormous resources in developing and implementing the capital adequacy requirements as one of their primary prudential regulatory tool. These efforts have been most evident internationally in the capital adequacy accords of the Basel Committee on Banking Supervision (BCBS). The first of these accords, widely known as Basel I, was released in July 1988 with the expectation that it would be fully implemented no later than the end of 1992 for internationally active banks (BCBS). A more sophisticated system of measuring capital adequacy, called Basel II, was issued in June 2004.Yet when tested by the financial crisis that started in 2007, the Basel approaches (I and II) to capital adequacy were not enough to sustain depositor and investor confidence in many large banking organizations. To be sure, the problem was not that investors lost confidence in banks because they were reporting low Basel capital ratios.

The global financial crisis highlighted substantial deficiencies in risk measurement and management across the financial sector. With respect to stress testing by banks, the scenarios used prior to the financial crisis were revealed to be significantly more benign than the crisis itself, while the loss estimates these exercises generated were well below banks‟ actual loss experience (BCBS, 2009).

The regulatory focus on stress testing has helped to drive improvements in banks‟ own stress-testing capabilities and risk management practices, with sophisticated, bank-wide stress testing now common practice at systemically important banks.

In light of the above, a lot of research work has so far taken place concerning the issue of stress testing in banking industry. For instance, (Alexander and Oleg, 2015) have shown the difficulty of establishing universal methodology of conducting stress test, though (Sorge, 2004) reports typical stages of stress testing. Firstly, identify the scope of analysis and potential risks and vulnerabilities of the system. Secondly, it is required to define

shocks and design relevant scenarios, all assumptions should be listed. Thirdly, a researcher maps macro shocks to banks' balance sheets using an econometric model. Finally, interpreting the results; second-round effects are analyzed, and the limitations of the performed analysis should be carefully discussed.

Larry (2013) examined the importance of stress testing and the weakness of Basel. He explained the Basil ratios are static and unconditional measures of capital adequacy. Besides, the Basil measure capital adequacy at a single point in time using a process to calculate the ratios that does not depend upon the expected future state of the economy. Furthermore, the Basel ratio use historical data to estimate the bank specific distribution of losses associated with various asset categories and concluded that the Basel ratios failed to maintain investor confidence during the recent financial crisis. Although Basel II underestimated some risks, the bigger problem with the Basel II appears to have been largely lack of market confidence in asset valuations.

On the contrary, Frankel et al., (2000) stated the limitation of stress test that a stress test estimates to a specified event, but not the probability of such an event occurring. In addition, numerous decisions in the specification of a stress test must be made that relay on the judgment and experience of the risk manager. There is thus no guarantee that the risk manager will choose the „‟right‟‟‟ scenarios or interpret the results effectively. Stress test also imposes a high computational cost, particularly in collecting the data from diverse units and from the need to revalue complex options-based positions. A further limitation is that, at present, firms cannot integrate market and credit risk in a systematic way in their stress tests.

As currently, banking industry is expanding in Ethiopia; besides this expansion it calls for a sound risk management practices and techniques for their survival, as well as, to be competitive enough in this turbulent business environment in service delivery, as it‟s a key driver behind profitability. To do so, it‟s a must to identify, select and apply the appropriate risk measurement and management mechanisms, which are simple but effective risk management tools or techniques.

To this end, stress testing is considered as one of the measurement, monitoring, and controlling tools in risk management activity (NBE directive, 2010). In the limitation on

Banks investment‟ directives, NBE requested the Banks to develop policy that cover risk management including stress testing.(NBE(SBB/60/2015), 2015). In addition, in the liquidity requirement directives, commercial banks instructed to incorporate stress testing in liquidity management policy and conduct using by scenario analysis and also periodic reviewing the stress testing scenario, assumptions taken as well as the result of stress test have been considered the task of risk management.

Stress testing involves identifying possible events or future changes in economic conditions that could have unfavorable effects on a bank. Stress testing can range from relatively simple alterations in assumptions about one or more financial, structural or economic variables, to the use of highly sophisticated financial models (NBE directive, 2010). In view of the above stands point, commercial banks and other financial institutions required to undergo stress tests to check whether they are strong enough to hold up in the face of more difficulties and risks.

In developed countries, stress testing is considered as a vitally important risk management tool used by banks as part of their internal risk management and a tool that is actively and fully promoted by supervisors (through the Basel II capital adequacy framework). Some African countries have used the stress test as a risk management tool and prepared detail guideline. In the context of Ethiopia, NBE in its risk management guideline stated Scenario analysis and stress testing are useful ways of assessing areas of potential problems. Even though the stress test is disclosed as a tool in risk management, there is no general guideline how to conduct the test for commercial banks. As to the knowledge of the researcher, there no research has been conducted in relation to stress testing.

Taking the above essence, stress testing is relevant to the commercial banks for risk mitigation technique. This study seeks to assess the effectiveness of stress test as an instrument of mitigating risk in commercial banks in Ethiopia. Besides, this research work seeks to bring to light the need for stress test and helps financial institutions to pay attention in stress testing.

1.2 Statement of the problem

In this turbulent business environment, most recently where the financial institutions, particularly banks, in the world were in a financial crisis elsewhere, it calls for careful

assessment and treatment of banks risk inherent to their operations in order to survive and eventually be competitive enough in the financial industry.

Effective risk management is very critical to sustaining banks growth and profitability, in that banks are risk taking enterprises. Shareholders and other interested parties are expected to contribute to effective risk management in the banking industry through market discipline. (Kuranchie, 2012).

Following the onset and development of the global financial crisis, greater focus has shifted more to the art and science of stress-testing, in the hope of a more pro-active risk management strategy that goes beyond our historical experience and captures potential root causes. Stress testing is considered by researchers as a tool for risk management in determining failure or success of financial institution.

For the stress test, taking appropriate frequency, selecting factors, creating scenarios at various levels, evaluating the impact of those on the portfolio and making decision are considered at a meaningful part of the risk management framework. In some risk areas, stress testing is necessarily done frequently while overarching firm-wide stress testing may be done with lower frequency. For example, large complex institutions will have a number of risk areas requiring frequent stress testing e.g. market risk, which will inform the broader stress testing framework. Smaller, simpler institutions may not have the same range of requirements. The frequency of stress tests should be proportionate to risk areas and the need for overall firm-wide stress testing.

Stress testing can be conducted by taking various scenario from micro and macroeconomic variable and analyze the impact on risk factors that leads to a major loss.

Endawek, (2015) stated in his research, in case of Ethiopia, there is the general belief that the banking sector in Ethiopia is relatively stable with individual banks having good risk profiles and sound risk management frameworks because the banking industry in Ethiopia have not experienced major losses in the face of the global financial crises.

However, this doesn‟t mean that the banking industry continue without risk. No one knows about the future. The risk is everywhere. For the financial institution like banks, stress test one of the tool used as risk mitigation.

NBE in its revised risk management guideline stated that, the guideline formulated in consistent with international standards and best practices, is expected to provide

minimum risk management (risk identification, measurement, monitoring and control) standards for all banks operating in the country. It covers the most common and interrelated risks facing banks in the country namely credit, liquidity, market and operational risks. The guidelines are thus expected to assist risk-based supervision and contribute towards safety and soundness of the banking system.

Stress testing has been considered as a key risk management tool within financial institutions in developed countries and used to figure out whether capital held by banks is enough to withstand exogenous circumstances that may not be within the bank‟s control and also looks forward. To do so these country have detail guideline for both at supervisor and banks levels.

The first risk management survey has conducted by national bank of Ethiopia (NBE) in the year 2009 on banking industry. The survey has revealed that, credit risk was mostly affected the banks followed by liquidity and operational risks, and also credit and liquidity risks were most sensitive to banks. In addition, the survey has shown that, 13% of the banks exercise stress testing as a risk management tool, banks didn‟t create risk register and external and internal auditors have not reviewed the current risk management process effectiveness.(Gobena et al., 2009). Many Ethiopian researchers conducted a research in the area of risk factors determinants (liquidity, credit, operational and other risk) and their impact on performance of commercial banks in Ethiopia. All have used historical data and didn‟t say anything about risk mitigation tool effectiveness specially stress testing. They didn‟t use stress test (scenario and sensitivity analysis) as tool in risk management. There is limitation in their study because, they do not provide forward looking assessments of risk.

Having the above points in mind and to deal with the identified gap of the study, the researcher has assessed the effectiveness of stress testing in Ethiopian commercial banks risk management practice.

1.3 Objectives of the study

1.3.1 General Objective

This study was designed to assess the effectiveness of stress testing as an instrument in mitigating risk in commercial banks in Ethiopia by pursing to unveil the extent of its worthwhile practicality. Therefore, mainly the study dealt as to determine the extent of

practicality in order to indicate possible strategy of effective application in the industry as one of means of risk mitigation**.**

1.3.2 Specific Objectives

To achieve the main purpose, the following specific objectives were established:

- To assess the practicality of Stress Test.
- To examine the challenge in stress test practice of commercial banks in Ethiopia.
- To see how the stress tests, result integrated with risk management decision.
- To identify area of focus for its practicality.

1.4 Research Questions

Main Research questions

What is the extent of effectiveness of stress test as one of risk mitigations strategy in Ethiopian commercial banks risk management practices in order to eliminate and/or minimize the risk in commercial banks?

Subsidiary Research Questions

1. How do commercial banks conduct stress test?
2. What is the purpose of stress test result?
3. Determinants of an effective stress test practice in the risk management?
4. What are the challenges faced by banks in implementing effective stress test in mitigating risk?

1.5 Scope of the study

The researcher believes that it was worthwhile to conduct the study in large scale and financial institution as a whole but the researcher concentrated on the banking industry. Most of the empirical research work relating to stress testing, disclosure and risk taking of banks were conducted in the developed countries using the setting pertaining there, whereas the phenomena is widespread. Empirical study in this area is highly required especially in Africa. Due to constraints of time and access to data, this study was limited to commercial banks in Ethiopia. Banks whose ages of establishment 10 years and above were considered for the study.

1.6 Limitation of the study

It is quite known that any study is not absolutely free from limitations. As a result, the researcher assumes that there were some sorts of limitations. The researcher expected problems like delay by the respondents in returning back the questionnaire, shortage of time to undertake the study. Despite these limitations, the researcher attempted to make the study as complete as possible using the unreserved effort.

1.7 Significance of the Study

It is the believe of the researcher that, the findings and recommendations that were made based on data analysis was an important ingredient to the banks and regulatory body in particular and to the society in general in mitigating risk. Additionally, the study had the following significances:

- To provide possible information for regulatory body on the effectiveness of stress testing in risk management and findings used for in policy formulation, procedure and general guideline.
- To add some inputs for the contemporary strategic risk mitigation challenges while financial institutions are operating in the dynamic marketing environment;
- To be the source for financial institutions and concerned institutions to identify areas of intervention in strategic management of risk mitigation;
- To help to develop the researcher‟s research skills, and provide first hand exposure in research undertaking.
- To be used as a reference for those who want to investigate similar issues.

1.8 Organization of the study

This study is organized in to five chapters and the chapters in this study portrayed as follows.

Chapter one: this chapter is concerned with the background, statements of the problem, objective of the study, research question and significance of the study. At last, the scope and limitation of the study portrayed.

Chapter two: the second chapter focused on the theoretical framework with detail assessment of literatures i.e. journals, articles, books and reports. And the review includes debates and findings on stress testing, practicality, challenges and effectiveness.

Chapter three: The third chapter has indicated the research design and technique supported with the discussion of the research paradigm. And also shows the instruments, and interpretation and analysis procedures.

Chapter four: this chapter as included the data analysis and presentation of findings from interview, questionnaire, and checklists. Moreover, the chapter also indicated the triangulation of the three independent findings and showed the consistency and inconsistency of the findings.

Chapter five: The last chapter included the discussion that the research unveiled in form of summary and conclusion. Moreover, the chapter also included the strategic intervention in form of recommendation.

CHAPTER TWO

2. Literature Review

“Stress testing“ is a term that comes with much mystique. In individual financial institutions, the term describes a range of techniques that attempt to measure sensitivity of a portfolio to a set of extreme but plausible shocks. Put more simply, a stress test is a rough estimate of how the value of a portfolio changes when you make large changes to some of its risk factors. We use the term rough estimate to avoid the perception that stress testing is a precise tool that can be used with scientific accuracy. Stress tests are simply an analytical technique that can be used to produce a numerical estimate of a particular sensitivity (Matthew T. Jones, 2004).

The Basel Committee on Banking Supervisions defines a stress test “as the evaluation of a bank“s financial position under a severe but plausible scenario to assist in decision-making within the bank. The term „“stress testing“ is also used to refer not only to the mechanics of applying specific individual tests, but also to the wider environment within which the tests are developed, evaluated and used within the decision-making process. Furthermore, (José Viñals, 2012) defined stress test as is a technique that measures the vulnerability of a portfolio, an institution, or an entire financial system under different hypothetical events or scenarios. It is a quantitative what if exercise, estimating what would happen to capital, profits, cash flows, etc. of individual financial firms or the system as a whole if certain risks were to materialize.

From the viewpoint of the examination and presentation of analysis, stress tests can be divided into two groups: sensitivity tests and scenarios testing. Sensitivity test assesses the impact of one or more risk variables on the financial situation of a bank. Scenarios tests are characterized by a more complicated structure and include a simulation of several variables at the same time, while such an analysis is more valuable than the previous one, because it takes into account the possible inverse correlation between theimpacts of individual risks. (Mohd and Aktar, 2012).

2.1 The theoretical aspects of the stress tests

2.1.1 Stress testing as a regulatory tool

The banking business is highly regulated because depositary financial institutions capture public savings and have specific risks and complexities that make their financial statements opaque and difficult to analyze by the general public(Petrella and Resti, 2013). The distinctive characteristic of these entities are mainly determined by: a) the assets composition, which includes loans granted to third parties and the general public lacks the necessary information to evaluate the credit risk attached to these loans, b) the highly liquid assets that are commonly booked in their financial statements which produce a constant change in the asset composition that is difficult to be followed by financial information users(Petrella and Resti, 2013) and c) the maturity mismatch caused because they borrow short from depositors and lend long to creditors, being this situation a source of interest rate risk in the banking book(IFRI-CRO , 2007)(Diamond and Dybvig, 1983)
In order to address and monitor the banking business risks, regulators use risk management tools to achieve regulatory objectives. Such supervisory efforts are increased during periods of financial turmoil (Flannery et al., 2010) and hence, regulators use stress tests to assess not only the vulnerability of individual banks but also of the entire banking system (Drehmann et al., 2010), (Sorge and Virolainen, 2006). As the main concern of regulators is a financial failure, they design a supervisory system that allows them to prevent institutional failure that could lead to the breakdown of the main financial functions in the economy such as the payment system, savings transformation and the monetary policy transmission mechanism (Weber, 2014). Regulators use two different approaches to measure capital adequacy: stress testing and Basel III capital requirements.

Wall, (2014) explains the difference between these two approaches. In the case of Basel III, it provides an unconditional static measure with the risk adjustment occurring in the risk weighting of assets (the denominator of the capital adequacy ratio). In contrast, the stress tests measure the individual bank capital adequacy using conditional, dynamic measures with the risk adjustment occurring via reductions in capital (the numerator of the capital adequacy ratio). The Basel III ratios use data on past performance to estimate the loss distributions associated with various portfolio positions, which are then used to calculate the expected losses in the extreme tail of the distribution.

Wall (2014) added that in the case of the stress tests, they are dynamic because they simulate how these regulatory ratios would evolve over time and are conditional because the results are calculated for a specific adverse scenario. The stress test is to estimate changes in accounting capital following a certain accounting framework. The estimates of the change in accounting capital are based in part on estimates of each bank,,s losses in each portfolio in each period.

While Basel III cannot be used to say what may happen in any particular scenario, individual stress test can do it. If the model used in the stress test exercise is correct, the stress test can provide a good estimate of what happens in a particular scenario.

In this context, there are mainly two types of stress tests that can be used by regulators: a) sensitivity stress tests that measure the impact that a large change in an asset price has on a portfolio,,s value and b) stress tests scenarios that measure the effect on a portfolio of simultaneous significant moves in several asset prices (for example, interest rate, exchange rates, equity prices) and can be done based on a historical scenario or a hypothetical one (Fender et al., 2001).

One of the most important elements of a stress test is the selection of the scenarios to be used that according to the Bank for International Settlements (BIS) must be severe but plausible (Alfaro and Drehmann, 2009); (Breuer et al., 2009). The complexity of this subject is such that the 2008 market collapse was driven by systemic events difficult to predict and that could have been dismissed ex-ante as implausible(Flood and Korenko, 2013);(Breuer and Csiszar, 2013). To add to this complexity, the market collapse occurred when the system appeared to be stable (Borio et al., 2012).

Goldstein and Sapra, (2013) discussed whether the stress testing results should be disclosed or not. Based on the argument that stress tests are not able to tests scenarios that are extreme enough to simulate a true scenario, Das (2011) argues that the disclosure of stress testing results is inherently flawed. Kevin (2015) also argued that revealing a bad result would undermine confidence in the public and central bank itself. Because it would raise awkward questions (like how could the banks system be so weak after all the resources devoted?) about its own competence.(Goldstein and Sapra, 2013), (Das, 2011),

With regard to stress test result publication, as stated in (Petrella and Resti, 2013) cited in Nicolas 2016), a recent study related to the disclosure of 2011 EU stress test results,

Petrella and Resti, (2013) find evidence of prices drop for tested banks on pre-results date (dilution effect) showing the concern of investors about the possibility that these banks could be under-capitalized. Their research shows that the stress tests produce *"valuable information for market participants"*. On the result publication date, they find price reaction for the tested banks. This shows the relevance of disclosing the results and the informational role of the stress test.

The release of bad results by regulators should call the industry attention and lead bank managers to improve the quality of the risk management tools used to assess the entity strength (D'Cruz and Crippa, 2012).

2.1.2 Risk management and stress tests

Jamshaid, (2013) stated in his paper that Stress testing has been useful tool but appeared to be "*less of an issue*" until the GFC which challenged the global financial systems indicating the usefulness of this tool in the banks and their respective regulators. Financial stress tests have not only been used as a risk management tool and key component of financial stability analysis but also as a crisis management tool, especially during the financial crisis. As a result, both United States regulator and the Committee of European Banking Supervisors (CEBS) predecessor to the European Banking Authority (EBA) conducted stress testing exercise to strengthen the financial system and boosting market confidence. There has been also a revision of stress testing guidelines by the Basel Committee on Banking Supervision (BCBS) and EBA respectively addressing the issues which were not adequately covered in the previous stress testing framework. Stress tests are also used by individual banks as a risk management tool to assess their own weaknesses and exposure to risk. This is done following the guidelines and recommendations set by regulators that aim to identify how much capital the bank needs to be prepared against shocks that could impact on its current capital and to the minimum capital requirements (see Basel Committee on Banking Supervision, 2006; (Peura and Jokivuolle, 2004). The similarity of stress testing used at a macro level, together with the techniques used by individual banks as an integral part of the risk management system see (Summer, 2008), and the recommendation of supervisors about the use of stress tests as risk management tools for banks (Basel Committee on Banking Supervision, 2006; Financial Stability Forum, 2008), suggest that stress testing is becoming very important for regulators (Drehmann et al., 2010).

The Bank for International Settlements, through the Pillar 1 (minimum capital requirements) of the Basel II framework *"requires banks using the Internal Models Approach to determine market risk capital to have in place a rigorous program of stress testing. Similarly, banks using the advanced and foundation internal ratings-based (IRB) approaches for credit risk are required to conduct credit risk stress tests to assess the robustness of their internal capital assessments and the capital cushions above the regulatory minimum. Basel II also requires that, at a minimum, banks subject their credit portfolios in the banking book to stress tests"*(BCBS, 2009) Stress tests are the evaluation of the financial position of a bank under a severe but plausible scenario to assist in decision making within the bank. The Basel Committee on Banking Supervision (2006) indicates that *"board and senior management involvement is critical in ensuring the appropriate use of stress testing in banks' risk governance and capital planning. This includes setting stress testing objectives, defining scenarios, discussing the results of stress tests, assessing potential actions and decision making".* Taking this into account, stress testing should form an integral part of the overall governance and risk management culture of the bank. The objective of bank internal stress testing is to promote the identification of risks, complement other risk management tools and improve capital management.

Stress tests as part of a bank risk management system are useful to determine the sufficient capital buffer size (Peura and Jokivuolle, 2004), to evaluate the bank„s reaction to different adverse scenarios, its credit portfolio quality (Worrell, 2008) and to identify the level of capital required to support the current level of risk taking (Kuritzkes et al., 2002).

