ADDIS ABABA UNIVERSITY

THE DETERMINANTS OF BANKING SYSTEM STABILITY IN ETHIOPIA: A PANEL REGRESSION ANALYSIS

Submitted to the Department of Economics, College of Business and Economics, Addis Ababa University

BY: EDIMEALEM MIHRETIE

JUNE 2014

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A project submitted to the Department of Economics, College of Business and Economics, Addis Ababa University in Partial fulfillment of the requirement for the Degree in Masters of Art in Applied Economic Modeling and Forecasting

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This is to certify that the paper prepared by Edimealem Mihretie entitled: "The Determinants of Banking System Stability in Ethiopia: A Panel Regression Analysis", and submitted in partial fulfillment of the requirement of the Degree of Masters of Art in Applied Economic Modeling and Forecasting complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

Approved	**Signature**	**Date**
Tassew Woldehanna (PhD)	**…..……**	**……...**

Advisor

JUNE 2014

ADDIS ABABA

DECLARATION

I, the undersigned, declare that this is my original work and has not been presented for a degree in any other university and that all sources of materials used for the project have been duly acknowledged.

Declared by	Confirmed by Advisor
Name: Edimealem Mihretie	Name: Tassew Woldehanna (PhD)
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Date: ……..……..	Date: ……..

JUNE 2014

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Abstract

The Determinants of Banking System Stability in Ethiopia: A Panel Regression Analysis

Edimealem Mihretie

Addis Ababa University, June 2014

This study examines the various bank specific and macroeconomic variables that affect the banking system stability in Ethiopia during the study period ranging from 2000 to 2013. Arellano-Bond estimation technique had been employed to estimate the various determinants. From the Empirical result of this paper it was concluded that previous year banking system stability, economic growth and lending growth to the private sector were amongst determinants that affect the banking system stability positively; whereas total bank's asset, inflation and real interest rate were found to negatively affect the banking system stability; whilst government budget deficit, exchange rate volatility and treasury bills were found not having any impact on the banking system stability in Ethiopia. The policy implications of these results is so vital to the banking industry in Ethiopia, incase that most of the variables can be maintained and controlled by the National Bank of Ethiopia. The researcher thus finally puts the policy implications based on these results. To maintain the banking system stability in Ethiopia the researcher recommends to uphold: the economic growth of the country, previous year's banking system stability, bank lending growth and increasing the management's aptitude especially to lessen the diseconomies of scale in the banking industry; on the contrary the researcher recommends to dwindle the inflation rate and interest rate.

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Acronyms and Abbreviations

AfDB: African Development Bank

ECB: European Central Bank

WB: World Bank

IMF: International Monetary Fund

FE: Fixed Effect

RE: Random Effect

AB: Arellano-Bond

OLS: Ordinary Least Squares

GLS: Generalized Least Squares

GMM: Generalized Method of Moments

1. INTRODUCTION

1.1. Background of the study

Financial institution is an organization which comprises banks, micro finances and insurance companies that takes money from customers of its own and using it for the benefits of the institution itself and the customers as well. In most instances banks and micro finances take deposits into a secured position and use it to make loans to other customers, whilst insurances do not take deposits but provide a warranty if a certain problem occurred in exchange for premium.

Over the past two decades the world was characterized by global financial crises which automatically originated from the loose regulation of the US financial system especially the US banking system. Financial crises are very costly events. They result in a significant loss of private and public wealth. Once occurred, it is extremely hard to recapitalize the financial institutions and rebuild public confidence. In addition, it is worth noting that financial crises (i.e, banking crisis as financial crisis usually emanate from banking crisis) have a downturn impact on the real economy and hence may lead even to economic crises depending on the degree of financial crisis.

Thus, maintaining financial stability has been one of the most important issues for policy makers during the last decades both in developed and emerging economies. During this period, price stability and the soundness of financial institutions have been used commonly as a definition for financial stability. However, recent literature in this area suggests that financial stability is a more complex phenomenon which cannot be described only with price stability and the soundness of financial institutions. Despite the fact that there is still no unique and widely accepted

definition of financial stability, there are vital ingredients in various financial stability definitions. In this context, price stability (monetary stability), growth of the banking industry, infrastructure of the financial markets, functioning of financial markets, soundness of financial institutions – usually understood as the banking stability-, confidence in financial institutions and relevant regulatory authorities, sound economic growth, asset price volatility, sustainable capital flows, reliable risk management practices of financial institutions, and the interaction between these variables are emphasized mostly together with the concept of financial stability. Among them, the stability of the banking sector is perhaps the most crucial element of financial stability. (Münür Yayla, Alper Hekimolu and Mahmut Kutlukaya, 2008).

In Ethiopia, the financial system is focused on banks, which have a crucial role in financing the real economy and ensuring the financial stability. In this context, ensuring a healthy, stable and highly effective banking sector is of major importance to deal with long term economic growth and economic and financial stability. In the latest years, which preceded the current world economic crisis, amid significant structural, institutional and legislative transformations, Ethiopian banking sector has registered an extremely rapid growth, with major impact upon bank stability. Following a highly accelerated dynamic of loans, a diversity of banking operations, a range of banking products and services, the banks have recorded a growing income, with positive and significant impact upon the stability indicators.

Ethiopia, unlike many other countries did not experience to that extent the pains of financial crisis. One reason for this may be because that there are no international banking institutions that are operational in the country as they are not allowed to do

so. The second and the most important reason I believe is because of the good policies and a strict regulation of the banking industry by the national bank of Ethiopia. The national bank currently follow-up each and every bank that are operating in the country through onsite (i.e., by going to each banks' head offices physically and checking the activities undertaken and being undertaken) and offsite (i.e., being anywhere and simply check each banks' balance sheet and producing the CAMEL rating) approaches.

Before the emergence of the Dergue regime, Ethiopia had both state owned banking institutions and private financial institutions (many of which were foreign owned). The 1974 revolution brought major changes to the banking system. In this decade, the Marxist government nationalized all the existing banks operating in the country. After the downfall of the Dergue military regime, the EPRDF-led government allowed the private sector to engage in the banking and insurance industry in 1994. Since then, private banks began to flourish thereafter. In 1994, there was no single private bank; only three public banks existed. In 2013 the number of private banks reached 16 which totals 19 banks. It is also noticed that each banks profit are also increasing from year to year as their total assets, loans, deposits, dividends and the likes are increasing from time to time together with bank branches.

It is worth mentioning that, the banking sector development is playing a significant role for the sustainable economic growth maintained in the country for more than a decade. But despite the tremendous growth in the banking industry, with regard to access to the banking services Ethiopia is still low as compared to many other African countries. Banks in Ethiopia till now are only installed in towns and cities which show

us that the rural population [which accounted about 82.98% as of 2011 (according to mundi index) of the total population] is get rid of the banking services. The government of course is expanding micro finance institutions into the remote areas where banking is not available. But, micro finances have a draw back as they can't give most of the functions that banks give.

In general, the banking system in Ethiopia seems stable so far except the instability existed during the Dergue regime and the early days of the EPRDF regime. Inflation is still the major challenge in the banking system stability in Ethiopia. The national bank of Ethiopia has different measures such as tight monetary policy, controlling the amount of loans and through changing reserve requirement to tackle inflation because it is advisable that for a better banking system inflation should be no longer than 7%.

1.2. Statement of the problem

There is no common and internationally accepted definition of financial system stability, there is however international consensus of the need of stable financial system. Big international organizations like IMF and WB stressed the need of financial system stability to come up with the healthy economy. The banking system, being the major part of the financial system, should be strong enough to withstand if unexpected shock could happen in the respective country. If not, the consequence is harsh s it has a direct impact on the real economy. Weakness in the financial system may give rise to a quickly spreading systematic problems once underlying weakness become apparent. For this reason, it is desirable that the authorities in charge of the financial stability, the national bank in case of Ethiopia, to monitor the key structural developments in the financial system (specifically and especially the banking system).

No one can deny that there is growth in the banking industry in Ethiopia. On the other hand, no one should also not deny that despite this growth; Ethiopia still remain one of the lowest in Africa with respect to access to banking services. To get rid of this low access, we need to have a strong and stable banking industry to much extent so that new banks and new additional branches will be opened in the country. This can be achieved through identifying major determinant factors that influence the banking system stability in Ethiopia.

There exists a limited theoretical and empirical literature on the determinants of banking system stability, as studies on the determinants of banking system stability are important to diagnose the constraints to stabilize the banking system even further in the country. However, there is a dearth of studies focus on the determinants of banking system stability in Ethiopia. This study will therefore try to identify the major determinants of banking system stability in Ethiopia.

1.3. Objectives of the study

The major objective of this study is to examine the major factors that affect banking system stability in Ethiopia.

Specifically, this research will try to assess the following specific objectives.

i. To identify and test the determinants of banking system stability in Ethiopia
ii. To analyze empirically the effects of each explanatory variables on banking system stability
iii. To forward some policy recommendations based on the research findings

1.4. Research questions

It is assumed that this research tried to answer the following two important questions.

i. What are the major determinant factors that affect banking system stability in Ethiopia?
ii. To what extent does each factor influence banking system stability in Ethiopia?