Peura and Jokivuolle, (2004) analyze the bank„s capital buffer (defined as the difference between the current capital ratio and the minimum capital requirement) for G-10 banks from 1997-2001 and found that rating sensitive capital requirements necessitate higher bank capital buffers at least for high and average loan portfolios because the capital requirement is volatile.

Using a hypothetical but realistic group of six banks, (Worrell, 2008) shows that if a rapid credit growth causes a sharp increase of non-performing loans (NPL), banks may become insolvent in a relatively short time, but if credit quality is not affected, the group of banks

remains well capitalized even with severe shocks. (Worrell, 2008) argues that *"regulators would be advised to pay special attention to credit quality indicators, and to intensify scrutiny of any bank which appeared to be weak in this area, or any bank where the NPL migration pattern was worse than average"*

As stated in Pioter and Pawel, (2013), the stress tests were a credit the stress tests have the advantage over other methods; first of all the tests try to predict the possible changes in the economic parameters including the parameters of the extreme levels. In addition, unlike the sensitivity analysis or the models of the bankruptcy prediction (Altman, Hotchkiss, 2007), the stress tests focused on the future risks and the possible adverse changes which may cause this risk. The stress tests are also the methods merge the information at the micro and macro which creates a modern tool for the assessing management and the risk control. (Pioter and Pawel, 2013)

Jim et al, (2006), explained about the two macroeconomic stress tests. They stated as, firstly, scenarios of extreme but plausible adverse macroeconomic conditions need to be devised. Secondly, the adverse macroeconomic scenarios need to be mapped onto the impact on banks‟ balance sheets. Through this, the robustness of banks can be evaluated. They pointed out in their research that after devising the scenarios, the impact on banks will be estimated.

The authors further discussed the problem of the above approaches and pointed out two problems. first, once a scenario is chosen, how likely it is to occur is no longer an issue in the stress test; secondly, even if the predicted value of the soundness indicator is not significantly affected by the realization of the adverse scenario, it is hard to conclude that the risk is low because a large deviation from the average may occur with a "tangible" probability.

The researcher performed macro stress testing with the framework to assess the vulnerability and risk exposures of banks‟ overall loan portfolios and mortgage exposures and concluded that how estimates obtained from aggregate default-rate data can be applied to stress test individual banks. The framework can also be applied in a more comprehensive manner to assess the vulnerability of individual (or groups of) banks by using bank level (or group level) data to obtain bank specific (or group-specific) estimates for the macro credit risk model and VaR statistics.

2.1.3 The origins and the emergence of stress testing within banks

The financial crisis of 2007-2009 served to demonstrate how tightly woven the banking industry is to the fabric of the national and global economy. As a result, banking regulatory realized that their risk management tools needed to be assessed and improved in order to mitigate the risk of the future economic downturns. Prior to the financial crisis that started in 2007, bank supervisors in the developed world had invested enormous resources in developing and implementing the capital adequacy requirements as one of their primary prudential regulatory tool. These efforts have been most evident internationally in the capital adequacy accords of the Basel Committee on Banking Supervision(BCBS). The first of these accords, widely known as Basel I, was released in July 1988 with the expectation that it would be fully implemented no later than the end of 1992 for internationally active banks (BCBS). A more sophisticated system of measuring capital adequacy, called Basel II, was issued in June 2004.Yet when tested by the financial crisis that started in 2007, the Basel approaches (I and II) to capital adequacy were not enough to sustain depositor and investor confidence in many large banking organizations. To be sure, the problem was not that investors lost confidence in banks because they were reporting low Basel capital ratios.

Stress testing, which was introduced as a requirement under the Basel II accord, is a critical component of an effective risk management framework and is particularly important for assessing the potential impact of recessionary periods on the availability of capital and liquidity. Following the financial crisis, banking industry testing practices were critically evaluated and enhanced to provide banks with the appropriate warning they need to avoid unexpected losses, liquidity shortages, and potential insolvency during recessionary periods. (Miles, 2015).

According to (Miles, 2015), there are four broad areas of weakness that were highlighted by the financial crisis.

- Use of stress testing and integration in risk governance
- Stress testing methodologies
- Scenario selection
- Stress testing of specific risks and products

Regulators have responded to these observed areas of weakness through the issuance of new rules and guidance aimed at improving financial industry stress testing framework.

On the other hand (Osamah et al., 2015) explained, an effective stress-testing framework relies on five elements:

1. Determination of the objective/s of the stress testing (in general and in relation to the specific exercise in mind).
2. Selection of meaningful stress scenarios, which can be hypothetical, or based on historical experience or on simulation of risk factors.
3. Translation of those stresses as (first-round) impacts on the financial performance income statement and financial position of the banks.
4. Assessment of the stress-testing results and generation of remedial actions.
5. Taking the results into account in management decision-making.

On the other hand,(José Viñals, 2012)(Gobena et al., 2009) explained the effectiveness of stress tests does not depend on just a few parameters, but on the context within which they are conducted. This requires a clear ex ante understanding of the stress tests‟ objectives; knowledge of the key individual financial institutions in the system, their business models, principal sources of risk, and main channels of risk transmission; appropriate decisions on the tests‟ perimeter and coverage; the use of other complementary assessment tools; a communications strategy tailored to the circumstances and purpose of the tests; and a credible commitment to take the measures that may be required to address vulnerabilities uncovered by the tests.

As pointed out by (Mathias, 2008), a first distinguishing factor when discussing stress testing objectives is whether they are run for internal or external purposes. This already implies different model requirements. Whereas external models have to focus on the target audience, internal models have to be understood and accepted by senior management. As the background and risk management culture differs across institution especially when comparing commercial and central banks stress testing models have to reflect these variations. For internal purposes, two broad objectives can be distinguished. The first is validation, when stress tests are used to assess for example the robustness of capital models. But, the ultimate internal objective is decision making. For private banks, stress testing results may feed into capital decision or business planning and central bank use them as input into the supervisory dialog or for assessing FS vulnerabilities. But for

many nonsupervisory central banks, the main objective is not internal but external communication.

Basel Capital Accords: International agreement was reached by the BCBSon July 15, 1988. The 1988 agreement, now commonly referred to as Basel I, set requirements for the ratios of tier one capital to risk weighted assets (RWA) and of total (Tier 1 plus Tier 2) capital to RWA. Tier one capital consists primarily of common and perpetual preferred equity whereas tier 2 included items such as general loan-loss allowances, hybrid capital instruments and subordinated debt.

Basel I‟s crude measurement of credit risk in the banking book discouraged the accumulation of low risk loans to the private sector while encouraging banks to take risks that were underweighted by the standards. Concerns about these distortions led to the issuance of the BCBS publication of "International Convergence of Capital Measurement and Capital Standards: A Revised Framework," more commonly known as Basel II. Basel II contains three parts or "pillars." Pillar 1 provides the methodologies for calculating risk-based capital ratios. Pillar 2 deals with additional discretionary supervisory tools to address risks and other concerns not covered in Pillar 1. Pillar 3 is intended to enhance market discipline by requiring increased risk disclosure. (Larry, 2013)

2.1.4 The development of stress testing since the global financial crisis

The global financial crisis highlighted substantial deficiencies in risk measurement and management across the financial sector. With respect to stress testing by banks, the scenarios used prior to the financial crisis were revealed to be significantly more benign than the crisis itself, while the loss estimates these exercises generated were well below banks‟ actual loss experience (BCBS, 2009). As well as exposing the shortcomings of stress-testing practices at banks, the financial crisis also brought with it a step change in the use of stress testing within the regulatory sphere. Regulatory stress tests moved from being small-scale, isolated exercises within the broader risk assessment program, to large-scale, comprehensive risk-assessment programs in their own right leading directly to policy responses.(Krugman, 2014),(Schuermann, 2013).

The first prominent example of this new wave of stress tests was the US Supervisory Capital Assessment Program (SCAP) conducted by the Federal Reserve in early 2009. The SCAP stress test assessed whether the largest US banks had sufficient capital

resources to absorb losses and continue to operate under a common stress scenario. By design, the scenario was significantly more severe than the expected trajectory for the economy at the time (Bernanke (2010)). In a marked departure from the past, the results of the SCAP were publicly disclosed on a bank-by-bank basis. Those banks judged to need additional capital resources were given six months to raise that capital, with the US Treasury Department providing a backstop in the event that any bank was unable to do so in private markets. In the event, almost all of the banks were able to raise sufficient equity privately so as not to need Treasury support. The SCAP is widely regarded to have made a significant contribution to stabilizing the US financial system, and restoring broader market confidence with the Treasury backstop recognized as an important driver of its success (Krugman, 2014), (Schuermann, 2013).

As indicated by the above researchers, the success of the SCAP was followed by a proliferation of frameworks for regular concurrent stress testing across central banks and supervisory authorities. The first EU-wide concurrent stress test was conducted in late 2009 under the direction of the Committee of European Banking Supervisors (CEBS). This was followed by another exercise conducted under the direction of the CEBS in 2010, and a series of exercises conducted under the direction of the European Banking Authority (EBA) starting in 2011. In the United Kingdom, these EU-wide exercises initially served to complement the stress-test scenarios that were being provided to banks to run on a non-concurrent basis by the former Financial Services Authority (FSA), before the Bank of England launched its own concurrent stress-testing program in 2014.

This greater regulatory focus on stress testing has helped to drive improvements in banks‟ own stress-testing capabilities and risk management practices, with sophisticated, bank-wide stress testing now common practice at systemically important banks.

2.1.5 Stress testing principles

As stated by Basel committee on banking supervision, (BCBS, 2009) and IMF working paper and technical note on stress testing for institutions offering Islamic financial services (IIFS) banks should have written policies and procedures governing the stress testing program. (Osamah et al, 2016)

Most stress testing guideline includes the following principle:

1. General background about stress testing
2. The board of directors and senior management engagement
3. Stress testing methodologies and scenario selection
4. principal risk category
    - Credit risk
    - Liquidity risk
    - Interest rate risk
    - Foreign currency risk
    - Operational risk
    - Concentration risk
5. Data and appropriate management information system
6. Frequency of stress testing
7. Reporting and interpretation of stress test result
8. Internal control and independent assessment of the effectiveness of the stress testing
9. Remedial action
10. Disclosure

2.1.6 Purposes of Stress Testing

Stress testing should be embedded in enterprise wide risk management. A stress testing program as a whole should be actionable, playing an important role in facilitating the development of risk mitigation or contingency plans across a range of stressed conditions. It should feed into the institution‟s decision making process, including setting the institution‟s risk appetite, setting exposure limits, and evaluating strategic choices in longer term business planning.

An institution‟s stress testing program should serve the following purposes:

i. **Risk identification and control** – Stress testing should be included in an institution‟s risk management activities at various levels, for example, ranging from risk mitigation policies at a detailed or portfolio level to adjusting the institution‟s business strategy. In particular, it should be used to address

institution-wide risks, and consider the concentrations and interactions between risks in stress environments that might otherwise be overlooked.

ii. **Providing a complementary risk perspective to other risk management tools –** Stress tests should complement risk quantification methodologies that are based on complex, quantitative models using backward looking data and estimated statistical relationships. In particular, stress testing outcomes for a particular portfolio can provide insights about the validity of statistical models at high confidence intervals, for example those used to determine VaR.

Value at risk (VaR): A company's management, or investor, calculates VaR to assess the level of financial risk to the firm, or investment portfolio. Typically, VaR is compared against some predetermined risk threshold. The concept is to not take risks beyond the acceptable threshold. Standard VaR equations have three variables. The first is the probability of loss. The second is the amount of potential loss. Last is the time frame that encompasses the probable loss.

As stress testing allows for the simulation of shocks which have not previously occurred, it should be used to assess the robustness of models to possible changes in the economic and financial environment. Stress tests should help to detect vulnerabilities such as unidentified risk concentrations or potential interactions between types of risk that could threaten the viability of the institution, but may be concealed when relying purely on statistical risk management tools based on historical data.
Stress testing can also be used to assess the impacts of customer behavior arising from options embedded in certain products – particularly where the impact is not easily modeled under extreme events.

iii. **Supporting capital management** – Stress testing should form an integral part of institutions‟ internal capital management where rigorous, forward-looking stress testing can identify severe events, including a series of compounding events, or changes in market conditions that could adversely impact the institution.

iv. **Improving liquidity management** – Stress testing should be a central tool in identifying, measuring and controlling funding liquidity risks, in particular for assessing the institution‟s liquidity profile and the adequacy of liquidity

buffers in case of both institution-specific and market-wide stress events.(OSFI Canada, 2009)

2.1.7 The Role of stress testing

Stress testing is a tool that supplements other risk management approaches and measures. It plays a particularly important role in:

• providing forward-looking assessments of risk;
• overcoming limitations of models and historical data;
• supporting internal and external communication;
• feeding into capital and liquidity planning procedures;
• informing the setting of a banks‟ risk tolerance; and
• facilitating the development of risk mitigation or contingency plans across a range of stressed conditions. (Miles, 2015)

2.1.8 Stress testing methodologies

The use of appropriate methodologies in stress testing programs is a key to fulfilling their purposes. Whilst these guidelines do not prescribe methodologies, they are designed to enhance institutions‟ practices in stress testing, in particular by identifying the types of methodologies that should be considered by an institution in designing its stress testing program proportionate to its size and complexity. In a general sense, an effective stress testing program should consist of sensitivity analyses (single and simple multi-factor analyses) and scenario analyses addressing all material risks at various levels of the institution. The combination of approaches as well as the level of detail will depend on the size and complexity of the specific institution. A smaller institution may place greater emphasis on the qualitative elements of its stress testing program supported by quantitative outputs of the balance sheet, whereas large sophisticated institutions would be expected to run complex models which would be complemented by appropriate qualitative oversight. There are four methods in stress test.(CEBS, 2010)

1. ***Sensitivity analysis***
2. ***Scenario analysis***
3. ***Severity of scenarios***
4. ***Reverse stress testing***

1. Sensitivity Analysis

Sensitivity analysis is the simple stressing of one risk driver to assess the sensitivity of the institution to that risk driver. For example, institutions might choose a simple interest rate shift stress or a straight forward shift in probabilities of defaults (PDs), or the default of their largest counterparties, or a decline in value of liquid assets. Such analyses provide information about key risks and enhance understanding about potential risk concentrations in one or several risk factors.

2. *Scenario Analysis*

Forward-looking hypothetical scenario analysis is a core part of the suite of stress tests that institutions should include in their stress testing programs. The development of a hypothetical scenario can start from historically observed realizations of risk parameters, but relying solely on historical scenarios has proved to be insufficient. Pure historical scenarios can give insights into impact but not into the confluence of events that may occur. Moreover, as historical scenarios are purely backward-looking, they tend to neglect recent developments and current vulnerabilities.

In addition, (Frankel et al., 2000), stated in their study that firms tended to use both historical and hypothetical scenarios. Historical scenarios are easier to formulate and to understand intuitively. Hypothetical scenarios allow risk managers to challenge the common tendency to pay more attention to past events than future dangers. In both cases, scenarios are chosen with an eye to markets and business segments in which the firm is highly involved. The usefulness of the scenarios is enhanced when they are run at periodic intervals, allowing the firm‟s exposure to be tracked over time. Corporate-level stress tests are facilitated by the presence of firm-wide information-technology systems which offer risk managers an up-to-date, usable, accurate source of information on exposures.

Two surveys were conducted by the Committee on the Global Financial System in May 2000 and May 2004 on the various stress testing practices. Some examples of scenarios and sensitivity analyses used by the major financial institutions in developed countries are given below.

Category	Historical Scenarios	Hypothetical Scenarios
Equity	-Black Monday 1987 - Asian financial crisis 1997 - Bursting of IT bubble 2000 - Terrorist attacks 2001 - Historical equity market decline	-Hypothetical stock market crashes - New Economy scenarios - Risk arbitrage market boom - Equity exotics stress - Geopolitical unrest - Terrorist attack - Global economic outlook
Interest rate	-Historical interest rate increase and decreases -Bond market sell-off 1994,2003 -Asian financial crisis 1997 -Russian devaluation 1998 -Terrorist Attacks 2001	-Global tightening (focusing on increasing of short-term and long term interest rate) - US tightening - Differential shocks to short rates - Spike in repo rates - Yield curve twist - US economic outlook - Global economic outlook - Increase in inflation expectations - Japanese monetary outlook
Commodities		-Commodity crisis - Oil price scenario - Geopolitical unrest in the Middle East
Credit	-Russian devaluation and default 1998 - Asian financial crisis 1997 - Terrorist attack 2001	-Widening spread - Emerging market economic outlook - Euro area economic outlook - Global economic outlook - Natural disaster - China change in currency arrangement - US government sponsored enterprises - Terrorist attack
Others	-Gulf war 1990 - Iraq war 2003	- Volatility disruption - Bank funding - Global economy
Global	-Bond market sell-off 1994 - LTCM and Russia 1998 - Bursting of IT bubble 2000	- Global boom - Global crash - Global real estate collapse - Terrorist attack - Funding liquidity - Inflation expectations - Capital flight

Historical and Hypothetical scenarios

Source: Committee on the Global Financial System

3. Severity of scenarios

Ensuring that a stressed scenario is appropriately severe is one of the elements required for ensuring that stress tests are:

A. meaningful in terms of providing the appropriate type of information, as laid out elsewhere in these guidelines, which is designed to promote the stability of the institution and the financial system at all points in the economic cycle; and

B. consistently applied across the institution, recognizing that identical scenarios are not necessarily severe for all business lines.

4. Reverse stress testing

Reverse stress testing consists in identifying a significant negative outcome and then identifying the causes and consequences that could led to such an outcome. In particular, a scenario or combination of scenarios that threaten the viability of the institution‟s business model is of particular use as a risk management tool in identifying possible combinations of events and risk concentrations within an institution that might not be generally considered in regular stress testing. A key objective of such stress testing is to overcome disaster myopia and the possibility that a false sense of security might arise from regular stress testing in which institutions identify manageable impacts.

Arya, (2008) in his study about stress testing methodology, he classified in to three:

1. Sensitivity analysis
2. Historical scenarios
3. Hypothetical scenarios

On the other hand, Frankel et al., (2000) describe the four types of stress testing techniques.

1. **Simple sensitivity test**: this isolates the short-term impact on a portfolio‟s value of a series of predefined moves in a particular market risk factor. Change in portfolio value for one or more shocks to a single risk factor.
2. **Scenario analysis (hypothetical /historical):** this specifies the shocks that might plausibly affect a number of market risk factors simultaneously if an extreme, but possible, event occurs. It seeks to assess the potential consequences for a firm of an extreme, but possible, state of the world. Change in portfolio value if the scenario were to occur.

3. ***Maximum loss* approach**: This technique assesses the riskiness of a business unit‟s portfolio by identifying the most potentially damaging combination of moves of market risk factors. Sum of individual trading units‟ worst-case scenario.
4. ***Extreme value theory*** (EVT) as a means to better capture the risk of loss in extreme, but possible, circumstances. EVT is the statistical theory on the behavior of the "tails" (i.e., the very high and low potential values) of probability distributions.

Both simple sensitivity tests and scenario analyses are thought to be particularly well-suited for revealing the vulnerability of portfolios to tail risk that might go undetected were the firm to rely exclusively on other risk measures such as VaR. (Frankel et al., 2000)

2.1.9 Risk categories

Mohd and Aktar, (2012), in their study stated risk category in the stress test guideline of Bangladesh Bank.

A. **Credit risk**: The stress test for credit risk assesses the impact of increase in the level of nonperforming loans of the bank. This involves six types of shocks:

i. **Increase in NPLs**: The three scenarios shall explain the impact of 1%, 2% and 3% of the total performing loans directly downgraded to bad/loss category having 100% provisioning requirement. The impact of resultant loss will be calibrated on CAR

ii. **Shift in NPLs Categories**: The three scenarios shall explain the impact of 50%, 80% and 100% downward shift in the NPL categories. The impact of resultant loss will be calibrated on CAR

iii. **Fall in Forced Sale Value (FSV) of Mortgaged collatera**l: The forced sale values of the collateral shall be given shocks of 10%, 20% and 40% decline in the forced sale value of mortgaged collateral. The impact of resultant loss will be calibrated in the CAR.

iv. **Increase in NPLs in particular one or two sector. *ex. garments & Textiles*** and the respective provisioning**.** The three scenarios shall explain the impact of 5%, 7.5% and 10% performing loans of particular 1 or 2 sectors directly downgraded to bad/loss category having 100% provisioning requirement. The impact of resultant loss will be calibrated in the CAR.

v. **Increase in NPLs due to default of Top 10 large borrowers**. The three scenarios shall explain the impact of 5%, 7.5%and 10% performing loans of Top 10 large borrowers directly downgraded to bad/los category having 100% provisioning requirement. The impact of resultant loss will be calibrated in the CAR.

On the other hand, Nishanth and Neha, (2013) showed the credit risk stress test by analyzing the increase in NPLs by 100%, 30% of restructured assets become NPLs (substandard and loss asset). By doing this they assumed that an economic shock increases NPLs and ultimate affects the capital adequacy level of the bank.

B. **Interest Rate Risk:** Interest rate risk is the potential that the value of the on-balance sheet and the off balance sheet positions of the bank/DFI would be negatively affected with the change in the interest rates. The vulnerability of an institution towards the adverse movements of the interest rate can be gauged by using duration GAP analysis

C) **Equity Price Risk:** The stress test for equity price risk assesses the impact of the fall in the stock market index. Appropriate shocks will have to be absorbed to the respective securities if the current market value of all the on balance sheet and off balance sheet securities listed on the stock exchanges including shares.

D) **Liquidity Risk:** The stress test for liquidity risk evaluates the resilience of the banks towards the fall in liquid liabilities. The ratio "liquid assets to liquid liabilities" shall be calculated before and after the application of shocks by dividing the liquid assets with liquid liabilities. Appropriate shocks will have to be absorbed to the liquid liabilities if the current liquidity position falls at the rate of 10%, 20% and 30% respectively.

2.1.10 developing an effective stress testing

Omp.Arya, (2008), explained and listed issues considered in conducting effective stress testing.

- Large number of choices regarding scenarios, risk factors to stress, how risk factors are combined, range of shock to be considered and choice of timeframe
- Predicting stress events is hard and yet choosing the „right" scenario is very important
- Use relevant scenarios for the business which can pass the „reality check"
- For complex products it is difficult to identify set of risk factors and amount by which to shock (lack of data)
- Assumptions and weaknesses should be transparent
- Effectiveness of stress tests is critically dependent on skills, intuition and experience of developers
- Methodology used - Historical, Hypothetical or Sensitivity
- Holding period assumptions (1 day/1 week/1 month)
- Pricing models (Full Revaluation, Grid-based, Taylor series)
- Frequency of stress testing (Daily/monthly)
- Breadth of risk factors (several hundred to several thousand) and proxies used
- Asset liquidity/correlation assumptions
- Policy issues (approval/review of scenarios, risk limits and responsibilities)

IMF and Basel Committee on banking supervision have also suggested for conducting stress tests on the financial sector. At system level, stress tests are primarily designed to quantify the impact of possible changes in economic environment on the financial system. At institutional level, stress testing techniques provide a way to quantify the impact of changes in a number of risk factors on the assets and liabilities portfolio of the institution.(Mohd and Aktar, 2012).

Stress tests are exercises to make assessments of the potential impact of an adverse future environment or event on a bank. Stress testing can be carried out at various organizational levels. Stress tests are risk management tools that use an extreme, but plausible series of developments to assess the impact on the firm.

Stress tests, as a process, are intended to identify and quantify risks to business portfolios. They have been adopted by banking and insurance regulators following the financial crisis. For individual firms, stress tests promote risk and capital management. The risk management element may include decisions about risk reduction or transfer. On other

occasions it is the discussion that leads to increased organizational awareness and resilience.(Mark and Thomson, 2014).

2.2 Empirical Literature Review

The following section reviews the empirical evidence of the previous study undertaken by different researchers with regard to stress test as a risk management tools in commercial banks and its implication in mitigating risk.

Andre, (2009) in his study stated that the major obstacle for banks not to be successful implementation of effective stress testing. Among them, lack of data, complexity and quantitative models capability required and inability to integrate the results of stress testing with the risk management decision process.

In the literature, a variety of stress test techniques can be found, mainly implemented by central banks and regulatory authorities (Virolainen, 2004); (Burrows et al, 2012). ;(Varquez et al, 2012). Existing stress tests vary in terms of methodology used, degree of complexity, aggregation levels and the types of risk they focus on ((Sorge, 2004); (Sorge and Virolainen, 2006); (BCBS, 2009). Different perspectives can be found and the scope of each analysis varies depending on the aggregation level, the factors and the environment that are captured (Sorge, 2004). The majority of approaches are based on econometric models. However, it seems to be subjective to the developer what the macroeconomic shocks that could affect the financial system or a banking entity are and how their performance should be assessed, as the level of aggregation also depends on an analyst‟s choice.

Sorge and Virolainen, (2006) has proposed two approaches to financial stress testing modeling, balance sheet models and probabilistic Value at Risk (VaR) models, while they implement them to the Finnish banking system. In the balance sheet models, changes in macroeconomic factors influence particular balance sheet items. VaR models use probabilities to estimate the distribution of loss based on the sensitivity of portfolio items to risk factors. In the majority of the stress tests, risk managers focus on credit risk linked with macroeconomic variables (GDP growth, unemployment, etc) in developing macro credit risk models(Cihak et al, 2007). Cihak and his friends discussed the design of scenarios, focusing on an extensive range of risk factors and proposes a logistic model for the inputs.

Tsend and Oyun, (2012) conducted a research on bank specific credit stress test to test 12 Mongolian commercial banks and analyzed which kind of macroeconomic or bank specific factors have potential effect on which banks by regression model. They followed two approaches for conducting stress test for credit risk.

1. Approach based on loan performance data (assuming certain shocks to performance of loan or based on a regression analysis b/n loan performance & macroeconomic variable)
2. Approach based on data on borrower (financial leverage, interest coverage)

Finally they concluded that macroeconomic variable have different impacts on the banks.

Ekaterina et al., (2014) stated in their research, most (but not all) studies conclude that stress tests produce valuable information for market participants and can play a role in mitigating bank opacity. The second strand of related literature examines to what extent supervisory information should be disclosed (e.g. (Goldstein and Sapra, 2013); (Schuermann, 2013). Several of these studies conclude that it may not always be optimal to fully disclose stress test results. The final related strand of literature examines how stress tests can be used to set capital ratios, limit capital distributions, and set-up resolution regimes in case of financial distress (BCBS, 2009).

As Alexander and Oleg, (2015) pointed out, Central Bank of Russia (CBR) is the supervisory authority and the lender of last resort, which aims at financial stability and development, and stress testing, is a crucial tool for Central Bank of Russia in its policy. Since 2003, the Central Bank of Russia has conducted aggregate top-down stress tests twice a year according to IMF and World Bank methodologies, as Basel Commission on Banking Supervision requires supervisory authorities to perform stress-testing exercises regularly (BCBS, 2009). The study develops a statistical approach to stress testing, firstly, conducting analysis on institutional level among systematically important state banks, and secondly, performing stress tests of retail and loan segments based on VAR model of interaction between financial and real economy sector. Furthermore,(Alexander and Oleg, 2015) stated that, macroeconomic model is used which is essentially a system of linear regressions which describes the relation between macro and financial system variables. For each credit institution it is calculated what impact the macro shock would have on balance sheet parameters. The results of stress testing are the estimated losses and expected need for recapitalization.

The carrying out of stress testing may be considered in two categories: internal suitability for the financial institution and in the process of supervision. The first category is mainly aimed at improving the management of the bank and should be treated as an important element of corporate governance behavior. This contributes to the understanding of potential risk by the bank, to develop strategies for reducing the risk and to assess the capital adequacy properly. The second category refers to an external audit carried out by banking supervision. (Edward, 2010).

Mohd and Aktar, (2012) specified in their research, the committee on the Global Financial System (CGFS) initiated a census of stress test scenario of 43 banks (commercial and investment banks) of 10 courtiers constituting 293 stress test (stress test of potential market event, such as a stock market crash) and 131 sensitivity Stress test (stress test based on standardized moves in closely linked market risk factors, such as parallel yield curve shift) in early 2000. The census also reported that all the banks under study used stress test to understand the firm‟s risk profile and communicate with senior management. Just over half use stress test to set limits, one fifth use stress for capital allocation, two thirds of banks said that stress test result had directly led them to hedge their position. The report also pointed out that most banks run their stress test at high frequency (daily or weekly).

They also pointed out some countries stress test practices, during the 1st quarter of 2004, the General Secretariat of the Commission Bancaire (GSCB) and the Directorate General Economics and International Relations (DGEI) of the Banquede France conducted an assessment of the stability of the French banking system and its capacity to withstand a set of financial shocks through stress testing. The result of the assessment, on the basis of 2003 reports and predicted performance in 2004 and 2005, indicated that the French banking system is currently is in a position to withstand major economic shocks. With regard to disclosure of stress test result, Mohd and his friends mentioned that there is a consensus in Europe on the importance of stress testing but not on the release of results but methods and measures of impact and the reliability of the calculation should be explained to avoid any misinterpretation by the users.

Miles, (2015), has conducted a research in USA banks so as to assess the capital adequacy of the banks in the worst case scenario. The USA banks whose capital reached to $50 are required to conduct stress testing and submit the test result to the central bank.

Stress test results of individual institution can be released Comprehensive capital analysis and review stress testing was added to U.S. banking regulation in November 2011, with the adoption of the capital plan rule. This rule applies to bank holding companies with consolidated assets of $50 billion or more and requires them to submit detailed capital plans over a nine-quarter horizon across a range of stress scenarios (Miles, 2015). Stress tests were conducted on America‟s 19 largest bank holding companies (BHCs). These results revealed that nine (9) of the nineteen (19) banks tested already hold sufficient capital to operate through 2010 under the projected adverse scenario; those banks cannot be required to raise additional capital. Ten (10) of the nineteen banks were found to need additional capital totaling $75 billion in order to weather a more adverse economic scenario.

On the other hand, Stress tests were conducted by the staff team of the IMF and the World Bank in 2009 to assess the resilience of the banking sector covering the entire 48 banks operating in the country as of December 2008.The analysis depicts that credit risk continues to have a larger impact than any other single factor. Five banks including two state owned are currently below the CAR. All nine foreign banks operating in Bangladesh were resilient. Exchange rate risk does not preset a major risk in Bangladesh because the net open position of many banks is minimal.(Mohd and Aktar, 2012).

According to New Zealand bank, registered banks are required to conduct stress tests and report the results as part of their Internal Capital Adequacy Assessment Process (ICAAP). The reserve bank of New Zealand prefer to use stress testing as a component of supervisory assessment rather than directly tying supervisory action to stress test results. The Reserve Bank puts considerable effort into understanding the internal rating based(IRB) modeling being done by banks to determine the risk weights assigned to loans for capital purposes. In addition, New Zealand banks have freedom to build their own models and generate their own stress-testing results. The Reserve Bank expects to see innovation and improvement in stress test modeling over time, and obtain additional insights into risks from the modeling done by banks. (Resereve Bank of New Zealand, 2014).

According to Ojwag, (2015), risk management techniques are applicable by commercial banks in Kenya. Revised Basel 2 focuses on managing market risk. Different techniques

were being used by different banks with an 80% of the banks surveyed using more than 4 different techniques concurrently.

Alian et al., (2001) conducted a research on stress test and current practice. They tried to state the implications of stress test on risk management. On their research, they tried to look at how banks perform and use stress tests in risk management. They found that, most commercial banks used the stress test result to help the risk managers to communicate the nature of the firm‟s risk profile to senior management and to help risk managers better understand the nature of the firms risk profile. And also most of the banks done stress test on monthly basis and the same reported to senior management on monthly. In addition, they found first, stress testing has become an integral part of bank‟s risk management tool and risk manager seem to recognize the relative merits of scenario analysis over sensitivity &Var analysis in dealing with specific exposure. Second, banks appear to take in to account their position in the market & the strategic aspect of risk management. Besides, the appropriate reaction to a stress test will depend on the relationship between the bank‟s positions & the size of the market.

Beside, Marek, (2006) argue in discussion forum conducted in National Bank of Slovakia that both type of stress testing (sensitivity and scenario) have their own advantage and disadvantages. Sensitivity tests are designed to measure a bank‟s sensitivity to risk factors change. Whereas, scenario stress tests are more complex and their purpose is to analyze a bank‟s vulnerability during simulated fluctuations in various risk factors. Furthermore, in reality, however, stress situation involve the fluctuation of various relevant risk factors so that stress scenarios encompass this feature of real situation by means of correlations between risk factors.

As Larry, (2013) explained, the widespread runs that followed the failure of Lehman Brothers, the U.S. authorities turned to stress tests as a way of addressing market concerns about capital adequacy. The U.S. Supervisory Capital Assessment Program (SCAP) subjected the country‟s 19 largest BHCs to a stress test. BHCs under SCAP were required to evaluate the adequacy of their capital against a “severely adverse” scenario and they were expected to retain sufficiently high capital ratios throughout the scenario to be able to continue lending to creditworthy customers.

In addition, Larry, (2013) examined the importance of stress testing and the weakness of Basel. He explained the Basil ratios are static and unconditional measures of capital

adequacy. Besides, the Basil measure capital adequacy at a single point in time using a process to calculate the ratios that does not depend upon the expected future state of the economy. Furthermore, the Basel ratio use historical data to estimate the bank specific distribution of losses associated with various asset categories and concluded that the Basel ratios failed to maintain investor confidence during the recent financial crisis. Although Basel II underestimated some risks, the bigger problem with the Basel II appears to have been largely lack of market confidence in asset valuations.

Furthermore, Larry, (2013) stated that the first step towards Basel I standards came as U.S. supervisors noted the weaknesses in the leverage ratio and started looking at the more risk sensitive measures used in several G-10 countries. The U.S. then worked on its own and in coordination with increasing numbers of supervisors in other developed countries to reach agreement on a common capital standard.

Alexander and Oleg, (2015), have shown the difficulty of establishing universal methodology of conducting stress test, though Sorge, (2004) reports typical stages of stress testing. Firstly, identify the scope of analysis and potential risks and vulnerabilities of the system. Secondly, it is required to define shocks and design relevant scenarios, all assumptions should be listed. Thirdly, a researcher maps macro shocks to banks' balance sheets using an econometric model. Finally, interpreting the results; second-round effects are analyzed, and the limitations of the performed analysis should be carefully discussed. They have used satellite and Var models by using various macroeconomic scenarios to test the impact on credit risk in retail loan segment and on the corporate loan sector and concluded that macroeconomic shocks (namely, inflation and investment growth shocks) have considerable impact on credit risk in retail loan segment of Russian credit market, but do no significant impact on the corporate loan sector. On the contrary, the growth of loan market itself does not influence retail loan segment but has a significant impact on the corporate.

On the other hand, as stated in Fugacova and Jakubik 2012 (cited in Alexander and Oleg, (2015), the stress test methodology consist of five stage. Firstly, they create a baseline and adverse macroeconomic scenarios. Secondly, stress parameters are forecasted through „‟satellite‟‟ models. Thirdly, the projected via satellite models values are used to calculate credit, foreign exchange and interest rate risks for each bank. Fourthly, iterative interbank contagion is taken into consideration as follows. After losses are deducted from

bank capital and post-shock capital adequacy ratios (CAR) are computed, the latter are mapped into bank-specific PD (using expert judgment) and they are used to determine the likelihood of institution‟s default on interbank liabilities. Finally, post-shock and post-contagion CARs are calculated and recapitalization costs are estimated on a bank-specific level.

Another research made by Cihak et al, (2007) provided an overview of the stress testing of the Czech banking sector conducted by the Czech National Bank. The paper begins by updating historical and hypothetical stress-testing scenarios. It also includes a sensitivity analysis of the interest-rate risk and new presentation forms of such. The results of interbank contagion tests (both simple and combined) based on Czech banks‟ exposures on the interbank market are offered. Finally, the paper integrates the stress testing with CNB macroeconomic forecasts (i.e., the quasi--phase-matching model). The authors‟ stress testing was also integrated with the macroeconomic credit-risk model, with the impact on individual bank portfolios, and with interbank contagion. One baseline and three alternative scenarios were tested they have shown that the Czech banking sector was relatively resilient to the shocks.

As Mathias, (2008) suggested, there is a difference on how private and central banks view stress tests. Private Banks approach stress tests from a risk management point using mainly financial theory, mathematics and statistics. On the other hand, Central Banks approach stress tests from a macroeconomic perspective demanding macroeconomic fundamentals to be included in the formation of the procedure.

Mohd and Aktar, (2012) stated that, IMF and Basel Committee on banking supervision have also suggested for conducting stress tests on the financial sector. At system level, stress tests are primarily designed to quantify the impact of possible changes in economic environment on the financial system.

On the other hand, Alfaro and Drehmann, (2009) reported on a study of stress tests done prior to the Crisis of 2007–2009 and concluded that most stress tests were not adequate, since the majority did not raise any red flags with respect to banking system fragility.

Stress testing are useful ways of assessing areas of potential problem. Stress tests are one of the tools used by banks to understand their risk exposures. Bank regulators use stress tests to verify that banks will still be able to maintain adequate levels of capital under

stressful but plausible circumstances. Stress testing can also be used to consider the effectiveness of the banks compliant risk mitigation techniques for various risk types over their respective time horizons, such as to explore what could occur if expected mitigation techniques break down during stressful periods.(Luca and Michelle, 2012).

With regard to supplementary approach in stress test, Supplement stress tests with other assessment techniques, such as qualitative and quantitative bank risk analysis, early warning indicators, models of debt sustainability, and informed dialogue with supervisors and market participants, among others. Final conclusions on the resilience of an institution or a system should be based on all these sources, not just the results of stress tests (José Viñals, 2012).

2.3 The limitation of the stress test

Though stress testing has a major role in risk management, it has limitation. Frankel et al., (2000), argued that a stress test estimates the exposure to a specified event, but not the probability of such an event occurring. In addition, numerous decisions in the specification of a stress test must be made that rely on the judgment and experience of the risk manager. There is thus no guarantee that the risk manager will choose the "right" scenarios or interpret the results effectively. Stress tests also impose a high computational cost, particularly in collecting the data from diverse business units and from the need to revalue complex options-based positions. A further limitation is that, at present, firms cannot integrate market and credit risks in a systematic way in their stress tests. Besides, Christos, (2013) has revealed that one crucial limitation appeared to be that the majority of the models used historical data topredict the severity of plausible shocks. However, forecasted future stress events and their consequences proved to be insufficient and too optimistic, as they have been based in assumptions coming from a relatively stable and booming period for banks BCBS, (2009). This is what the Basel Committee on Banking Supervision (2009) stated:

"*... given a long period of stability, backward-looking historical information indicated benign conditions so that these models did not pick up the possibility of severe shocks nor the build-up of vulnerabilities within the system. Historical statistical relationships, such as correlations, proved to be unreliable once actual events started to unfold."* (BCBS, 2009).

In addition, Cihak et al, (2007), in their research also revealed certain limitations of the stress-testing approach. These are:

1. Challenges linked to the relatively "static" nature of the stress-testing methods, which might create some tensions when being integrated with more dynamic and advanced approaches.
2. The stress-testing method does not fully take into account the reactions of the involved economic agents (financial institutions, depositors, and regulators), including problems such as herding behavior or crowded trades.
3. Macroeconomic stress testing also lacks some important data available to the individual financial institutions and thus would never replace microeconomic stress tests conducted by banks themselves.

2.4 Research Gap

Though the issue "Stress Test" has got impressive attentions in the last few decades as to measure the level of economic resistance and to alert bankruptcy threat warning of the financial institutions in general, and the commercial banks in particular had the stress test scenario of a deepening economic and financial crises came truth, there is mere doubt that most of the studies related to the issue were done in the context of developed countries of the world and they are performed both by the domestic financial supervisory authority or by the banks. Very few studies were done and less attention has been given in the context developing countries, from academic research standpoints.

Most researches have been conducted with respect to stress test in developed countries commercial banks but the risk phenomena is everywhere. In addition, those countries commercial banks have detailed and well-designed guideline so as to conduct the stress test. Nevertheless, as per the researcher‟s knowledge, there are lacks of sufficient academic research regarding to stress testing generally in Africa particularly in Ethiopia banking sector. NBE gave less attention for stress testing because as a risk management tool, like developed countries banks, there should be detail procedure and guideline. The commercial banks also don‟t have detail and well-designed guideline. As a result of such gap there will not be effective forward looking risk management practice in the banking industry.