1.5. Delimitation of the study

It is impossible to study all the determinants of banking system stability in Ethiopia from the point of view of time and finance. So the researcher selected amongst determinants of banking system stability that are meant most important. Specifically, the researcher relied majorly on macroeconomic determinants and was supposed to take bank specific variables as control variables.

1.6. Limitations of the study

Lack of literatures on the determinants of banking system stability and time constraints were the major challenges in this study.

1.7. Significance of the study

In Ethiopia, as far as my knowledge is concerned, there is no any research done on "the determinants of banking system stability in Ethiopia". There is (are) studies only on the profitability determinant aspects of the banking industry. This study will thus contribute its own by filling this vacuum. In addition, this research will help researchers, policy makers and bank supervisors (especially for national bank of

Ethiopia by providing a tool to monitor and assess banking system stability and its determinants).

2. LITERATURE REVIEW

2.1. The impacts of banking failure

The 2008 financial crisis has actually become a global crisis severely affecting both the developed and developing nations. Some of the consequences of financial crisis include: a dramatic increase in unemployment rate, an increase in poverty especially in developing countries, a substantial loss in wealth, an immense decline in investments, a tighter lending conditions, an increase in uncertainty and the like which intern lead to a decline in global investment, production, trade, and of course GDP in general.

According to The African Development Bank Report (2009), the impact of the financial crisis in Africa is minimal as compared to other regions. However, the global crisis is gradually showing its effects on the fragile economy of the African continent. These countries, especially the Sub-Sahara African countries, are to a large extent dependent on the economies of the developed countries with regard to aid and other forms of development assistance, hence affecting them to a larger extent. AfDB in its report outlined about four risks of the crisis which include capital out flow risk, fiscal risk, export risk and the liquidity risk.

2.2. Banking system stability and its regulation

The role of bank remains central in financing economic activity and its effectiveness could exert positive impact on overall economy as a sound and profitable banking system is better able to withstand negative shocks and contribute to the stability of the financial system. Therefore, the determinants of bank performance have attracted the

interest of academic research as well as of bank management, financial markets and bank supervisors since the knowledge of the internal and external determinants of banks profits and margins is essential for various parties. (Athanasoglou et al, 2005).

Regular financial stability assessment and the identification of macro-prudential leading indicators signaling coming risks to the banking system are of major importance for central banks and supervisory authorities. A safe and sound banking system ensures the optimal allocation of capital resources, and regulators therefore aim to prevent costly banking system crises and their associated adverse feedback effects on the real economy. (Nadya Jahn; University of Münster) and (Thomas Kick; Deutsche Bundesbank).

Banking system plays an important role in the development of a country's economy and its financial stability (Ryu, Piao & Nam, 2012). Stability or sustainable growth would not be possible in a country with an unhealthy banking sector. Performance measurement of banks, which contribute, to economic activities especially by credit channels is important in terms of national and international assessment of sector's success (Demireli, 2010). For example the banking sector in Korea is found to be the backbone of the Korean economy and plays an important role; its health is very critical to the health of the general economy at large. (Rajan and Zingales, 1998; Levine, 1998; Cetorelli and Gambera, 2001)

Usually there are mainly two methods of monitoring the banking system stability which are practiced in many central banks worldwide; namely on-site and off-site approaches. On-site approach of monitoring the banking system stability include; different types of applications of CAMEL (capital adequecy, asset quality,

management, earnings, and liquidity) analysis usually used by supervisors. Such studies as Flannery (1998) or Curry, Elmer, Fissel (2003), Chan-Lau, Jobert, Kong (2004) make use of these indicators. On-site monitoring is presumed to be the best tool to acquire quantitative and qualitative information and to make suitable conclusion about bank's financial health. The other approach uses early warning system (EWS) to provide efficient off-site analysis (Brossard, Ducrozet, Roche, 2006). International organizations such as International Monetary Fund use different variations of EWS models to supervise current financial situation and to predict banking crises. According to Jagtiani, Kolari, Lemieux, and Shin (2002) plenty of different off-site monitoring systems have been created to identify developing financial troubles at banking institutions.