CHAPTER THREE

3. Research design and methods

3.1 Research Paradigm

As each design demands perfect tools and techniques, "The method of research provides the tools and techniques by which the research problem is attacked"(Singh, 2006) the research used interview, questionnaire and check list which are verified as a means to deal with the problem. The type of the research design detail is presented in this chapter.

3.2 Research design

The study attempted to assess the effectiveness of stress testing in commercial banks in Ethiopia and designed to be descriptive. Descriptive study was chosen as it enabled the researcher to describe current effectiveness of stress test practice as one of strategic means in mitigating risks of commercial banks considered in this study.

The researcher arranged all the data as to narrate and unveil the effect, therefore, a mixed methods approach was chosen as it increases the likelihood that the research generates more accurate results. The reason for choosing this approach is due to the aim of receiving in depth information regarding effectiveness of stress testing in mitigating risk.

3.3 Data type

In this study both qualitative and quantitative data for which its sources is primary was employed. In order to get primary data both structured questionnaire and structured interview were used. Since, the questionnaire items have an ordinal measurement scale an ordinal (quantitative) and structured interview (qualitative) data were integrated under data interpretation section.

3.4 Unit of analysis

According to Bhattacherjee (2012), the unit of analysis may be a person, group, organization, country, object, or any other entity that you wish to draw scientific inferences about. In this study unit of analyses are commercial banks which the researcher has opted for using particularly, risk management department staffs as a „key informant" or „proxy" for the banks as the study focus is at institutional level. Moreover,

the only section that can provide the reliable data on the subject matter is technically the risk management department staffs as the other department will not have enough knowledge or know-how about the study subject.

3.5 Population and sampling Techniques

It is known that any sample should be taken as to represent the target population and maximize the chance of generalize ability of the findings. Therefore, in this research three different subjects used as to strengthen the validity and reliability of the findings. The statistics also strictly and carefully considered to represent the parameters or the defined population and ensure the generalize ability of the research findings. The researcher employed mainly purposive sampling and random purposive sampling in securing valid representation of data by producing a well matched groups in regard to the criterion of proper mix and experiences of subject.

According to NBE (2012/13), currently there are about 2 governments owned and 16 private banks working in Ethiopia. such as; commercial bank of Ethiopia (CBE), Development Bank of Ethiopia (DBE), Dashen Bank S.C (DB), Awash International Bank S.C (AIB), Wegagen Bank S.C (WB), United Bank S.C (UB), Nib International Bank S.C (NIB), Bank of Abyssinia S.C (BOA), Lion International Bank S.C (LIB), Cooperative Bank of Oromia S.C (CBO), Berehan International Bank S.C (BIB), Buna International Bank S.C (BUIB), Oromia International Bank S.C (OIB), Zemen Bank S.C (ZB), Addis International Bank S.C (AIB), Abay Bank S.C (AB), Enat Bank S.C (EB) and Debub Global Bank S.C (DGB).

As it is purposive sampling, for this study only commercial banks have been chosen from the above stated banks. And also this study is interested in all banks that have been continuously operational and whose ages are 10 years and above. The study has been conducted at the head offices of 10 commercial banks considered in this study namely: CBE, AIB, DB, WB, ABY, UB, NIB, LIB, ZB and OIB. The questionnaire has been distributed 50to risk department senior experts.

3.6 Methods of data collection

The primary data has been collected by distributing a structured questionnaire to respondents (the bank‟s risk management (Risk Experts)). The questionnaire used under

this research included both open ended and close ended questions and it has been distributed to selected sample commercial banks to obtain their answers for the questions. The closed ended questionnaire was developed based on Summated Scales (or Likert-type Scales) with 5 choices; “strongly agree”, “agree”, “ neutral”, “disagree” and “strongly disagree” As the study is at institutional level, the risk management asked to give their view on a series of questionnaires distributed to them. Besides, a primary data collection means, the structured interview has been conducted. Moreover, various directives issued by the NBE have been used using standard checklist as to measure performance effectiveness of stress testing.

3.7 Data analysis and interpretation

To analyze the raw data collected from sample commercial banks, the researcher used SPSS 20 version which is specialized statistics program that can provide sufficient tools for analyzing the collected data and excel application for graphic presentation of the SPSS outputs. Therefore, the quantitative data from the questionnaires was analyzed using simple descriptive statistics (mean, frequency and percentage) and presented in the form of graph and table. This enabled the researcher to make the analysis and to assess the effectiveness of stress testing in the commercial banks.

3.8 Research Instrument

Triangulation were the heart of the instruments selected, focused and targeted to answer the basic research questions and maximize the validity and reliability of the data collected. Therefore, research tools administered on the sample subjects for collecting evidence or data as to select and administer and maximize the reliability and validity of the data that have been collected. It is believed to provide objective data for interpretation of results in the study. Employing the right instruments is not an end until it is to be administered and collect valid data.

Particularly for the purpose of this research, three different instruments have been used and collect primary and secondary data. As it is a qualitative research, the research was rely highly on primary data, therefore, appropriate instruments need to be employed, that has been included Interview, questionnaire analyzed.

CHAPTER FOUR

4 Result and Discussions

In this chapter both questionnaire and interview results analyzed and discussed as it was designed to assess the effectiveness of stress testing as an instrument of mitigating risk in commercial banks in Ethiopia. The questioner was developed to gather information related to trends, and practice of risk mitigation particularly on stress testing sensitivity and scenario analysis, composed of an ordinal and scale questions. The interview question was also designed as to explore the awareness, practice trend and dependency on stress testing as a tool for sensitivity and scenario analysis of risk in commercial banks.

The questionnaires‟ data was analyzed using an SPSS 20 version and interpreted on basic thematic developed from the questioners and derived from the objectives of this research. Therefore, the data analysis, interpretation and discussion made in this chapter as to assess the effectiveness of the stress testing in mitigating risks, designed to probe the effectiveness of stress testing.

The question has three main sections including background information of the respondents; general overview on stress test trend and practice, and the third sections includes the measurement of the trends and practice of stress testing on commercial banks. The nature of data collected in this questionnaire section is string and numeric which has been measured in nominal, ordinal and scaling parameters.

Interview analysis and discussion made under basic thematic of trend, practice and policy of stress testing in National bank and commercial bank perspective as to measure the practicality and its effectiveness in mitigating risks using sensitivity and scenario analysis.

The discussions of both questionnaire and interview results are triangulated as to measure the validity and reliability of the methods including data collection and sampling.

4.1 General Information

The four parameters used for background information are sex, age, service and academic status. This section discusses the general information on the respondents‟ gender, age,

work experience and academic status, as to indicate the validity of the source of information and level of awareness concerning to stress test as risk mitigating methods.

As it is indicated in the summary of data collected from 45 total respondents 71% or 32 of them were male and the remaining 29% or 13 were female respondents. The other background information of the respondents was age composition; the data has indicated that 71% of the respondents fall under the range of 30-39 and the minimum age range which had accounted 2% or only one respondent found in the age range of 50-59. From the respondents 6 of them fall under the age range of 18-29 and 5 of the respondents fall 40-49 age range.

Table 1 Background information sex and age

		Frequency	**Percentage**
Sex	**Male**	32	71%
	Female	13	29%

Age	**Frequency**	**Percentage**
18-29	6	13%
30-39	33	73%
40-49	5	11%
50-59	1	2%

Source SPSS output from survey data 2017

The third section of the background data collected was service year of the respondents in the financial industry. The service year grouped under four levels of service which were 1-5; 6-10; 11-20 and above 20 years of service. From the summary the service years of the respondents majority (89.89%) of the respondents were have a service year (tenure) within a range of 6-10. In addition the age and gender mix also has increased the validity and reliability of the research, since the researcher has sampled respondents with the right understanding and practical experience of risk mitigation in the bank industry.

The fourth section of background information gathered was academic or educational levels of the respondents. As it is indicated in the pie chart below, the academic level considered from Diploma upto Phd. The data showed that 73% or 33 of the respondents were a degree holder and 24% or 11 of the respondents were found MSC/MA holders and the remaining one respondents was a diploma holder.

Table 2 Background information education and service

Service years

Service	Frequency	Percentage
1-5	7	16
6-10	31	69
11-20	7	16

Education

Education	Frequency	Percentage
Diploma	1	2
BA degree	73	73
MSC/MA	11	24

Source SPSS output from survey data 2017

Accessing the right sample for research was the centre focus and determinant activity in insuring the validity and reliablity of this research, therefore, from both the service year and academic status summary indicated that the respondants understanding and experience regarding stress testing in mitigating risk would have been valid input in this research.

4.2 Analysis of response rate and missing values.

Out of the total of 50 samples selected from commercial banks, 45 of them made a response and provide their input for this research. As stated under sample size section above, from the distributed questioner, 45 respondents which account for 90% of the

sample provided their response. As compared to expected sample used, only 10% did not provide their responses. This non-response does not have a material effect on the research output and the response rate also is reasonable to make a conclusion for issues raised under this research paper.

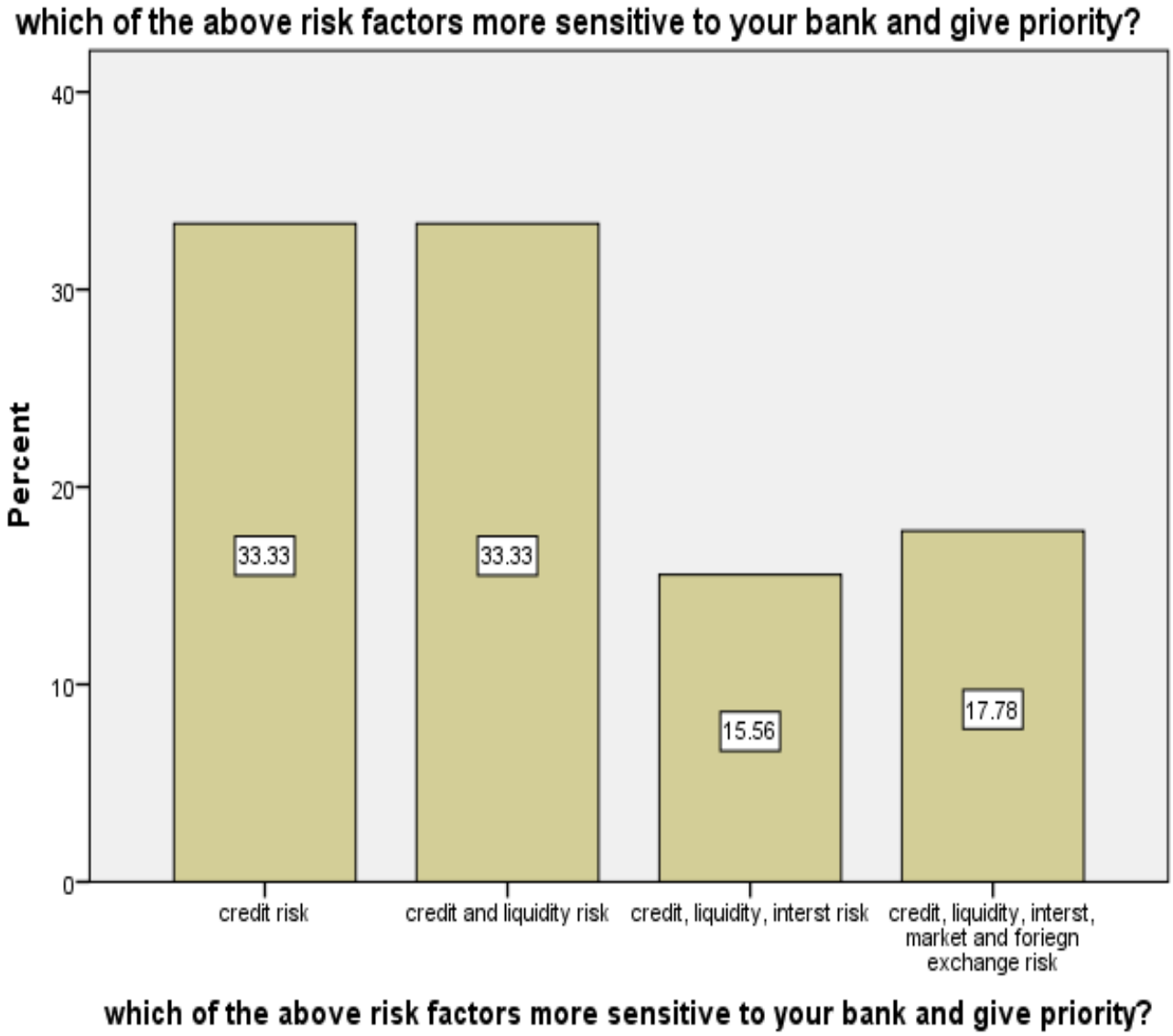
4.3 Basics on risks factors effect, sensitivity and contingency plan of commercial banks.

In this section risk factors including credit risk, liquidity risk, interest risk, market risk and foreign risk sensitivity, factor, and disaster plan assessment that had been made analyzed and discussed. As it was illustrated in the literature the banks‟ strategic risk management need a primarily identification of risk factors and nature of sensitivity before setting a contingency plan. Therefore, in this section the complement between sensitivity, effect and contingency were analyzed and discussed.

Sensitivity of risk in commercial banks

This section showed the analysis made on identifying the risks which were sensitive to the commercial banks as it was given for the respondents to give an order from the given risk types. As of the data indicated below credit risk and liquidity risks were the 100% sensitive risks in the commercial banks since all the 45 respondents agreed in their responses and found in all the respondent‟s choice. The foreign exchange and market risk also found a moderate sensitivity with the record of 30% in their response. Interest risk found the less sensitive risk from all other risk types.

Figure 1 risk factors sensitive to banks



Source SPSS output from survey data 2017

The risks which mostly affect the commercial banks

As it depicted, 45 respondents asked to identify risks that mostly affect the commercial banks based on the hands on experience and information from basic risk identified i.e. credit, liquidity, interest, market and foreign exchange risks. Out the total respondents 21 of the respondents put credit risk as a solemn risk factor which had been also the most risk factor affecting the commercial banks, whereas 12 respondents had identified both credit risk and liquidity risk as mostly risk factors affecting the commercial banks. Out of 45 respondents 6 of them also added interest risk together with credit and liquidity risk as

mostly affecting risks in commercial banks and the other one respondents added market risk as one of mostly affecting risks in commercial banks. The remaining 5 respondents added foreign exchange risk also mostly affecting risks together with other four risk identified above.

Therefore, from the aggregate data shown in the graph below credit risk identified as highest most risk affecting the commercial banks followed with liquidity risk. From the rest of risks also interest risk identified as the third most risk affecting commercial banks and market and foreign exchange risks identified the less risk which were affecting commercial banks.

Table 3 Risks mostly affected

Risk factors	Frequency	Percentage
Credit Risk	21	46.67
Credit & Liquidity risk	12	26.67
Credit, liquidity & interest rate risk	5	11.11
Credit, liquidity, interest rate, & market risk	1	2.22
Credit, liquidity, interest rate, market & foreign exchange rate risk	6	13.33
Total	**45**	

Source SPSS output from survey data 2017

Risks which demands business disaster recovery plan

As any of the sensitive and mostly affecting risks demand disaster recovery plan, the need for identifying those risks are an inevitable primary task in commercial banks before proceeding to develop the plan. This section analyzed the response made on identifying the risks that mostly demands disaster business plan in commercial banks.

Out of 45 respondents 17 identified credit risk which demands disaster recovery business plan whereas 14 of the respondents added liquidity risks together with credit risk demanded need for business recovery plan. The other 6 respondents added interest risk as one of the risk demanded disaster recovery plan together with credit and liquidity risk, whereas the other three respondents considered market risk as it needed to have disaster recovery business plan. The remaining five respondents considered all the risks as they all need to have disaster business recovery plan.

As it were identified both in the sensitivity and factors of risks affecting commercial banks analysis sections credit and liquidity risk indicated to be the sensitive and most affecting risk factors, in this section also identified to be the most demanding risk factors

which were needed to have business disaster recovery plan in commercial banks whereas foreign exchange found to be the less risk factor which needs to have business disaster recovery plan.

Table 4 Banks disaster recovery/ contingency plan

Risk factors	Frequency	Percentage
Credit Risk	17	37.78
Credit & Liquidity risk	14	31.11
Credit, liquidity & interest rate risk	6	13.33
Credit, liquidity, interest rate, & market risk	3	6.67
Credit, liquidity, interest rate, market & foreign exchange rate risk	5	11.11
Total	**45**	

Source SPSS output from survey data 2017

From the above three subsection analysis made on risk factors‟ sensitivity, effect and need for disaster recovery plan, the conclusion can be drawn that both credit risk and liquidity risk found to be the center focus of the commercial banks, as both were sensitive and had effect which implied need for disaster recovery plan. The other conclusion that can be drawn as it implied in the analysis foreign risk and market risk had less sensitive and less effect which in turn had demanded disaster contingency plan with inconsiderable extent in commercial banks of Ethiopia.

4.4 Concentration of Risk factors on given risk mitigation methods in commercial banks

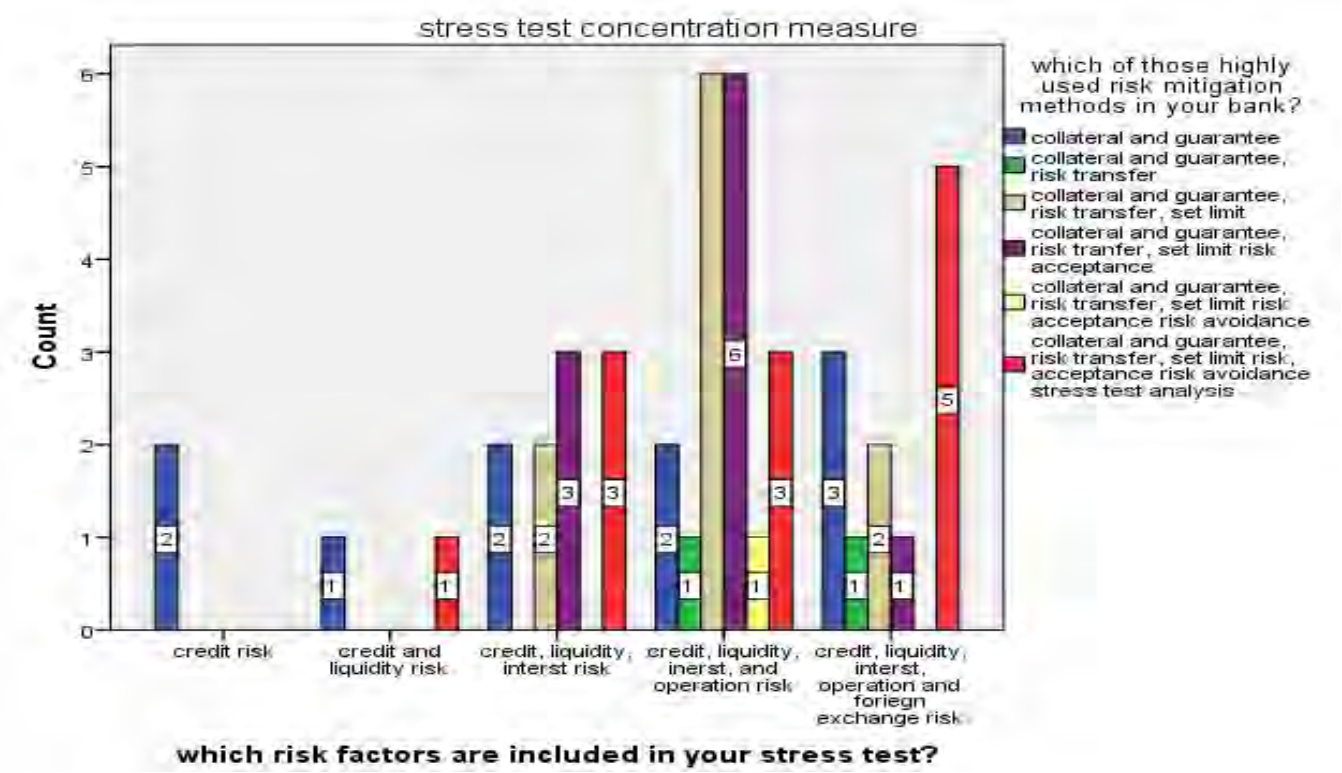
In this section two different analysis made on drawing conclusion in the commercial banks risk mitigation methods, which were about identifying highly used risk mitigation methods and concentrations of risk factors on stress testing risk mitigation as one of risk mitigation method in commercial banks.

In order to analyze these two basic variables, the researcher had used crosstab of descriptive analysis of SPSS. As it is indicated stress test analysis concentration as risk mitigation methods for an identified risk factors, in all the types where credit, liquidity, interest, operation and foreign exchange risk considered 12 response concentration found from the total of 45, related with collateral and guarantee as risk mitigation methods which had found 100% or 45 response made, stress test had indicated as very limited

concentration to be applied as any of risk mitigation methods. Collateral and guarantee, risk transfer, set limit and risk acceptance together indicated as highly used methods of risk mitigation counted to had 100% response while risk avoidance alone indicated as very limited rate of application as risk mitigation methods in commercial banks which had only 1 response rate in the Crosstab indicated below.

From the analysis and discussion made in this section, the conclusion drawn regarding the extent and frequency of risk mitigation methods particularly stress test analysis indicated. Commercial banks had used stress test analysis in very limited risk factors related to other risk mitigation methods applied to the banks. The risk factors which had limited stress test analysis had found higher concentration on foreign, operation and interest risk and very limited concentration on credit and liquidity risks. The data indicated that, stress test analysis practice is very limited in commercial banks as risk mitigation methods.

Figure 2 Concentration of Risk factors on given risk mitigation methods



Source SPSS output from survey data 2017

4.5 Years and frequency of implementation and conduct of stress test analysis

In mitigating risks, commercial banks have been employing different methods of risk mitigation from its time of inception, since banks need to sustain and being competitive in the industry. From those strategic methods of risk mitigation stress test analysis is one and have unique role in dealing with sensitivity and scenario analysis. In this section

stress test analysis implementation and conduct of commercial banks is analyzed and discussed.

4.5.1 Commercial banks' conduct of stress test periodic measure

Table 5 Frequency of conducting stress testing

How often does your bank participate in the conduct of stress tests?

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	Bi-Monthly	2	4.4	4.4	4.4
	Quarterly	32	71.1	71.1	75.6
	Semi-Annually	4	8.9	8.9	84.4
	Annually	6	13.3	13.3	97.8
	No particular schedule, as and when needed	1	2.2	2.2	100.0
	Total	45	100.0	100.0	

Source SPSS output from survey data 2017

As it indicated in the table above, 70% of commercial banks conducting stress test analysis every quarter, 13% of commercial banks conduct annually. There were banks conducting stress test analysis when a need arises with inconsiderable number of banks and there were also banks conducting stress test analysis semi-annually. The data indicated that more than 90% of commercial banks conducting stress test analysis regularly. Based on the analysis finding most the commercial banks conduct stress test analysis as one means of mitigating certain risks.

4.5.2 Years of employing stress test as risk mitigation in commercial banks

The analysis made to measure the commercial banks" years of employing stress test as one of risk mitigation methods. From the data indicated, below more than 69% of banks exercising stress test analysis for about 1-3 years and 20% of banks exercising stress test for about 4-6 years in mitigating risk. The remaining 10% of commercial banks considered in the sample exercising stress testing for about 7-10 years.

Table 6 Years of employing stress testing

how long does the bank exercising stress test as one of risk mitigation strategy?

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	1-3 years	31	68.9	68.9	68.9
	4-6 years	10	22.2	22.2	91.1
	7-10 years	4	8.9	8.9	100.0
	Total	45	100.0	100.0	

Source SPSS output from survey data 2017

The conclusion made based on the findings indicated above that, commercial banks has early experience in implementing stress test analysis in mitigating risks by sensitivity and scenarios analysis. Only very limited commercial banks exercise stress test for more than seven years those might have to expertise on it and being leading and model in scenario and sensitivity analysis.

4.6 Reporting and disclosing stress test result

The stress test result has to be reported and disclosed for the concerned members, as it cannot be classified information for those concerned body of the organization. Reporting and disclosing results can promote the better decision of management and other parties related with the firm. Here in this section the analysis made as to identify to whom the commercial banks reporting and disclosing the stress test result and considered such trend of commercial banked.

Table 7 Reporting and disclosing stress test result

to whom the stress test result shall be reported and disclosed?

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	to Banks Management	10	22.2	22.2	22.2
	to Banks Management, and to Bank's Board Directors	27	60.0	60.0	82.2
	NBE, to Bank's Board Directors, to Banks Management	8	17.8	17.8	100.0
	Total	45	100.0	100.0	

Source SPSS output from survey data 2017

Based on the statistics indicated above for about 60% of the respondents pointed out that stress test result has reported and disclosed for the banks‟ management and banks‟ board of directors as working procedures and 22% of them responded that it is reported for only the management of bank. The remaining 18% or 8 respondents out of 45 added NBE as part had needed to have reports or disclosure of stress test result as working procedures.

Summary made as the stress test report has to be reported and disclosed and for 80% of commercial banks reported and disclosed the stress test result for both the management and the board of directors where as 20% added to the NBE. There in conclusion had made by the researcher that commercial banks had trend and working procedures of reporting

and disclosing the stress test result for the party of interest and regulatory procedural groups.

4.7 Utilizing of Stress Test Results

Stress test analysis need to be practiced and utilized as to mitigate certain risk in the industry, since banks has to reduce, avoided, and minimized certain risk happening, especially in today fast-pace changing business environment with a global and national impact. In this section the analysis made how the commercial banks used stress test analysis result.

Table 8 Utilization of stress testing result

Utilization of stress testing result	**Frequency**	**Percentage**
To know bank‟s risk profile	4	8.89
To know bank‟s risk profile & set tolerance limit	6	13.33
To know bank‟s risk profile, set tolerance limit & allocate capital	4	8.89
To know bank‟s risk profile, set tolerance limit, allocate capital & monitor liquidity risk	14	31.11
To know bank‟s risk profile, set tolerance limit, allocate capital, monitor liquidity risk & prepare contingency	17	37.78
Total	**45**	

Source SPSS output from survey data 2017

Based on the data indicated above 4 respondents agreed that stress test result has used to better understand the nature of the firm‟s risk profile and the 17 respondents agreed that stress test result has used as to know better the nature of the firms‟ risk profile, to set limit, to allocate capital, to monitor liquidity risk and to conduct contingency planning for time of market stress. As in particular response made at each element 14 respondents have agreed that stress test result has used to know better the risk profile, to set limit and only to allocate capital.

As to summarize the statistics result in commercial banks has used stress test result as an input to better understand the banks‟ risk profile, to set limit and allocate capital and some banks also has used to develop contingency plan.

As to draw conclusion from the summary, commercial banks had utilizing stress test results mostly to understand and set limit by allocating capital accordingly, but only limited commercial banks found used beyond timely action and planning and used as to set contingency plan.

4.8 Time taken to conduct stress test

Time and frequency basic variable in conducting stress test and banks need to have enough time to conduct with the right frequency in such liquid market competitive environment, as to sustain in the industry by being competitive. In this section, the commercial banks duration taken to conduct stress test is analyzed and discussed.

Figure 3 Time taken to conduct stress testing

.

Source SPSS output from survey data 2017

Based on the statistical data indicated above out of total 45 respondents 18 of them had informed that the commercial banks conduct stress test within less than two weeks whereas 17 of them conduct stress test within two weeks up to one month. The four of the respondents indicated that banks conduct stress test for more than one month and less than two months, whereas the remaining six respondents indicated that commercial banks conduct stress test for more than two weeks and within three months.

As to summarized commercial banks indicated to conduct stress test from one week up to three months range, which implied to have wider range of duration. As to conclude the

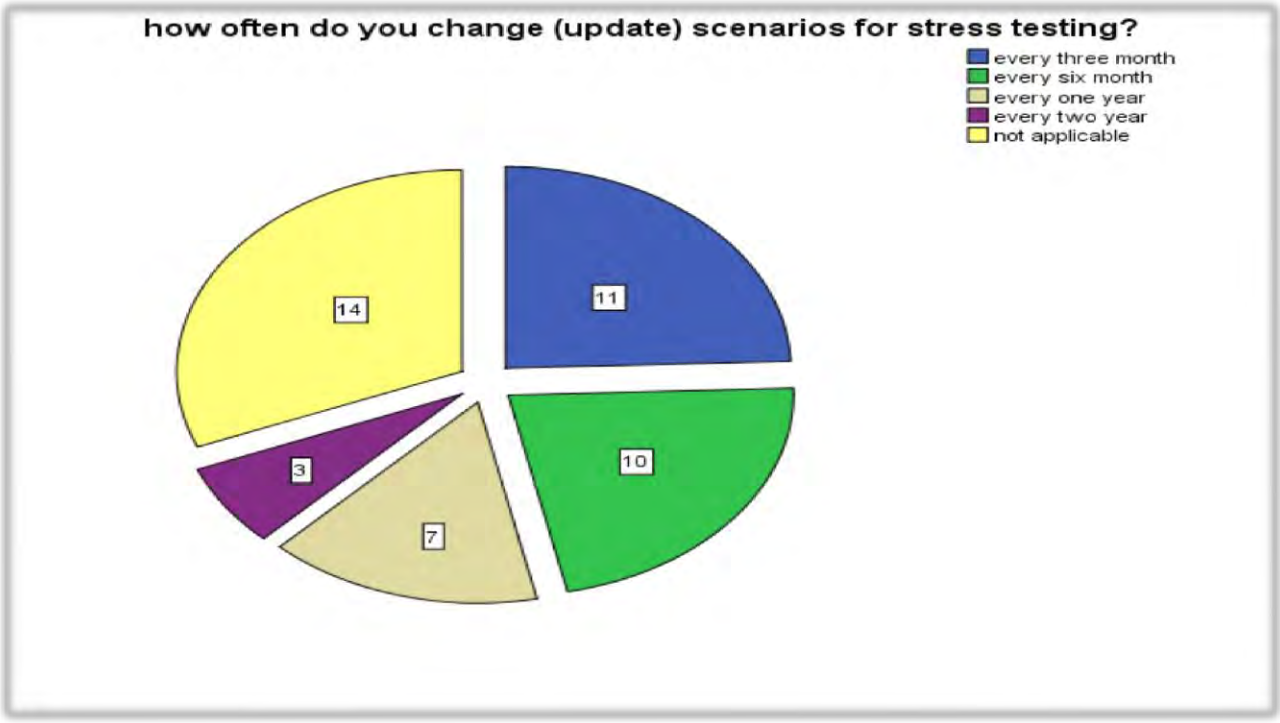
commercial banks conduct stress test some in very short endure while other conducted in very long endure, which would signify that commercial banks had found with different trend of conducting stress test in time frame.

4.9 Frequency of updating stress test scenarios

Updating the stress test scenario is an inevitable practice that has to be handled in the industry where internal and external dynamic are the push factor to stay in the industry. Not only updating, but commercial banks need to update with the right frequency as to mitigating risk with a proper strategy since time become critical variable than ever in today‟s financial market. The sensitivity and scenario analysis of stress test can be conducted to forecasting the future based on the future plausible, the present and the past events.

In this section, the analysis and discussion on commercial banks frequency of updating the stress test scenario dealt. And indicated the proactive and farsightedness of the commercial banks as to mitigate risk and sustain in the market competitively.

Figure 4 Frequency of updating stress test scenarios



Source SPSS output from survey data 2017

As it is indicated based on the statistics for about 31.11% or 14 respondents‟ states that scenario stress test update is not applicable in their banks and three respondents indicated

that the update is made very two years, where 7 of the respondent had informed that the update made once in a year. To the very opposite there were 11 respondents that update on scenario stress test made in every three months whereas the remaining 10 subjects indicated that the update made in their banks in every six months.

The summary that has made based of the result that there were commercial banks updating scenarios for their stress test in a considerable time gap, whereas there were banks updating the scenarios for stress testing in very long-time gap. The gap ranged were from updating periods of every three months up to none or not applicable at all in the banks. As to conclude majority of the commercial banks do not update the scenarios in the stress testing practice.

4.10 Benefits of stress testing to the commercial banks

Stress testing is not new singularities in the financial market since liquidity is the very nature of the industry relative to other areas. In the early times, such nature of the industry puts under pressure the expertise of risk management to benefit from using stress test analysis by which arousing curiosity of the present and the future. The more the financial industry become dynamic, the more sensitivity and scenarios analysis under stress test becomes demanding strategic act of the industry particularly the risk management expertise in the section.

Table 9 Benefits of stress testing to the commercial banks

Benefit of stress testing to banks	Frequency	Percentage
Strategic plan	2	4.44
Strategic plan & better performance	8	17.78
Strategic plan, better performance & increase regulatory compliance	11	24.44
Strategic plan, better performance, increase regulatory compliance & improve internal control	17	37.78
Strategic plan, better performance, increase regulatory compliance, improve internal control & improve risk impact	7	15.56
Total	45	

Source SPSS output from survey data 2017

Therefore, in this section analysis and discussion made to assess how much the commercial banks are benefiting in using stress test using certain critical streaming area of the banks. As it is indicated above out of total 45 respondents, 17 of them highlighted improve strategic plan, better business performance, increase regulatory compliance and improve internal control as the benefits that theirs banks has capitalized in using stress

test, but the other 11 respondents were highlighted internal control at has been capitalized in using stress test.

From the remaining respondents two of them only indicated improving strategic performance as singular benefits captured in using stress test while eight of the respondents added better business performance. The remaining seven respondents indicated all the above including improving risk impact likelihood that has been capitalized in their banks in employing stress test as a risk mitigation methods.

Form the discussion the conclusion that has drown were, commercial banks were unable to capitalized the stress test benefits fully and implies that effectiveness is an issue in the commercial banks.

4.11 Overall stress test trends of the banks

The trend of stress test stated in certain forms in the organizations are determinant factors, including methodological uniqueness, effectiveness, availability of stress tests guideline, future-oriented, make use of decision making, updating of models, role in forward looking of risks, informing the setting of risk tolerance and predicting the possible risk happenings were thematic identified. The analysis was made as to measure the trend.

The total respondents 45 of them provided the answers and were zero missing values and indicated below in the table as percentiles and value of the response. The analysis made based under a scaling measurement indicated below in the tables" caption.

The standardized measure were given based on variables listed in the table with a scaling measure were provided for the respondents. And in the table statistics computed were means, media and percentiles, as each interpreted as to measure the commercial banks trends of stress test.

Based on the data indicated below in the table, the respondents showed neutrality regarding the uniqueness of stress test as a risk mitigation methods, however, the respondents agreed to its effectiveness. The respondents also showed neutrality to making use of stress test result in decision making, and also its standard guideline availability by the NBE. Respondents also agreed that stress testing had an important role in assessment of forward-looking of risks, and also agreed that it would inform the setting of risk tolerance. Lastly the mean indicated in the data showed neutrality that stress test prediction of all the dangers that the banks faced.

Table 10 stress testing trend.

stress test trends of commercial banks

Variables	Mean	Median	Percentile 99	Total N
stress testing is unique to your bank's risk management instrument	3	3	5	45
current risk mgt tools are effective in mitigating risks?	4	4	5	45
the banks' mgt make use of the stress test result for decision making?	3	4	5	45
the risk management tools that the bank is using are future oriented/forward-looking	4	4	5	45
there is excellent NBE guidelines for stress testing	3	3	5	45
striving to upgrade their existing stress testing framework and model	3	3	5	45
stress testing can play an important role in providing forward-looking assessment of risk	4	4	5	45
stress test can inform the setting of a bank's risk tolerance	4	4	5	45
stress test can predict all the dangers that a given institution is going to face	3	3	5	45

1= strongly disagree

2= disagree

3= neutral

4= agree

5= strongly agree

Source SPSS output from survey data 2017

As to summarize the analysis made, the respondents showed neutrality on uniqueness of methods, use of result in making decision, availability guideline, updating and upgrading of model and stress test predict all the danger the bank face. And the respondents agreed on stress test effectiveness, future oriented, inform banks‟ risk tolerance. From the summary discussed above, commercial banks have limited application of stress test with no availability of standard guidelines and make use of stress test result for decision making found to be unaware or inapplicable. Updating and upgrading of stress test model had not been the concern of commercial banks.

4.12Stress test procedure and practice

The stress testing procedure and practice is critical factor for its effectiveness in mitigating risks, and in order to develop stress testing tool organizations need to update and upgrade every time gap using clear easier procedure which is flexible for change. With static and complex procedures, the stress test developed might become dysfunctional. As in considering the procedures, stress test also can be affected in its

practicality, the easier steps, clarity and flexibility, and contextuality the easier and effective of its practicality.

In these sections, the standardized checklist used to measure the stress test procedure and practice of commercial banks with the perspective of measure stress test effectiveness. As shown below using five scaling standard the data had gathered from 45 subjects with zero missing values. The analysis made considering the max and minimum scale response. With especial analysis made at neutral responses.

From the total subject 2 and 4 agreed and strongly agreed respectively that bank has policies and procedures governing stress test program and documentation whereas 28 and one of the subject disagree/ strongly disagree about the availability. The remaining 10 respondents remain neutral about the availability of written policies and procedures. Regarding the stress test type of data, infrastructure, MIS and expertise availability 17 and 9 strongly disagree and disagree, additionally 17 subjects remain neutral. On market and accounting data utilizations in stress test analysis 10 subjects found to be neutral whereas 25 subjects agreed on its utilizations in usage for stress test analysis.

Subjects also agreed on usage of historical data in conducting stress test to predict the severity of plausible shocks-historical data (total outstanding loan, NPLs, top borrowers, interest and exchange rate..) and indicated for about 29 and 7 agree and strongly agree respectively.

In the sample, commercial banks as data indicated by 29 neutral for determining the frequency according to the nature of risk and types of test whereas 5 and 7 respondents strongly disagreed and disagreed on determining the frequency of stress test based on the nature of risk and types of test.

The senior management involvement in the process of designing stress test program checked and 22 subjects were remained neutral whereas 9 and 12 subjects were strongly disagreed and disagreed about their involvement. Subject asked if the banks used the latest update of economic, political, geographical and global perspective in stress test procedures and practice and 25 subjects disagreed and 9 subjects remanded neutral.

From the data analysis indicated above, commercial banks do not have policies and procedures, infrastructure, utilizations of expertise and latest inputs in developing and implanting stress testing.

From the discussion made on stress test practices and procedures the conclusion was that, the commercial banks found very dependent only on internal information particularly

historical data and marketing and financial report findings. Commercial banks also had found poor in using infrastructure and latest data on macro environment in stress test procedure and practice. From the discussion indicated above, commercial banks also found poor in utilizing management expertise in the development and design of stress test programs.

Table 11 stress testing procedure and practice

Variables	Frequency					
	strongly disagree	disagree	neutral	agree	strongly agree	Total
the bank has written policies and procedures governing the stress testing program and document the process of stress testing analysis	1	28	10	2	4	45
there is infrastructure sufficiency in type of data, MIS and expertise regarding in stress test procedure and practice.	17	9	17	2	0	45
our bank has used both accounting and marketing data source to conduct stress test, i.e. financial report, market SWOT analysis	1	6	10	25	3	45
historical data is used in conducting stress test to predict the severity of plausible shocks-historical data (total outstanding loan, NPLs, top borrowers, interest and exchange rate..)	1	1	7	29	7	45
the frequency of stress test can be determined in accordance with the nature of risk and the type of test performed	5	7	29	4	0	45
the senior mgt actively involved in the process of designing the stress test program.	9	12	22	2	0	45
the bank takes into consideration the latest development from the economic, political, geographical and global perspective.	2	25	9	2	4	45

Source SPSS output from survey data 2017

4.13Aspects incorporated in stress test internal procedure/documents

The nature and type of risk determined the aspects/features to be incorporated in stress test and in turn features considered/incorporated in the stress test affect its effectiveness. Therefore, to increase the effectiveness of stress test an organization need to incorporate

feature that needed to be incorporated which identified as common features and also create possible features that can benefit or maximize stress testing effectiveness.
The commercial banks through the sample subject were measured based on the pre-determined common features of stress test i.e. detailed description of stress testing methodology, testing model, testing frequency, testing assumption used in scenario, reviewing risk tolerance limit, contingency planning as basic common features, however, there are features added in certain circumstance based on the nature and type of risk.