2.3. Different ways of estimating of BSSI

Calculating or measuring the stability index has had many challenges, as there is no widely accepted set of measurable indicators that can be monitored and assessed over time (ECB, 2005 Cihák and Schaeck, 2010). To measure financial stability, the empirical literature has relied on three broad categories of indicators (Das et al., 2004 or Borio and Drehmann, 2009). The first strand of literature has employed banking crisis indicators based on certain dating schemes that identify whether an economy experienced a crisis event during a certain period of time. Studies that use banking crisis indicators utilize dummy variables to indicate whether or not a crisis has occurred (see Boyd et al., 2009). A second strand uses single variables as proxies for financial stability. This category includes balance sheet items from financial institutions, such as statistics based on the CAMELS-variables – e.g., measures of

financial institutions' capitalization or non-performing loans. Ratings (such as Moody's Financial Strength Rating) also fall into this category (Cihák, 2007; Borio and Drehmann, 2009). A third strand of empirical studies makes use of so-called composite indicators of financial stress. After selecting relevant variables, often based on the early-warning indicator literature, a single aggregate measure is calculated as a weighted average of the variables identified (Gadanecz and Jayaram, 2009).

A study by Elena Mucheva and Magdalena Petrovska, 2013 used two composite measures which will provide timely warning of potential risks, composed of a set of economic and financial indicators which (aggregate banking stability indicator/index) according to them will help: first, as an attempt to assess the risks to banking stability by focusing on a set of key soundness indicators of the banks to prevent or (minimize) banking crisis and second to provide timely warning of potential risks. They, in the construction of banking system stability index, selected on the basis of their relevance to the stability of the banking system; does not include macroeconomic variables and qualitative indicators and Includes only CAMELS approach for each bank. They also reported that international standards to calculate the index- still not developed. Others notify that there are in most situations two methods of calculating the stability and/or instability index; namely equal weighting and non equal weighting approaches. Illing and Liu (2006) for instance develop a financial stress index for the Canadian sector by variance-equal weighting several financial market indicators into one single index. Hanschel and Monnin (2005) both develop and examine a continuous stress index for the Swiss banking sector by equal-weighting approach. On the other hand, Puddu (2008) used the different weight approach to calculating the banking system stability index for the US banks.

Some central banks have recently attempted to construct a single indicator to designate the level of stability of the banking system which of course is a tough task. Most of the attempts focus on constructing an aggregate indicator for the banking sector, which is the most important part of the financial system with respect to banking stability and/or financial stability. A relatively simple aggregate indicator of banking sector stability can be constructed as a weighted average and/or simple average of partial indicators of the soundness of banks. Such an index is used, for example, by the Turkish central bank (CBRT, 2006). Its banking stability index consists of six sub-indices covering asset quality, liquidity, foreign exchange risk, interest rate risk, profitability and capital adequacy. Before aggregation the individual sub-indices are normalized in order to achieve the same variance (variance-equal weighting scheme) (Geršl and Heřmanek, Czech National Bank). Similarly according to Albulescu (2008) the banking system stability index represented by a single quantitative measure which can be used to capture and forecast the stability of the banking system. The model he utilized is based on the methodology of a single banking stability index based on the aggregation of constituent indicators or sub-indices.

Further to the wave of banking failure since 1990 which affected many financial sectors worldwide, banking distress has been of major interest in the field of economics. A study by Jean-Michel Sahut2011 on bank distress in MENA countries used used CAMEL approach to predict bank distress. Many other studies (Meyer and Pifer 1970; Altman 1977; Martin 1977; Pettaway and Sinkey 1980) have also a similar approach using financial ratios to reflect the different dimensions of CAMEL rating system; in which case the most significant variables which can better express

each of the CAMEL ratings have been employed. Safarli and Gumush (2012) conducted a study to determine the internal & external factors affecting the Azerbaijan banking sector. CAMELS' model was used to estimate the performance of the banks.

2.4. Internal (bank specific) and macroeconomic determinants

As the researcher is more concerned with the macroeconomic analysis, theoretical literature and empirical evidence provides deep insight into the interaction between the financial and real sector, and helps to derive subsequent explanatory variables and leading indicators as determinants for banking system stability. Among the first authors who theoretically proved an existing macro-financial linkage was Bernanke et al. (1996), who initially formulated the financial accelerator mechanism.

Empirical evidence of the determinants of banking system crises and –instability has a long history. Whereas some studies capture periods of crisis for several countries with a binary variable and explain the latter with macroeconomic factors applying either logit/probit or signaling approaches, other studies focus on a single country and identify appropriate country-specific determinants of banking system stability. For example, Demirgüc-Kunt and Detragiache (1998, 2005) did a research that focus on leading indicators for banking crises by applying a multivariate logit approach. The authors link a set of macroeconomic explanatory variables to the probability of occurrence of a binary crisis variable. Their results for both industrial and emerging market economies indicate that low real economic growth, high inflation and high real interest rates impact significantly on the probability of a banking crisis.