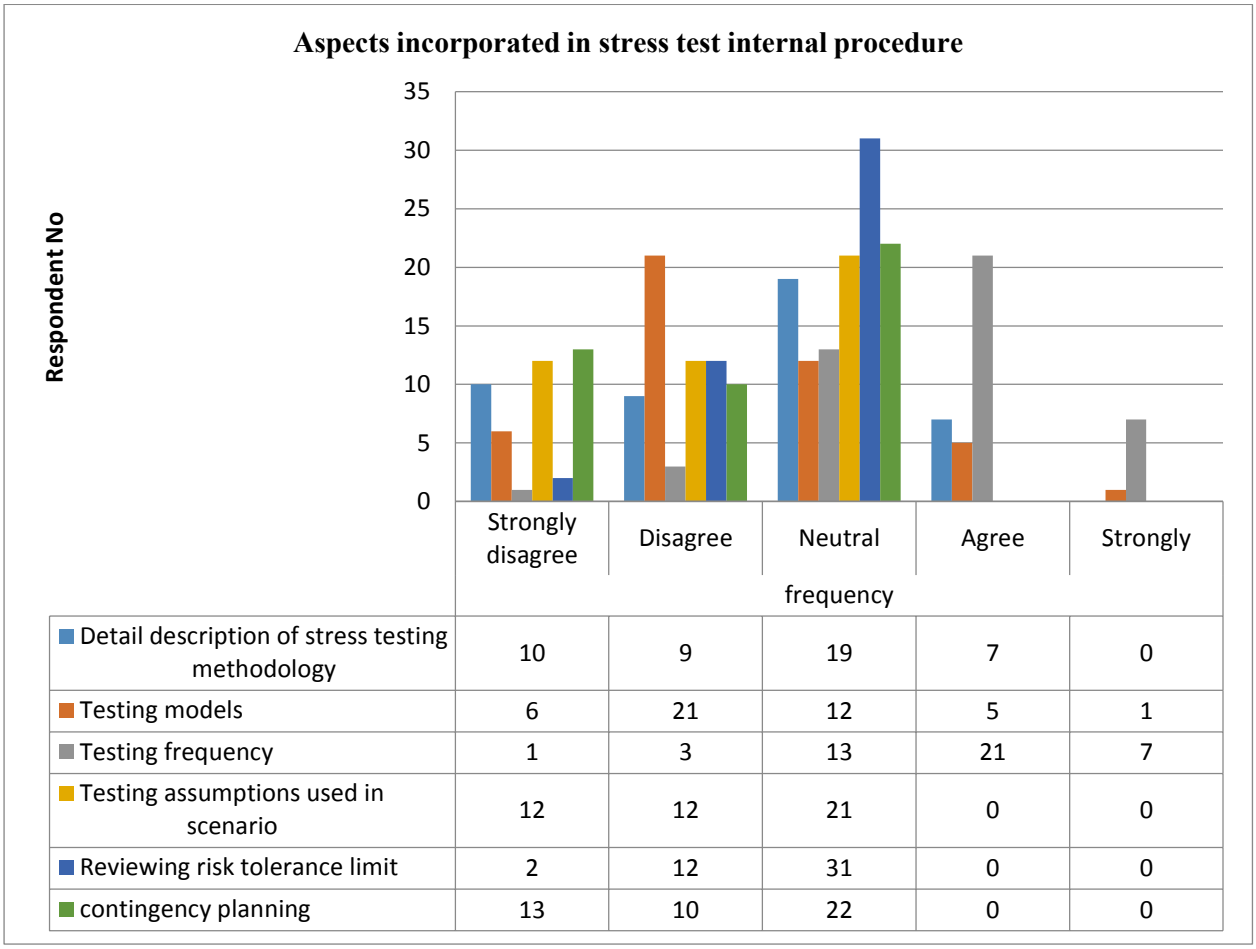
As the checklist report indicated detailed description of stress test methodology as feature of stress test 10and 9 subjects strongly disagreed and disagreed respectively whereas 19 subjects remain neutral. Out of 45 subjects, the remaining 7 subjects agreed on the availability of detailed description of stress testing methodology.

Testing models as feature of stress test, 5 and 1 out of 45 subjects agreed and strongly agreed respectively that it was incorporated whereas 12 respondents remained neutral. The remaining 21 and 6 subjects disagreed and strongly disagreed on the testing models feature incorporation on stress testing. The other model of stress testing was testing frequency feature, and 21 and 7 subjects had agreed and strongly agreed on it availability respectively whereas 13 respondents remained neutral. The remaining 4 subjects disagreed that testing frequency incorporated as feature of stress testing in the commercial banks.

Testing assumption used in scenario were feature that the respondents had asked if it were incorporated as feature of stress testing, and out of total 45 respondents 21 remanded neutral whereas 12 and 12 respondents disagreed and strongly disagreed respectively on its availability as the feature of stress testing in the commercial banks. Reviewing risk tolerance limit were also common feature to incorporated in stress testing of commercial banks, and 31 respondents remained neutral whereas 12 and 2 respondents disagreed and strongly disagreed respectively as the reviewing of risk tolerance limit as the feature of stress testing to be incorporated in the commercial banks.
Contingency plan as stress testing feature in the sampled commercial banks through subjects if it were incorporated, and 22 subjects remained neutral whereas, 13 and 10 subjects strongly disagreed and agreed that contingency plan as feature of stress testing in commercial banks.

Based on the analysis and the statistics indicated above, the availability of detailed description of stress test methodology, testing assumption, reviewing of risk tolerance limit, testing model and contingency plan as stress testing feature was not extensively available as feature whereas testing frequency indicated as it were featured in the stress testing of commercial banks.

Figure 5 Aspects incorporated in stress test internal procedure



	Strongly disagree	Disagree	Neutral	Agree	Strongly
Detail description of stress testing methodology	10	9	19	7	0
Testing models	6	21	12	5	1
Testing frequency	1	3	13	21	7
Testing assumptions used in scenario	12	12	21	0	0
Reviewing risk tolerance limit	2	12	31	0	0
contingency planning	13	10	22	0	0

Source SPSS output from survey data 2017

4.14 Scenario selection procedures and practice

The scenario selection procedure and practice in stress test is a determinant factor for its effectiveness. The procures and practice that the organization takes in scenario selection needed to be revised as to measure, update and upgrade in keeping stress test scenarios up-to-date and employing an effective stress testing.

In this checklist, commercial banks were evaluated how scenario selection procedures and practice had followed and practiced and considered elements, procedure and practice in commercial banks. The checklist had considered hypothetical and historical scenario analysis, scenario relevancy and reliability, considering more than one scenario, employing of Sensitivity analysis, how sensitivity and scenario analysis suited in revealing the portfolio, usage of reverse stress testing, employing other methods, and lastly involvement and utilizations of managements in scenario and sensitivity selection decision making process.

As in the case on the assessment of commercial banks of Ethiopia on the scenario selection procedures and practice, for usage of hypothetical scenario over historical scenario for flexibility, relevancy and forward looking subject 21 and 4 strongly disagreed and disagreed respectively whereas 7subejects remained neutral. The remaining 8 subjects agreed on the usage of hypothetical scenario in the commercial banks. The statistics indicated that very limited commercial banks were employing hypothetical scenario over historical scenario.

The subject remained natural on the realistic, reliable and relevancy of scenario selected in the commercial banks were 31 whereas only 9 subjects agreed on its realistic, reliability and relevancy. The remaining subject of 5 strongly disagreed. Neutrality on these elements of checklist implied as not transparent, or unaware of the situation and in turn being unaware in such critical issue from the nature of the subject could in turn affect the effectiveness of scenario selection and relied on the transparency might in turn leaded to disagreement. In both cases of assumptions, the scenario selection procedure and practice in such a regard had affected its effectiveness.

The subjects were also asked if commercial banks considered more than one scenario in stress testing. Out 45 subjects 32 of them remained neutral whereas 8 and 2 subjects agreed and strongly agreed respectively about the consideration made GDP and NPLs or shift NPLs. The remaining 3 subjects disagreed on considering more than one scenario in stress testing of the commercial banks. The other measures of practice made were sensitivity analysis and 23subjects still remained neutral whereas 6 and 6 subjects only agreed and strongly agreed. The remaining 10 subjects disagreed on its practice of scenario selection by commercial banks. As to made conclusion in both checklist, there were commercial banks found to consider more than on scenario and also practice

sensitivity analysis however, more than 90% of subject commercial banks had not considered more than one scenario and were not conducting sensitivity analysis in scenario selection.

The subjects were also asked if both sensitivity and scenario analysis were suited in revealing the vulnerability of portfolio and on its technical nature 30 and 9 subjects were agreed and strongly agreed respectively. The remaining 6 subjects remained neutral. As it were indicated more than 80% subjects agreed on employing both sensitivity and scenario analysis for an effective stress test. The subjects were also asked if the commercial banks employing reverse stress testing and 16 subjects remained neutral whereas 16 others subject disagreed. The remaining 8 and 5 subjects agreed and strongly agreed that commercial banks employing reverse stress test.

The subjects were also scaled if the commercial banks were used other testing in scenario selection and 23 subjects were disagreed whereas 11 subjects remained neutral. The remanding 8 and 6 subjects agreed and strongly agreed respectively. Subjects were also asked to scale if advanced management and personnel involvement in sensitivity and scenario selection and decision making used as procedure and practice. Out of 45 total subjects 20 remained neutral whereas 15 subjects disagreed on it. The remaining 2 and 8 subjects agreed and strongly agreed respectively that commercial banks had used advanced management and personnel involvement.

Based on the data analysis and discussion on scenario selection procedures and practice of commercial banks, neutrality of subjects leads to ineffectiveness on certain scenario selection procedures and practice. Most the commercial banks chose historical scenario over the hypothetical scenario analysis that is backward-looking historical information indicated benign conditions so that this did not recognize the possibility of severe shocks nor the build-up of vulnerabilities with in the banks, involvement of management, consideration of more than one scenario, reverse stress testing, using other testing methodology, were found not widely practiced and taken as procedures in scenario analysis in the commercial banks.

Table 12 Scenario selection procedures and practice

Variables	Frequency					
	strongly disagree	disagree	neutral	agree	strongly agree	Total
Hypothetical Scenario analysis is used over historical scenario analysis due to its relevancy, flexibility and forward looking.	21	4	7	2	6	45
To select the appropriate scenario it should be relevant, realistic, and reliable.	1	4	31	9	0	45
We consider more than one scenario in stress testing. (for example, 5%, 10%, 15%... decrease in GDP, 25%, 50%, 100%... increase in NPLs or a shift Npls category)	0	3	32	8	2	45
Sensitivity analysis is used more because it is very simple to apply	0	10	23	6	6	45
Both scenario and sensitivity analysis are suited for revealing the vulnerability of portfolio	0	0	6	30	9	45
Depending on the circumstances, the bank is used a reverse stress test	0	16	16	8	5	45
The bank may also use other testing methodologies and their combinations, considering the usefulness; it's transparent, clearly regulated, proportionate and objective	0	23	11	8	6	45
Advanced management and personnel involvement in sensitivity and scenario selection and decision making	0	15	20	2	8	45

Source SPSS output from survey data 2017

4.15 Determinants of stress test practice in risk management

Determinant factors for effectiveness of stress test practice in risk management needed to be identified by which to maximize the advantages and minimizing the disadvantages of each. Factors identified under such thematic were the availability of updated stress test methodologies, principles and guidelines, Availability of appropriate disclosure method within the existing reporting mechanism, Availability of Models and Modeling Expertise, the bank regularly maintains and update its stress testing framework, the strong correlations between risk types and factors influencing them, Training and development in the area of stress test.

To measure the stress test practice based on the above determinants 45subjects were asked to scale and with zero missing values all data were filled by them. Out of 45

subjects 27 disagreed on the availability of updated stress test methodologies whereas 7 and 11 subjects agreed and strongly agreed on the availability respectively. From the total respondents 20 of them disagreed on the availability of appropriate disclosure methods within the existing reporting mechanism, whereas 8 and 10 subjects agreed and strongly agreed to its availability. The remaining 7 subjects remained neutral. On the availability of model and modeling expertise, 18 and 9 subjects disagreed and neutral respectively, whereas 8 and 10 subjects showed agreement and strong agreement respectively on it. Respondents asked if the banks were regularly update and maintain its stress testing framework, 16 and 12 subjects strongly disagreed and disagreed respectively whereas 6 and 6 subjects agreed and strongly agreed respectively. The remanding 5 subjects remained neutral. On the case of correlation between risk type and factors if there were strong correlation in between 29 subjects remained neutral whereas 9 and 6 subjects agreed and strongly agreed respectively.

Respondents were also asked to scale regarding the availability of training and development in the area of stress test, 19 and1 subjects disagreed and strongly disagreed respectively while 6 subjects remained neutral. The remaining 12 and 7 subjects agreed and strongly agreed on the availability of training and development on stress testing respectively. Regarding the independent review of stress test by external and internal auditors on its effectiveness, 16 and 22 subjects were neutral and disagreed respectively, while the remaining 3 and 4 respondents agreed and strongly agreed respectively on the conduct of independent audit review.

From the data analysis and discussion, the conclusion made at the determinants of stress test practice were that, the commercial banks had difficulty on the availability of updated stress test methodologies, appropriate disclosure methods, models and modeling expertise, training and development, an independent audited review, and an updated stress test framework, which in turn affected the effectiveness of stress test practice and procedure.

Table 13 Determinants of stress test practice in risk management

Variables	Frequency					
	strongly disagree	disagree	neutral	agree	strongly agree	Total
The availability of updated stress test methodologies, principles and guidelines	0	27	5	7	11	45
Availability of appropriate disclosure method within the existing reporting mechanism	0	20	7	8	10	45
Availability of Models and Modeling Expertise	0	18	9	8	10	45
The bank regularly maintains and update its stress testing framework i.e. stress test programs and major individual components	16	12	5	6	6	45
The strong correlations between risk types and factors influencing them	0	1	29	9	6	45
Training and development in the area of stress test	1	19	6	12	7	45
Independent review has been conducted by external and internal auditors the effectiveness of stress test in mitigating the bank's risk	0	22	16	3	4	45

Source SPSS output from survey data 2017

4.16 Variables considered in commercial banks in designing and conducting stress test

Variables considered in conducting and designing stress test can impact its effectiveness. In this section of thematic, the commercial banks were measured by the variables identified as standard that have to be included in the design and conduct of stress test.

As indicated in the data below GDP scaled by 18 and 4 subjects as agreed and strongly agreed respectively whereas, 10 subjects disagreed as it was considered in the design and conduct of stress test. The remaining subjects of 12 remained neutral. Inflation rate were also identified as a factor to be considered and subjects were asked to scale, out of 45 subjects 28 and 6 subjects agreed and strongly agreed whereas 4 subjects disagreed. The remaining 7 subjects remained neutral about the consideration made in the stress test. The other variable identified and asked subjects to scale were foreign exchange rate and 25 and 9 agreed and strongly agreed respectively whereas 7 subjects remained neutral. The remaining 4 subjects disagreed on the consideration made for stress test. Unemployment was listed as one of the variable to be considered in stress tests design and conduct and as

it is indicated, 14 and 2 subjects agreed and strongly agreed respectively whereas 17subjects remained neutral. The remaining 2 and 10 subjects were strongly disagreed and disagreed respectively about the consideration made on unemployment rate in the design and conduct of stress test.

Country‟s instability (political aspect) were listed as the variable to be considered in the design and conduct of stress testing and out of the total subject 21 and 5 subjects agreed and strongly agreed respectively, while 11subjects remained neutral. The remaining 8 subjects strongly disagree as to be considered as variable. Contagion effect were also stated under basic variables to be considered and 25 and 4 subjects agreed and strongly agreed that consideration made for design and conduct of stress test whereas 7 subjects disagreed. The remaining 9 respondents remained neutral on the variable of contagion effects in the design and conduct of stress test where all the total subjects responded.

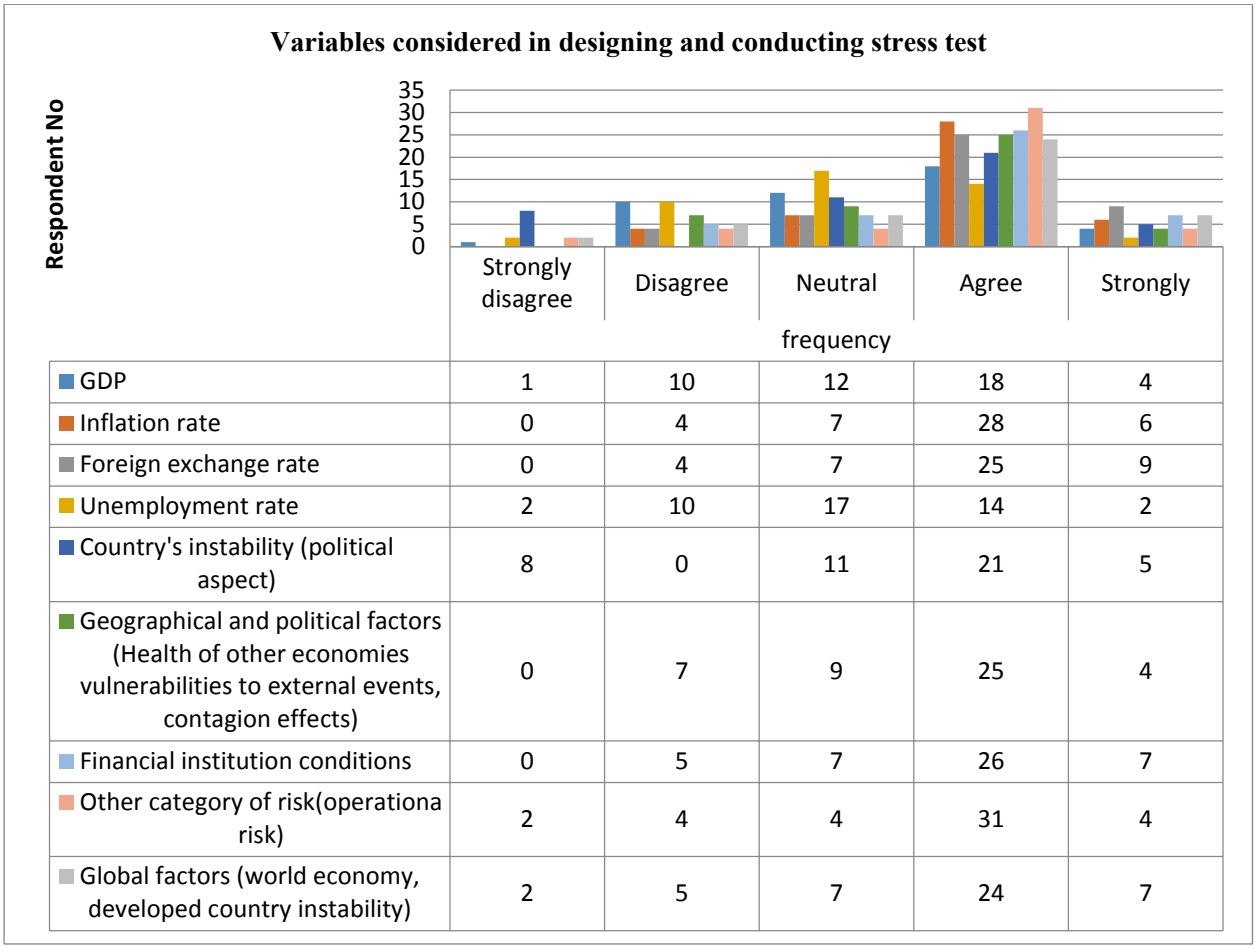
The financial institution conditions listed as the basic variable under the consideration in the design and conduct of stress test, and out of the total subject 26 and 7 agreed and strongly agreed respectively whereas 5 subjects disagreed. The remaining subjects of 7 remained neutral for about the consideration of financial institution condition in the design and conduct of stress test. Operation risk and strategic acquisitions between banks grouped under other category of risk which has been listed for scaling, and from the total respondents 31 and 4 subjects agreed and strongly agreed respectively whereas 4 and 2 respondents disagreed and strongly disagreed respectively. The remaining 4 subjects remained neutral about the consideration made as variable in the design and conduct of stress test.

Global factors were also listed for scaling under the basic variable in the design and conduct of stress test by including the world economy and instability of developed country, and out of the total subject 24 and 7 subjects agreed and strongly agreed respectively whereas 2 and 5 strongly disagreed and disagreed respectively. The remaining 7 subjects remained neutral about the consideration of global economy.

As to summarize based on the analysis and discussion made regarding the variables considered in the design and conduct of stress test, commercial banks considered global economy, financial institution condition, inflation, foreign exchange rate, GDP, other category of risk and contagion effect and political instability in a considerable level. However, commercial banks found not considerate in a greater extent unemployment rate

as a risk factor indicator in the design and conduct of stress test, from this conclusion the implication taken were commercial banks found poor in the scenario analysis.

Table 14 Variables considered in designing and conducting stress test



	Strongly disagree	Disagree	Neutral	Agree	Strongly
GDP	1	10	12	18	4
Inflation rate	0	4	7	28	6
Foreign exchange rate	0	4	7	25	9
Unemployment rate	2	10	17	14	2
Country's instability (political aspect)	8	0	11	21	5
Geographical and political factors (Health of other economies vulnerabilities to external events, contagion effects)	0	7	9	25	4
Financial institution conditions	0	5	7	26	7
Other category of risk(operationa risk)	2	4	4	31	4
Global factors (world economy, developed country instability)	2	5	7	24	7

Source SPSS output from survey data 2017

4.17 Credit risk stress testing application

Credit risk stress test application has been evaluated as it proved to be a widely operating area of commercial banks. Therefore, in the section based on the sensitivity and scenario analysis different variables, practice and conditions were listed and scaled by the subject with zero level of missing response and mainly designed to measure how commercial banks testing credit risks.

For the application of credit risk testing regarding the increase in the total NPLs the subject was asked if the banks employing scenario and sensitivity analysis, and out of the total subject 27 and 13 agreed and strongly agreed respectively that banks employing both methods, whereas 5 subjects remained neutral. the shift or movement in NPLs category (substandard, doubtful and loss) can be tested by sensitivity and scenario analysis were

also listed for scaling and 32 and 11 subjects agreed and strongly agreed respectively whereas the remaining subjects 2 subject‟s neutral. In testing credit risk, the percentage of restructured loan become NPLs were raised to be scaled by the subjects and out of total subject 29 and 9 subjects agreed and strongly agreed respectively whereas, 9 out of total subject remained neutral. The increase in NPLs in particular one or more sector can be tested by sensitivity and scenario analysis were also listed for scaling and out of the total subject 24 and 7 of subject agreed and strongly agreed respectively whereas 6 subjects disagreed. The remaining 7 subjects remained neutral.

The increase in NPLs due to default of top 10 large borrowers can be tested by sensitivity and scenario analysis were listed, if banks would practice and out of the total subject 23 and 10 subjects agreed and strongly agreed respectively, while 8 subjects remained neutral. The remaining 3 subjects disagreed on the both analysis made for the particular case in the commercial bank.

Migration from loan category started from special mention up to loss category listed for scaling if sensitivity and scenario analysis have conducted by the subject commercial banks, and 27 and 9 agreed and strongly agreed respectively, while the remaining 9 subject remained neutral. The last particular measure for scaling were, the default in specific sector/industry/region listed for scaling if banks were conducting sensitivity and scenario analysis and 21 and 7 subject agreed and strongly agreed respectively while 7 subjects were disagreed. The remaining 10 subjects remained neutral.

To summarized based on the analysis and discussion regarding credit risk stress testing trend on sensitivity and scenario analysis, the commercial banks practice and trend on stress test scenario and sensitivity analysis on the increase in total NPLs, on the shift or movement on NPLs categories, on the restructured loan of NPLs, increase in one or more particular sector NPLs, increase in NPLs by the default of top 10 large borrowers, migration from loan category and default in a specific sector/region/industry were indicated with frequent and extensive application of stress testing of scenario and sensitivity analysis.

From the summary stated, the conclusion drawn that sensitivity and scenario analysis is an effective application of stress test on the credit risk factors of commercial banks.

Table 15 Credit risk stress testing application

Variables	Frequency					
	strongly disagree	Disagree	neutral	agree	strongly agree	Total
In testing credit risk, the increase in total NPLs can be tested by sensitivity and scenario analysis	0	0	5	27	13	45
In testing credit risk, the shift or movement in NPLs category (substandard, doubtful and loss) can be tested by sensitivity and scenario analysis	0	0	2	32	11	45
In testing credit risk, the percentage of restructured loan become NPLs can be tested	1	0	9	26	9	45
Increase in NPLs in particular one or more sectors can be tested by sensitivity and scenario analysis	0	6	8	24	7	45
Increase in NPLs due to default of top 10 large borrowers can be tested by sensitivity and scenario analysis	0	3	8	23	10	44
Migration from loan category/classification(i.e from special mention to NPLs, from substandard to doubtful, from doubtful to loss) can be tested by sensitivity and scenario analysis	0	0	9	27	9	45
Defaults in a specific sectors/industry/region	0	7	10	21	7	45

Source SPSS output from survey data 2017

4.18 Other risk categories considered in stress test sensitivity/scenario analysis

The other risk categories considered in stress test of sensitivity/scenario analysis were foreign exchange, liquidity risk sudden withdrawals of large amount, liquidity risk unexpected utilizations of credit risk, and major operational risk. The above identified risk categories are also considerable frequency of happening in the commercial banks of Ethiopia next to credit risks. Using all this risk categories of sensitivity and scenario analysis of commercial bank"s practice and procedure effectiveness were measured.

In foreign exchange risk of adverse movement in exchange rate were listed to be scaled, and out total subject 31 and 7 subject agreed and strongly agreed respectively on that sensitivity and scenario analysis made to measure the impact of nets open position on major currencies, impact of major customer, with substantial withdrawal of foreign exchange positions are being tested. The remaining 7 subjects remained neutral.

Respondents were also given list to scale if the banks made sensitivity and scenario analysis for liquidity risk of sudden withdrawal of large amount of deposition by their relative commercial banks and out of the total subject 31 and 9 subjects agreed and strongly disagreed respectively whereas, the remaining 5 subjects remained neutral. And the other category of risk list for scaling were, liquidity risk of unexpected utilizations of credit line/facilities were being tested and out of total subject 20 and 12 subject agreed and strongly agreed that sensitivity and/or scenario analysis made in their relative commercial banks while 4 subjects disagreed. And the remaining 9 subjects remained neutral.

The other risk category identified to be scaled by the respondents were, if their relative commercial banks conduct an effective sensitivity and/or scenario analysis on major operational risk and were sufficiently and adequately stressed and analyzed their impact on capital considering business environment internal control factor as well as macroeconomic variable. Out the total subject 15 and 5 agreed and strongly agreed respectively whereas 12 subjects disagreed. The remaining 13 subjects remained neutral regarding scenario and sensitivity analysis made in major operational risks.

As to summarized from the data analysis and discussion sampled commercial banks of Ethiopia conduct scenario and or sensitivity analysis extensively on liquidity and foreign exchange risk categories and whereas conduct of analysis indicated limited on the major operation risk categories. Conclusion drawn from the summary findings were commercial banks conducting sensitivity and or scenario analysis on foreign and liquidity risk categories in a considerable extent and conduct the analysis on major operational risks in inconsiderable extent.

Table 16 other risk category considered in stress testing sensitivity/ scenario analysis

Variables	Frequency					
	strongly disagree	disagree	neutral	agree	strongly agree	Total
In foreign exchange risk: adverse movement in exchange rate:i.e impact of net open position on major currencies, impact of major customers with substantial withdrawal of foreign exchange position are being tested	0	0	7	31	7	45
In liquidity risk: sudden withdrawal of large amount of deposits are being tested by using sensitivity and scenario analysis	0	0	5	31	9	45
In stress test liquidity risk, the unexpected utilization of credit line/facilities are being tested	0	4	9	20	12	45
Major operational risks are sufficiently and adequately stressed and analyzed their impact on capital considering business environment and internal control factors as well as macroeconomic variables	0	12	13	15	5	45

Source SPSS output from survey data 2017

4.19 Challenges of commercial banks in implanting effective stress test

Implementing an effective stress test demands an organization/financial institution to conduct timely analysis of internal and external audit by which to identify and tackle the key challenges. The perceived challenges that could commercial banks effectiveness of stress test identified on the checklist included were lack of qualified staff in the department, lack of management support in designing stress test methodology, scenario selection, the complexity of stress testing, lack of guideline of stress test, lack of sufficient data in macroeconomic variables, and poor platform on result review and communication.

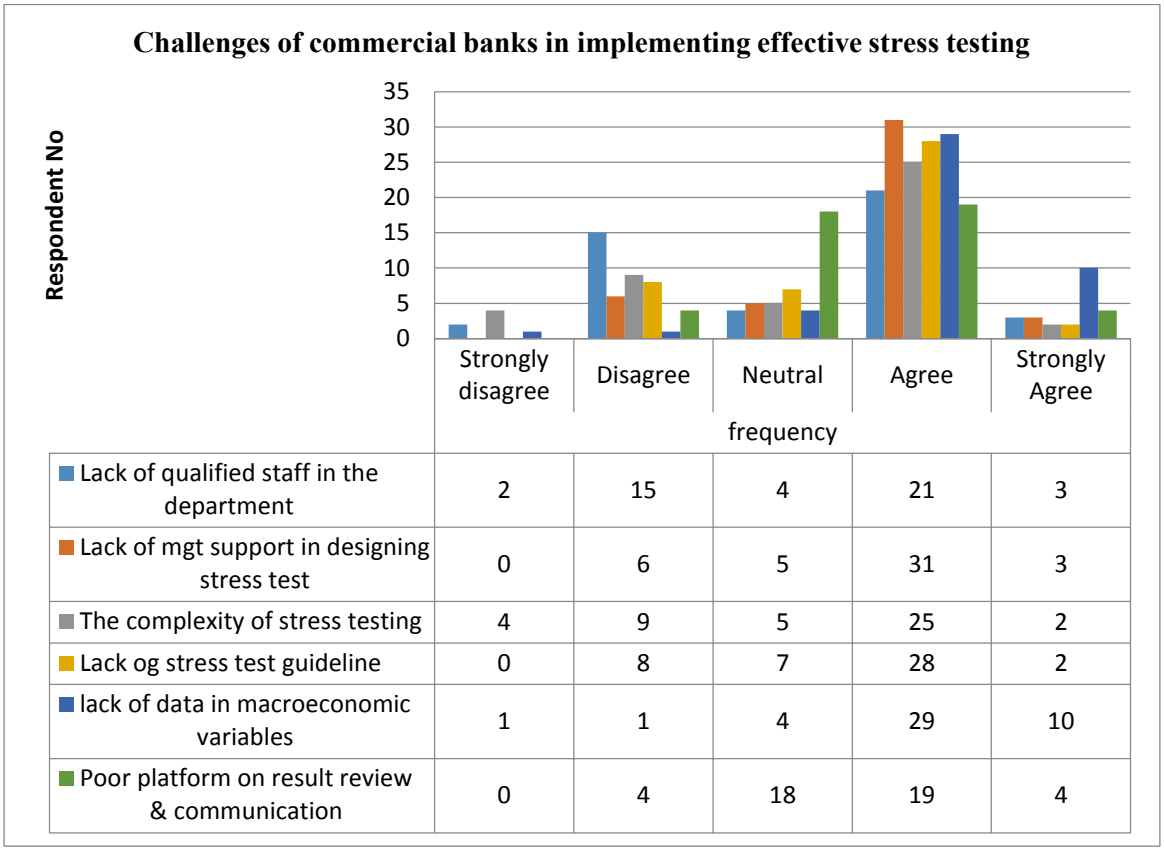
Regarding lack of qualified staff in the department 21and 3 subjects agreed and strongly agreed whereas 15 and 2 subjects disagreed and strongly disagreed. The remaining 4 subjects remained neutral. Out of total subject 31 and 3 subjects agreed and strongly agreed respectively about the existing challenge or lack of management support in designing stress test methodology and scenario selection, whereas 6 subjects disagreed on the existence of challenge. The remaining 5 subjects remained neutral. Subjects were provided with list to scale if the stress testing were complicated in implantation and

design and 25 and 2 subjects agreed and strongly agreed respectively as its‟ complexity appeared as a challenge whereas 9and 4 subjects disagreed and strongly disagreed as its complexity appeared to be as a challenge.

The respondents were also provided with list to scale about the lack of guidelines of stress test if it appeared as challenge in their respective banks‟ and 28 and 2 subjects agreed and strongly agreed respectively whereas 8 subjects disagreed as it to be considered as a challenge. The remaining 7 subjects remained neutral. Lastly respondents provided with a checklist to scale if the banks had poor platform on result review and communication and out of the total subject19 and 4 agreed and strongly agreed respectively whereas 18 subjects remained neutral on its existence as challenge. The remaining 4 subjects disagreed that commercial banks had poor platform on result review and communication.

From the analysis indicated and discussion made above, summary on the challenge of commercial banks on effective implementation of stress test identified as lack of qualified staff in the department, lack of management support in designing stress test methodology, scenario selection, the complexity of stress testing in design and implementation, lack of guideline of stress test, lack of sufficient data in macroeconomics variables and poor platform on result review and communication were found challenge which in turn affect stress test effectiveness as a tool to mitigating risks in the institution.

Figure 6 Challenges of commercial banks in implanting effective stress test



	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
Lack of qualified staff in the department	2	15	4	21	3
Lack of mgt support in designing stress test	0	6	5	31	3
The complexity of stress testing	4	9	5	25	2
Lack og stress test guideline	0	8	7	28	2
lack of data in macroeconomic variables	1	1	4	29	10
Poor platform on result review & communication	0	4	18	19	4

Source SPSS output from survey data 2017

4.20 Analysis of open ended question

An open-ended question was developed as to assess the effectiveness of the commercial banks stress test as risk mitigation methods. Open-ended questions are useful when the researcher want to see how respondents discuss an issue or discover what are in their minds without imposing an agenda Moreover, open ended questioner permits an unlimited number of possible answers and unanticipated finding can be discovered. It gives an opportunity to the respondents to answer in detail and can clarify their responses.

In this open-ended question 10 subject from all 10 sampled commercial banks were participated and out the subject 5 respondents were in managerial position in the risk department and the rest 5 subjects were form the expert levels in the risk department. Form the total subject 6 of them serve in the risk department for more than 10 years and the remanding 4 subjects serve in the risk department ranged from 4-10 years, 8 the respondents were male and the remanding 2 respondents were female.

Although there was no a comprehensive overview of responses for the questionnaire from the respondents, the researcher tried to see and analyses what the majorities of the respondents agreed on the open- ended questions. The researcher designed and implement semi-structured questions by which basic thematic were measured regarding commercial banks practice, and trends on stress testing. Using an open-ended question, the validity and reliability of methods together with questioner had measured through triangulation of consistency and inconsistency.

Analysis and discussion

The first open ended question asked the respondent regarding the current risk mitigation strategy intervention and its success and also the role of stress test as a risk management tool.

Regarding the current risk mitigation strategic intervention, respondents stated in a more similar fashion that commercial banks concentrated on collateral and guarantee, risk transfer and set limit as to mitigate credit, liquidity and interest risks. The respondents were also indicated that commercial banks employing risk avoidance on most of foreign exchange and operation risks.

Interviewee were also implied that the current risk mitigation methods in the commercial banks might seem successful in national context however, in the dynamic and paradoxical financial industry and especially sensitive to the global market, the existing models, trends, and practice of risk mitigation needed to be updated, upgraded and globally contextualized, since Ethiopia‟s economy is marching to the global market to which financial institution will have first-hand exposure.

The expertise and mangers in the risk department indicated that stress testing underutilized as risk mitigation in the commercial banks. Two of them were argued that stress test as a method doesn‟t needed to be employed in the Ethiopian commercial banks and had rationalized that stress test only needed to be under practice in the serious financial crisis. However, the remaining eight subjects agreed on the need for stress test as risk mitigation and indicated that as it was practiced widely on credit and liquidity risk based on historical stress test analysis. And indicated, both sensitivity and scenario needed be applied as to mitigate certain risk factors including interest risk, foreign risk, and operation risks using both hypothetical and historical analysis.

The second open ended question asked to the interviewee, do you think that banks should employee stress test as one means of risk mitigation. How important is for your bank to use stress testing as one of risk management strategy?

In regard to question two all interviewee answered yes; most of the interviewee believe that banks should use the stress test as a tool in risk management activities in all area of risk category and banks do not concentrate on testing credit, but practically they interviewee that they are not used as tool in all respect. With regard to stress test importance, the interviewee answered that it helps banks to evaluate their shock observing capacity under different adverse outcomes and based on the results banks will take risk measures to reduce loss exposure from such adverse changes. It also benefits banks to strengthen their capital so as to absorb unforeseen events.

The third open ended question asked to the subjects, what are the main stress test types used? How they are integrated with the bank‟s risk management process? and also the availability of standard guideline. The following responses were given by most of the respondent:

The subjects fully indicated that commercial banks employing sensitivity analysis on credit, liquidity, foreign exchange and interest risk areas. And three subjects were also indicated that scenario analyses employed in foreign exchange, credit and liquidity risks with a limited extent. Based on the result of the test, commensurate actions usually being made by the concerned organ as stipulated in the business continuity plan of the bank. Usually as it was indicated by the subject set limit, risk transfer, collateral and guarantee were aside as mitigating risks identified and based the result taken from the analysis. In conducting extensively historical scenario analysis considered as a base and hypothetical scenario analysis in their bank context.

Regarding the availability of detailed description stress test standard guideline, out of total interviewee eight of them indicated that the availability of stress test standard guideline in national and institutional level. However, only two commercial banks have draft guideline but which is not yet practically utilize the guideline in institutional level.

The fourth open ended question asked to the respondent firm to explain the success in employing the stress test and the extent that the management utilized in decision making and a based on the summary discussion made with the interviewee, four of the subject

indicated about the success in employing stress test in the credit, liquidity and foreign exchange risk extensively. The remanding six subjects argued that stress test as a risk mitigation is underutilized both in institutional and national level and only conducted historical sensitivity analysis. The rational raised by this group were that in the industry rampant within national and global level historical sensitivity analysis could not be solemn and dependable methods to be utilized rather both historical and hypothetical sensitivity analysis put into practice synergistically by which to pass long and short-term decision which could lead to in a more competitive strategic intervention.

Regarding the decisions made based on the stress test analysis, all the subjects agreed that the both sensitivity and scenario analysis helped their department in deciding the risk mitigation methods for certain risk factors including in setting limit, in transferring certain risks, in avoiding risks and determining credit and liquidity level using collateral and guarantee. Moreover subjects also indicated that stress test helped them to evaluate and adjust the capital adequacy and setting tolerance limits, contingency plan, ban lending activities and rising margins from L/C.

On the last question, that if there was data capturing mechanism from crisis or event, and their impact on credit, liquidity and other risks and also if there were challenges on stress testing practice.

All respondent answered that they do not have any data capturing mechanism. As an example, the recent instabilities in some regions and the impacts on the aggregate loan collection in the sector of hotel and tourism & its effect for other sectors and also the adverse contributions of the banks to profit. With regard to stress testing practice, allthe respondents said that it is useful tool to enhance the risk management process of the bank. Currently banks are not used the tools to the expected level yet due to various internal and external factors such availability of data, adequacy of MIS, knowledge gap in both supervisory organs and banks concerned departments.

As to summarize the open-ended question discussion made, the subjects suggested that they have the intention to utilize the stress testing as a tool in all respect but due to the lack of general guideline and enforcement from the supervisory organ and less emphasis has been given considered as an obstacle to use effectively. One respondent added that there is some trials conducting stress testing to see the impact of other external events like exiting Britannia from EU on FCY(GBP balance), the impact of developed countries

election over-all economy(recent election in USA & France) and foreign currency risk. And in few banks, the scenarios that can be utilized in the process of conducting stress test for some risk factors developed by their own. It doesn‟t have any procedure by who shall reviewed the scenarios, when do these scenarios can be adjusted Finally most of the respondent summarizes, in banks currently stress test practice is in the infant stage and the risk management department spent much time in the compliance issues.

In general based on the responses on open ended question from the respondent, there are some practices of conducting stress testing in some risk factors like credit and liquidity. Moreover they are using historical data for the analysis, there is no guideline for both the NBE and banks stress testing, and also they didn‟t utilize macroeconomic variable for the test. So it is possible to conclude that commercial banks are not utilized the stress test effectively as an instrument in risk mitigation.

Triangulation of the findings

By triangulation, the consistency and inconsistency of the independent findings were evaluated and examined how the triangulation of different findings had given complete picture. The findings discussed were interview, questionnaire, and checklist together with the questionnaire. And in this section, the validity and reliability of the methods, samples, and instruments are examined through triangulating all the independent findings together and looking for any consistency and inconsistency. The more the findings found consistent, the more the validity and reliability of the findings.

Consistency in findings

The findings of the interview, questionnaire and checklist of distinct sample group given had uniformity regarding the following points;

- Stress test practice and trend

Complete consistency was indicated as commercial banks had limited stress test practice as a method and concentrated more on credit and liquidity risk in all the independent findings. The stress test trend also showed in commercial banks was found to be dependent on historical data and conduct sensitivity analysis.

- Availability of detailed guideline and updated models of stress test

Complete consistency was also indicated in this thematic in all the independent findings, and commercial banks found short of detailed guideline and updated model of stress test in national and institutional context.