The determinants of bank stability can be classified into bank specific (internal) and macroeconomic (external) factors (Al-Tamimi, 2010; Aburime, 2005). These are stochastic variables that determine the output. Internal factors are individual bank characteristics which affect the banks performance. These factors are basically influenced by internal decisions of management and the board. The external factors are sector-wide or country-wide factors which are beyond the control of the company and affect the performance of banks. Studies have shown that bank specific and macroeconomic factors affect the performance of commercial banks (Flamini et al. 2009). Other studies by Molyneux and Thornton (1992), Willianms (2002), Athanasoglou, Brissimis and Delis (2008), and Heffernan and Fu (2008) applied a General Methods of Moments (GMM) technique to a country's panel data. These studies examined the effect of bank-specific, industry-specific and macroeconomic determinants of bank performance. In similar fashion, Bourke (1989) examined the internal and external determinants of bank performance across in Europe, North America and Australia. Thus, it can be said that bank specific and macroeconomic determinants that are practiced by most researchers.

Variables such as interest rate, inflation, GDP, money supply, exchange rate, money market growth are amongst the external determinants (macroeconomic variables) that affect the whole economy and considered as important determinants of performance and stability of the banking system. Several studies have reported a positive relationship between GDP and bank profitability (Demirguc-Kunt and Huizinga 1999, Bikker and Hu 2002: and Athanasoglou et al. 2008, among others). Revell (1979) discussed the relationship between bank profitability and inflation. He found that the effect of inflation on bank profitability varies depending on how fast the level of

increase in banks operating expenses is, as well as the rate of inflation. Perry (1992) stated that inflation impacts on banks profitability depends on whether it is fully anticipated or not (e.g. Rasiah 2010, among others). A positive relationship between inflation and profitability has been reported by Bourke (1989), Molyneux, and Thornton (1992) vii and Athanasoglou et al. (2008), among others. On the other hand, Hasan (2009) reported a negative relationship between inflation and performance. There is a negative relationship between the 6-month Treasury bill yield and the AFSI, indicating that increases in interest rates can stimulate deterioration in aggregate stability such as by influencing an increase in the default rate on loans (Bordo et al. 2000).

A number of studies have been done to identify the origins and causes of banking system stability and instability aspects focusing on macroeconomic factors that can help predict banking system stability/instability issues. Macroeconomic variables such as inflation, changes in exchange rate, interest rate may either enhance or distress the performance of banks. Cordella and Levy Yeyati (1998) stressed that if there are widespread shocks to the economy and banks cannot control their asset portfolio risks, then full transparency of the bank's risk positions may destabilize the banking system. According to them country's macroeconomic environment may also affect transparency levels, making it difficult to relate to the financial performance of commercial banks. They also added that early warning systems based on macroeconomic variables are also assumed important tools to systematically detect banking stability/distress. Sufian (2010) analyzes the determinants of the bank performance in Korea between 1994 and 2008 using macroeconomic variables (inflation and GDP) and industry specific variables (banking sector concentration).

The result of his study showed inflation has a significant pro-cyclical impact, the GDP has a counter-cyclical influence, and the banking sector concentration has a negative impact upon the profitability of the Korean banks.

A study by Xiaoxi Zhang and Kevin Daly examines the impact of bank specific and macroeconomic factors on the performance of Chinese banking from 2004 to 2010 and was presented on Global Economy and Finance Journal Vol. 6. No.2. September, 2013. In the study; total bank deposit and total assets were amongst bank specific determinants and GDP, inflation and bank concentration were amongst macroeconomic determinants and found a positive and significant relationship between all the above bank specific and macroeconomic variables and the bank performance except inflation in the country. A study (amongst bank specific determinats) by Halkos and Salamouris (2004); on the determinants of banking performance in Greek; showed that banks with larger assets are more profitable. A positive relationship between size and bank efficiency was also suggested by Bikker (1999) for the European banking industry. Kosmidou (2008) studied the determinants of performance for 23 Greek banks during the period 1990-2002. In his study of bank performance, he used the annual change in GDP, inflation rate, growth of money supply, stock market capitalization to total assets, total assets to GDP, and concentration as external determinants of performance. The results show that both size and the growth of GDP were positively related to banks performance, while inflation had a negative impact on banks performance. Correspondingly, a study by Delis and Papanikolaou (2009) found that bank size, industry concentration, and investment environment had a positive impact on bank's efficiency.

3. DATA AND METHODOLOGY OF THE STUDY

3.1. Data

The type of data was mainly secondary data which was collected at the national bank of Ethiopia. The data was of annual data which covered from year 2000 to 2013. The study had covered all the banks that were established before 2000 which totals 8 banks. These were Commercial Bank of Ethiopia, Construction and Business Bank, Dashen Bank, Awash International Bank, Bank Of Abyssinia, Wegagen Bank, United Bank and Nib International Bank.

3.2. Methodology of the study

3.2.1. The function form

For this research the dependent variable was BSSI which was calculated by using each CAMEL (CAMEL is defined in the definition of variables and their prior expectation part). The CAMEL and their proxies can be summarized in the following table.

Table 1. CAMEL variables and their proxies

Variable	Proxy
Capital Adequacy	$\frac{Capital}{Assets}$
Asset Quality	$\frac{NPL}{Loans}$
Management Quality	$\frac{NIE}{NII + netII}$
Earnings	ROE
Liquidity Ratio	$\frac{LiquidAssets}{Deposits}$

Where,

NPL= non performing loan

NIE= noninterest expense

NII= non interest income

NetII= net interest income

ROE= return on equity

By using the above table, the banking system stability index for each bank is calculated; and to make the value between 0 and 1, the researcher makes use of the normalization formula which is given as:

$$I_{it}^{n} = \frac{I_{it} - \min(I_i)}{\max(I_i) - \min(I_i)}$$

Where,

I_{it}^{n} : Represents the normalized value of each CAMEL for bank i at year t

I_{it} : Represents the value of each CAMEL for bank i at year t

$\min(I_i)$: is the minimum value of each CAMEL from all of the banks at year t

$\max(I_i)$: is the maximum value of each CAMEL from all of the banks at year t

But to make the higher value of BSSI represents higher stability index, it is wise to use the formula for asset quality and management instead as:

$$I_{it}^{n} = \frac{I_{it} - \max(I_i)}{\min(I_i) - \max(I_i)}$$

Once the index for each of the CAMEL is calculated, then the BSSI value for each of the banks at year t has thus been calculated by taking the average value of the CAMEL values of each of the banks in the given year.

The function form of the equation had contained both bank specific (which was used as a control variable) and macroeconomic determinants. That is,

BSSI= (bank specific variables, macroeconomic variables)

Where,

BSSI= banking system stability index

Bank specific variable which was the total asset for each bank

Macroeconomic variables include: fiscal balance, GDP growth, real interest rate, inflation, money market growth, exchange rate volatility and credit allotted to the private sector.

3.2.2. Model specification

The model was of panel regression model which included eight banks across 2000-2013 time periods. Incorporating the variables into the above function form, the tentative panel regression was as follows:

$$BSSI_{it} = \alpha + \beta_1 lass_{it} + \beta_2 rgdpg_{it} + \beta_3 defgdp_{it} + \beta_4 \inf_{it} + \beta_5 rir_{it} + \beta_6 exv_{it} + \beta_7 ltb_{it} + \beta_8 lc2p_{it} + \beta_9 \ln fa + \beta_{10} lm2 + \beta_{11} dep + \nu_i + \varepsilon_{it} \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where, i= index for banks (1, 2 …8) and t= index for time period in years (2000-2013)

$BSSI_{it}$ =banking system stability index

$lagBSSI_{i,t-1}$=lag of the banking system stability index

$lass_{it}$ =natural log of the total bank asset

$rgdpg_{it}$ =real GDP growth

$defgdp_{it}$ =total government deficit as a percentage of GDP

inf_{it} =inflation rate

rir_{it} =real interest rate

exv_{it} =exchange rate volatility

ltb_{it} =natural log of total T-bill outstanding (both bank and non bank)

$lc2p_{it}$ =natural log of total credit to the private sector

lnfa= natural log of total net foreign exchange reserve

lm2= natural log of total money supply

ldep= natural log of total bank deposits

β_1, β_2, ... B_{11}= unknown parameters of the explanatory variables

ν_i = individual specific fixed effects

ε_{it} = the error term

According to the theory, if the panel data cover heterogeneous banks and time periods, the possible correlation between the regressors and bank-specific effects, the endogeneity of regressors with respect to idiosyncratic shock and the heteroscedasticity of the disturbance term (idioscyncratic shock) would result in a biased and inconsistent estimation with Ordinary Least Square (OLS) estimation technique. The OLS estimator would result in an upward estimate of the coefficient while the within-group estimator would be downward biased. A natural technique for dealing with variable that are correlated with the error term is to instrument them. The most rational way to solve these problems is to instrument them (Blundell *et al*. 1992).