- Determinants of stress test

Regarding the determinant of stress test both the independent findings indicated the some and complete picture as availability of detailed guideline, expertise availability, updated models, right frequency, and training and development were list summary of the findings. Moreover, in both independent findings, managements support in the design of stress test, lack of sufficient data, and poor communication platform indicate well.

Inconsistency in findings

In the findings there were complete triangulation, therefore, one supported the other. The summary of triangulation had also shown consistency of results in all features. Therefore, there was no inconsistency in the findings.

CHAPTER FIVE

5. Summary, conclusion and Recommendations

The aim of this chapter is to provide summary of finding, conclusion regarding the findings and analysis of the research study. Finally the researcher will provide recommendations on findings identified under this research.

5.1 Summary of the finding

From the data interpretation and analysis made under the preceding chapter the following major findings can be summarized as follows:

- Starting from the simple demographic presentation, majority of the respondents were male (71.11%), and the composition of age ranged 30-39 (74%), likewise, majority of the respondents‟ (68.89%) were have a service year (tenure) within a range of 6-10, in addition, majority of the respondent‟s 73.33% were BA holder and 24.44% were MSC/MA holder, which was used as a good indication of the respondents role and involvement in risk management section considered as valid for this study.

- Credit risk identified as highest most risk affecting the commercial banks followed with liquidity risk. From the rest of risks also interest risk identified as the third most risk affecting commercial banks and market and foreign exchange risks identified the less risk which was affecting commercial banks. With regard to risk factors sensitive to commercial banks, credit and liquidity risk found to be the sensitive to banks.
- The data indicated that more than 90% of commercial banks conducting stress test analysis quarterly and commercial banks had used the stress testing in very limited risk factors. Furthermore, commercial banks have early experience in implementing stress test analysis in mitigating risks.
- 80% of the respondent reported and disclosed the stress test result for both the management and the board of directors where as 20% added to the NBE. As to summarize the statistics result in commercial banks has used stress test result as an input to better understand the banks‟ risk profile, to set limit and allocate capital and some banks also has used to develop contingency plan.

- As to conclude majority of the commercial banks do not update the scenarios in the stress testing practice.
- From the summary discussed above, commercial banks have limited application of stress test with no availability of standard guidelines and make use of stress test result for decision making found to be unaware or inapplicable. Updating and upgrading of stress test model had not been the concern of commercial banks.
- From the discussion made on stress test practices and procedures was that, the commercial banks found very dependent only on internal information particularly historical data and marketing and financial report findings. Commercial banks also had found poor in using infrastructure and latest data on macro environment in stress test procedure and practice. In addition, the discussion indicated above, commercial banks also found poor in utilizing management expertise in the development and design of stress test programs.
- Based on the analysis and the statistics indicated above, the availability of detailed description of stress test methodology, testing assumption, reviewing of risk tolerance limit, testing model and contingency plan as stress testing feature was not extensively available as feature whereas testing frequency was featured in the stress testing of commercial banks.
- Most the commercial banks chose historical scenario over the hypothetical scenario analysis that is backward-looking historical information indicated benign conditions so that this did not recognize the possibility of severe shocks nor the build-up of vulnerabilities with in the banks, involvement of management, consideration of more than one scenario, reverse stress testing, using other testing methodology, were found not widely practiced and taken as procedures in scenario analysis in the commercial banks
- From the data analysis and discussion, the determinants of effective stress test practice were that, the commercial banks had difficulty on the availability of updated stress test methodologies, appropriate disclosure methods, models and modeling expertise, training and development, an independent audited review, and an updated stress test framework, which in turn affected the effectiveness of stress test practice and procedure.
- As to summarize based on the analysis and discussion made regarding the variables considered in the design and conduct of stress test, commercial banks considered global economy, financial institution condition, inflation, foreign

exchange rate, GDP, other category of risk and contagion effect and political instability in a considerable level. However, commercial banks found not considerate in a greater extent unemployment rate as a risk factor indicator in the design and conduct of stress test, from this conclusion the implication taken were commercial banks found poor in the scenario analysis.

- Finally, the challenge of commercial banks on effective implementation of stress test identified as lack of qualified staff in the department, lack of management support in designing stress test methodology, scenario selection, the complexity of stress testing in design and implementation, lack of guideline of stress test, lack of sufficient data in macroeconomics variables and poor platform on result review and communication were found challenge which in turn affect stress test effectiveness as a tool to mitigating risks in the institution.

5.2 Conclusion

The purpose of this research was assessing the effectiveness of stress testing as a risk mitigation method in Ethiopian commercial banks and based on the findings indicated above and the empirical reviews conducted for this research. The following conclusions were made on challenges and determinants of stress test effectiveness.

- Based on the finding indicated, commercial banks conduct stress testing on historical data and conduct the extensive sensitivity analysis and very limited hypothetical scenario analysis on institutional context. However, very limited banks found conducted the hypothetical analysis on Britannia exist form EU, both France and US presidential election effect of foreign exchange which were not supported.
- Most of the commercial banks conduct stress test with only limited and own guideline to mitigate credit, liquidity and interest risks. Commercial banks found conduct sensitivity analysis extensively with own historical data, and also conduct scenario analysis limited own guideline and zero availability of models. While the global banks and other Euro zone banks employing an extensive empirical model and also IMFs suggested guidelines.
- As indicated in the findings in the case of commercial banks, stress test conducted as to mitigate, a limited number of risk factor and were included credit, liquidity, interest and foreign exchange risks. Even though stress test had found to be

determinant tool in risk management, needed to be employed extensively and synergistically.

- Commercial banks found lack on the need and importance of stress test as risk mitigation method, which in turn had implied that detailed guideline and purpose of each stress test type unclassified by the commercial banks.
- In exalting stress test practice in the institutions, commercial banks failed to use fully macroeconomic variables in the stress testing analysis, it was also indicated in the review of Mathias.
- Determinants of stress test practice in the commercial banks were identified including stress test methodology, expertise involvement, updating and upgrading scenario, training and development, review of stress test effectiveness, government/National bank support, detailed description of stress test procedures, availability of models and strong management information system.
- Challenges indicated in the independent findings summarized as lack of management support in stress test design and scenario selection, lack of detailed description of methodology and guideline, lack of sufficient data in macroeconomic variables, poor platform on result review and communication, complexities of stress testing in design and implementation, and lack of MIS, as it was also indicated in the review of Andrew study and IMF study results.

5.3 Recommendation

In the global context, the banks are increasingly using stress testing as a risk management tool. Banking industry in Ethiopia is growing at a rapid pace. After recent global financial crisis, stress testing has gained strength in the field of bank management. Merely studying and analyzing the historical data may not be sufficient to manage the future uncertainty. Therefore, it‟s felt necessity of forward looking approaches for risk management. Stress testing is the forward-looking risk management tool popularly used by banks globally.

Based on the findings of this research the following feasible recommendations have been forwarded.

1. The banks should have a written policies and procedures governing the stress testing framework in place to facilitate the implementation of the stress testing.

2. The Board and senior management should regularly review the results stress testing, including the major assumptions that underpin them.
3. The commercial Banks should design and implement short-term training programs to banks‟ risk management staffs.
4. The commercial banks should have to design and or adopt model in using stress test as to mitigate risks.
5. The commercial banks should have data capturing mechanisms(MIS) past, present, and future crisis/events and their impact on credit, liquidity, and other risk factors.
6. The stress test should not only concentrate on credit and liquidity risk but rather should cover all risk factors.
7. The commercial banks should undertake hypothetical scenario analysis in addition to historical scenario and sensitivity analysis as part of their suite of stress tests which should be (i) dynamic and forward- looking and (ii) incorporate the simultaneous occurrence of events across the banks. In addition, the banks should try to incorporate more than one scenario in all risk factors.
8. In stress testing, commercial banks should incorporate macroeconomics variables in addition to microeconomics variables.
9. Even though stress test had found to be determinant tool in risk management, needed to be employed extensively and synergistically in all based in national bank and IMF suggested guidelines.

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Appendix 1

Addis Ababa University

College of Business and Economics

Department of Accounting and Finance

MSC program

Objective of the questionnaire:

Dear, Sir/Madam

This questionnaire is prepared by Addis Ababa University graduate student to gather a data on a research topic **"Assessment on the effectiveness of Stress testing in commercial banks in Ethiopia: Exploratory study on selected Ethiopian Commercial Banks."** as a partial fulfillments of the requirements for the Masters of accounting and Finance.

The main objective of the study is assessing whether the stress test is used as an instrument of mitigating risk in commercial banks in Ethiopia. Accordingly, this questionnaire is designed to collect data in the subject matter. Therefore, your cooperation in filling out the questionnaire carefully and genuinely, apart from contributing towards the successful completion of the study is essential input towards the creation of a levelheaded knowledge regarding the aforesaid issue.

Finally, I want to kindly assure you that all the information you provide will be confidential & will exclusively be used for research purpose.

Section I. Personal information

Instructions:

Please use this [√] mark for each question to indicate your response.

1. Sex: Female ☐ Male ☐
2. Age:
   - ☐ 18-29
   - ☐ 30-39
   - ☐ 40-49
   - ☐ 50-59
   - ☐ 60 years and above

3. Years of service in the industry:

- ☐ 1-5 years
- ☐ 6-10 years
- ☐ 11-20 years
- ☐ 21-30

4. Level of education:

- ☐ Diploma
- ☐ Bachelor Degree (BA, BSc)
- ☐ Msc
- ☐ Phd

Section II:

1. Which of the above risk factors more sensitive to your bank and give priority?
   - ☐ Credit risk
   - ☐ Liquidity risk
   - ☐ Interest rate risk
   - ☐ Market risk
   - ☐ Concentration risk (borrowers, industry, & region)
2. Which risks mostly affect your bank?
   - ☐ Credit risk
   - ☐ Liquidity risk
   - ☐ Interest rate risk
   - ☐ Market risk
   - ☐ Concentration risk (borrowers, industry, & region)
3. To which of risks does your bank have business disaster recovery/contingency plan?
   - ☐ Credit risk
   - ☐ Liquidity risk
   - ☐ Interest rate risk

- ☐ Market risk
- ☐ Concentration risk (borrowers, industry, & region)

4. Which of those highly used risk mitigation methods in your bank
   - ☐ Collateral and guarantee
   - ☐ Stress test analysis
   - ☐ Set limit
   - ☐ Risk Acceptance
   - ☐ Risk avoidance
   - ☐ Risk Transfer
5. What risk factors are included in your stress tests? (please put the tick mark)
   - ☐ Credit risk
   - ☐ Liquidity risk
   - ☐ Interest rate risk
   - ☐ Foreign Exchange rate risk
   - ☐ Operational Risk
6. How long does the bank exercising stress test as one of risk mitigation strategy?
   - ☐ 1-3 years
   - ☐ 4-6 years
   - ☐ 7-10years
   - ☐ Above 10 years
7. How often does your Bank participate in the conduct of Stress Tests?
   - ☐ Bi-Monthly
   - ☐ Quarterly
   - ☐ Semi-Annually
   - ☐ Annually
   - ☐ No particular schedule, as and when needed
8. Does NBE enforce all commercial banks to conduct stress test.

   ☐ Yes ☐ No
9. To whom the stress test result shall be reported and disclosed
   - ☐ To NBE
   - ☐ To Bank‟s Board of directors
   - ☐ To Bank‟s Management
   - ☐ To shareholders and potential investors

10. How do stress test results used?

- ☐ To help risk mgr better understanding the nature of the firm‟s risk profile
- ☐ To set tolerance limits
- ☐ To allocate capital
- ☐ To monitor liquidity risk
- ☐ To conduct contingency planning for times of market stress
- ☐ Others

11. How long does the stress test process take to conduct – from the initial internal data request to the final presentation to the ultimate user?

- ☐ Two weeks or less
- ☐ Two weeks and one month
- ☐ Two months
- ☐ Three months
- ☐ More than three months

12. How often do you change (update) scenarios for stress testing?

- ☐ Every 3 months
- ☐ Every 6 months
- ☐ Every 1 year
- ☐ Every 2 years
- ☐ Not applicable

13. To which areas does stress test benefit your bank?

- ☐ Improve strategic plan
- ☐ Better business performance
- ☐ Increase regulatory compliance
- ☐ Improve internal control
- ☐ Improve risk impact likelihood

14. Do you believe that the NBE enforcement for commercial banks to increase their paid up capital is the result of stress test analysis?

Yes ☐ No ☐ ☐ I have no idea

15. What is the reason of current increment in paid up capital of your bank?

☐ Own stress test analysis result ☐ NBE requirement ☐ I have no idea

Section III

3.1 Overall stress test trends of the bank /How do commercial banks conduct stress test?

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
3.1.1 Stress testing is unique to your bank‟s risk management instrument.					
3.1.2 Current risk mgt tool is effective in mitigating risk					
3.1.3 The bank‟s mgt make use of the stress test result for decision making					
3.1.4 The risk mgt tools that the bank is using are future oriented/forward-looking/					
3.1.5 There is excellent NBE guideline for stress testing					
3.1.6 Striving to upgrade their existing stress testing framework and models.					
3.1.7 Stress testing can play an important role in providing forward-looking assessments of risk.					
3.1.8 Stress test can inform the setting of a banks‟‟ risk tolerance.					
3.1.9 Stress tests can predict all the dangers that a given institution is going to face.					

3.2 Stress test procedure and practice

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
3.2.1 The bank has written policies and procedures governing the stress testing program and document the process of stress testing analysis					
3.2.2 There is infrastructure sufficiency in type of data, MIS and expertise regarding in stress test procedure and practice.					
3.2.3 Our bank has used both accounting and market data source to conduct stress test, i.e. financial report, market SWOT analysis.					
3.2.4 Historical data is used in conducting stress test to predict the severity of plausible shocks(risk)-Historical data(total outstanding loan, NPLs, top borrowers, interest and exchange rate…)					
3.2.5 The frequency of stress testing can be determined in accordance with the nature of risk and the type of test performed					
3.2.6 The senior management actively involved in the process of designing the stress tests program. In identifying potential stress scenarios and also choose stresses to be examined as part of their responsibility for managing the entity-wide risk					
3.2.7 The bank take into consideration the latest development from the economic, political, geographical and global perspectives					

3.3 In which of the following aspect do your bank incorporate in stress test internal procedure/documents

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
3.3.1 Detail description of stress testing methodology					
3.3.2 Testing Models					
3.3.3 Testing frequency					
3.3.4 Testing assumptions used in scenario					
3.3.5 Reviewing risk tolerance limit					
3.3.6 contingency planning					

3.4 Scenarios Selection procedures and practice/What are the procedure and practice of scenario selection and/or sensitivity analysis

	Strongly disagree	Disa gree	Neutral	Agree	Strongl y agree
3.4.1 Hypothetical Scenario analysis is used over historical scenario analysis due to its relevancy, flexibility and forward looking.					
3.4.2 To select the appropriate scenario it should be relevant, realistic, and reliable.					
3.4.3 We consider more than one scenario in stress testing. (for example, 5%, 10%, 15%... decrease in GDP, 25%, 50%, 100%... increase in NPLs or a shift Npls category)					
3.4.4 **Sensitivity analysis is used more because it is very simple to apply**. Sensitivity test covers the predetermined or identified changes of the individual (isolated) risk factor or closely related risk factors characterized by high degree of correlation. This test provides information about the types of risk relevant to the bank and helps to determine the concentration of risk types.					
3.4.5 Both scenario and sensitivity analysis are suited for revealing the vulnerability of portfolio					
3.4.6 **Depending on the circumstances, the bank is used a reverse stress test**. Reverse stress testing consists in identifying a significant negative outcome and then identifying the causes and consequences that could led to such an outcome					
3.4.7 The bank may also use other testing methodologies and their combinations, considering the usefulness; it‟s transparent, clearly regulated, proportionate and objective.					
3.4.8 Advanced management and personnel involvement in sensitivity and scenario selection and decision making					

3.5 Determinants of an effective stress test practice in the risk management

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
3.5.1 The availability of updated stress test methodologies, principles and guidelines.					
3.5.2 Availability of appropriate disclosure method within the existing reporting mechanism					
3.5.3 Availability of Models and Modeling Expertise					
3.5.4 The bank regularly maintains and update its stress testing framework i.e. stress test programs and major individual components.					
3.5.5 The strong correlations between risk types and factors influencing them.					
3.5.6 Training and development in the area of stress test					
3.5.7 Independent review has been conducted by external and internal auditors the effectiveness of stress test in mitigating the bank‟s risk.					
3.5.8 Board of director & senior mgt is involved in stress testing preparation program this is essential for stress test effectiveness.					
3.5.9 The NBE assistance and guidance.					

3.6 Variables that the commercial banks consider when constructing the stress test.

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
3.7.1 Macroeconomic variables used in conducting stress test					
3.7.1.1 GDP					
3.7.1.2 Inflation rate					
3.7.1.3 Foreign exchange rate					
3.7.1.4 Unemployment rate					
3.7.1.5 Country‟s instability (political aspect)					
3.7.2 Geographical and political factors (Health of other economies vulnerabilities to external events, contagion effects)					
3.7.3 Financial institution conditions					
3.7.4 Concentration risks(borrowers, industries, region)					
3.7.5 Other category of risk (operational risk…)					
3.7.6 Global factors (world economy, developed country instability)					

3.8 **Credit risk stress testing application**

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
3.8.1 In testing credit risk, the increase in total NPLs can be tested by sensitivity and scenario analysis.					
3.8.2 In testing credit risk, the shift or movement in NPLs category (substandard, doubtful and loss) can be tested by sensitivity and scenario analysis.					
3.8.3 In testing credit risk, the percentage of restructured loan become NPLs can be tested.					
3.8.4 Increase in NPLs in particular one or more sectors can be tested by sensitivity and scenario analysis.					
3.8.5 Increase in NPLs due to default of top 10 large borrowers can be tested bysensitivity and scenario analysis.					
3.8.6 Migration from loan category/classification (i.e from special mention to NPLs, from substandard to doubtful, from doubtful to loss) can be tested by sensitivity and scenario analysis.					
3.8.7 Defaults in a specific sectors/industry/region					

3.9 **Other risk categories application included in the stress test sensitivity/ scenario analysis.**

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
3.9.1 In foreign exchange risk: adverse movement in exchange rate:i.e impact of net open position on major currencies, impact of major customers with substantial withdrawal of foreign exchange position are being tested					
3.9.2 **In liquidity risk**: sudden withdrawal of large amount of deposits are being tested by using sensitivity and scenario analysis					
3.9.3 In stress test liquidity risk, the unexpected utilization of credit line/facilities are being tested.					
3.9.4 Major operational risks are sufficiently and adequately stressed and analyzed their impact on capital considering business environment and internal control factors as well as macroeconomic variables.					

3.10 What are the challenges faced by banks in implementing effective stress test in mitigating risk?

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
3.10.1 Lack of qualified staff in the department					
3.10.2 Lack of management support in designing stress test methodology, scenario selection					
3.10.3 The complexity of the stress testing					
3.10.4 Lack of guideline of stress test					
3.10.5 Lack sufficient data in macroeconomics variables.					
3.10.6 Lack of management information system					
3.10.7 Poor platforms on result review and communications					

Appendix 2

Open ended interview questions

This interview question is designed to assess of the effectiveness of stress testing in commercial banks of Ethiopia as one risk mitigation tool. Moreover, it also designs to examine the strengths and weaknesses in stress test practice in commercial banks of Ethiopia. The researcher invited the interviewee to forward all their feelings, experience, and thoughts on the questions raised freely as to maximize the valid and reliable based recommendation and conclusion of the research and make valuable input for all concerned party including themselves. All the data collected will be used for the research purpose and the confidentiality in using only for this research is assured by the institution and the respected Bank which includes (*list of Banks*).

Name: _____

Institution/organization: _____

Position: _____

Years of service (tenure):

1. How do you see that bank‟s today and their risk mitigating strategic intervention and its successes? What is the role of stress testing as a risk management tool?
2. Do you think that banks should employee stress test as one means of risk mitigation? How important is for your bank to use stress testing as one of risk management strategy?
3. What are the main types used? How closely are they integrated with the banks‟ risk management processes? Are there any standardized procedure and practice?
4. How do you explain the success of your bank in employing stress testing as one of risk mitigation? To what extent that the stress tests result used as an input in management decision making?
5. Is there data capturing mechanism for crisis/events and their impact on credit, liquidity and other risk? What can you say in general about stress testing in risk measurement and practices?