Berger *et al*. (2000) stressed that bank profitability tend to persist over time reflecting impediments to market competition, informational opacity, and sensitivity to macroeconomic shocks. Likewise, it is generally presumed that banking system stability will resume over time. This is to mean that previous (lag) years banking system stability/ instability will most likely affect this /current year banking system stability. So, it is wise to include the lag value(s) of the dependent variable as an independent variable in the given study.

Given the aforementioned problems and the persistence of the dependent variable, dynamic panel data estimation (e.g., Arellano-Bond estimation method) is the most widely used technique. A more practical form of the dynamic panel data model can be given as follows.

$$y_{it} = \alpha + \gamma y_{i,t-1} + \beta x_{it} + \nu_i + \varepsilon_{it} \quad \text{..... (2)}$$

Where, $\varepsilon_{it} \approx (0, \delta^2{}_{\varepsilon})$ and $|\gamma| < 1$.

y_{it} = the dependent variable

$y_{i,t-1}$ = the lagged endogenous variable

γ = unknown parameter of the lagged endogenous variable

x_{it} = vector of k explanatory variables

β = unknown parameter vector of the k explanatory variables

ν_i = individual specific fixed effects

ε_{it} = the error term

Introducing a lagged dependent variable complicates estimation very much, because $y_{i,t-1}$ is correlated with the error term(s). Under random-effects this is due to the presence of ν_i at all *t*. Under fixed-effects and within transformation $\Delta y_{i,t-1}$ is correlated with $\overline{\varepsilon_i}$ .Therefore, both the FE and the RE-estimator will be biased. If $y_{i,t-1}$ and x_{it} are correlated (what generally is the case, because x_{it} and ν_i are correlated) then estimates of both γ and β will be biased. Therefore, other estimation techniques other than fixed and random effect models have to be used in such instances. To confirm or refute this, the researcher compared (in the analysis section) the outputs of the fixed effect model (which was chosen over the random effect model using the hausman test) with the outputs obtained from the dynamic panel model (the Arellano-Bond model).

Arellano and Bond (1991) in their study revealed that GMM estimators are found to be unbiased as compared to GLS, OLS, and other related estimators. They proposed an efficient GMM estimator that uses instruments of which the validity is based on the orthogonality between the lagged values of the dependent variable and the errors. The technique eliminates the unobserved heterogeneity/omitted variable bias and control for possible endogeneity problem (because it is assumed that individual specific fixed effects will be eliminated) by making use of differencing of the explanatory variables except the lagged endogenous variable as instruments. The researcher makes use of GMM estimator as proposed by Arellano and Bond (1995) to ensure efficiency and consistency of the estimations. Therefore, a dynamic GMM model is adopted via the inclusion of a lagged dependent variable among the regressors to capture the persistence of banking system stability over time.

Hence incorporating the above variables in to the dynamic panel data model would look like as follows. But it is worth nothing that because of multicollinearity problem, some of the variables are removed from the tentative model. The new model would thus be given as follows:

$$BSSI_{it} = \alpha + \gamma lagBSSI_{i,t-1} + \beta_1 lass_{it} + \beta_2 rgdpg_{it} + \beta_3 defgdp_{it} + \beta_4 \inf_{it} + \beta_5 rir_{it} + \beta_6 exv_{it} + \beta_7 ltb_{it} + \beta_8 lc2p_{it} + \nu_i + \varepsilon_{it} \quad \text{.....(2)}$$

Where, $lagBSSI_{i,t-1}$ = lag of the banking system stability index

γ = the adjustment parameter

Whilst the remaining are as defined in the tentative model

3.3. Definition of variables used in the model and their prior expectation

3.3.1. The dependent variable

The dependent variable would be banking system stability indicator (BSSI). The BSSI for each bank was calculated using the "CAMEL" system. CAMEL is acronyms for: Capital adequacy, Asset quality, Management quality, Earnings and Liquidity. One has to note that there are different methods of calculating each of these variables. So, the researcher chose one method which can express the variable better.

Capital adequacy: is the ratio of a financial institution's primary capital to its assets which is used as a measure of its financial strength and stability. Regulators try to ensure that banks and other financial institutions have sufficient capital to keep them out of difficulty. This not only protects depositors, but also the wider economy, because the failure of a big bank has extensive knock-on effects. Remember that "The Capital of a Bank protects the Bank against unexpected future losses." It is proxied as

total bank's capital divided by total bank's assets. The higher this value is the higher the capital adequacy is and hence the higher will be the banking system stability.

Asset quality: is a measurement of the credit risk a borrower takes on by acquiring an asset. It accounts for the extent of Non Performing Asset in the portfolios of the banks and the extent of damage this particular asset class can have on the financial performance. It is proxied as non performing loans divided by total loans. The higher this value is the lower the asset quality is and hence the lower will be the banking system stability.

Management quality: The ability of management is reflected by the management soundness. The competence of management and personnel, policies and procedures, internal control system all are judged by applying different ratios to determine the management soundness. It is usually proxied as total noninterest expenses all over net interest income plus noninterest income. The higher this value is the lower the management is and hence the lower will be the banking system stability.

Earnings: In banking operation, the sustainability and quality of earnings is more important than quantity of earnings. Inappropriate credit risk management adversely affects both quality and quantity of earnings. If a bank can achieve strong quality and quantity of earnings, then it will be able to pay a sustainable return to its shareholders. The capability to absorb any unexpected shock arising from different risks will also be increased for strong earnings and profitability of a bank. It is usually proxied by ROA or ROE; ROE is chosen in this case as it better express profitability than ROA does.ROE is calculated as net profit of the specified bank after tax divided by total

equity of the specific bank. The higher this value is the higher profitable the bank is and hence the higher will be the banking system stability.

Liquidity: is one of the most important criteria for sound banking operation. If any bank faces liquidity crisis, there is a probable chance of bank run. So, in banking business, a certain portion of time and demand deposits has to be maintained as liquid assets. It is proxied as liquid assets divided by total deposits. The higher this value is the higher the liquidity the bank has and hence the higher will be the banking system stability.

3.3.2. The explanatory variables

3.3.2.1. Bank specific variable

Total assets: Total asset of a bank is used as a proxy for the bank size. Many papers in the literature use this variable in measuring the bank size (Afanasieff et al. 2001; Maudos and Guevera, 2004). It is assumed that strong and solvent banks have higher assets that they are able to diversify and reduce the probability of risks. Traditionally, it is common to hear "too big to fail" proverb in many situations. But in real situations an ever increase in total bank's assets may lead to positive effects on bank profitability and hence bank stability only if there are significant economies of scale; but if increased diversification leads to higher risks, the variable may exhibit negative effects. Thus, it is expected that the size of the bank on stability is uncertain. Many researchers in their research pointed out that if the size of a certain bank is extremely large its failure will have a disastrous impact on the country's economy. That is why Lanine and Vennet (2006) recommend including bank size as one of the variables in

the study of bankruptcy. Thus, keeping such type of banks to always remain stable will have a positive impact on the stability of the whole banking system.

3.3.2.2. Macroeconomic variables

Fiscal Balance: refers to the difference between total government revenue and total government expenditure. When government revenue is greater than government expenditure it usually refers to fiscal surplus and its negation what we call it fiscal deficit. It is generally presumed that higher the budget deficit is the higher it will exert negative perception on investors. Similarly, if there is a budget deficit, it is probable that government demand to borrow money from banks increases leading to an increase in interest rate. So, it is theoretically expected that fiscal balance (budget deficit in Ethiopia case) will exert a negative pressure on banking system stability.

GDP growth: GDP growth is the most important indicator that affects banking system stability of a country. It is generally presumed that GDP growth will have a positive impact on stability of the banking system. Deterioration in the growth of GDP will contribute a downturn impact on bank loans and deposits which intern will have a negative impact on banking stability. Studies done by Kaminsky and Reinhart (1999) confirmed that slowdown in output is one of the best indicators of banking crisis. They argue that adverse shocks affecting the whole economy will increase the nonperforming loans of banks and cause systematic banking crisis. Gorton, 1988 strengthen this by saying that negative shocks to the whole economy affect the solvency of bank borrowers. In such situations banks cannot accommodate their lending effectively in an economy with banks in distress; their balance sheet subsequently worsens.

Inflation: An increased rate of inflation diminishes real rates of return on bank assets and therefore induces credit rationing. Consequently, high inflation countries will have less financial intermediation (Boyd et al. 2001). While there is evidence that higher rate of inflation lead to a decrease in the quantity of bank assets and thus the quantity of credit risks, higher inflation can have a negative impact on earnings of existing borrowers thereby impairing the quality of previously extended loans. If the credit rationing effect proves to be stronger, higher inflation rates may result, ceteris paribus, in banks taking fewer risks on their balance sheets. On the other hand, not only high inflation, but also disinflation can have a detrimental impact on the financial sector and increase bank risk. Rapid disinflation in a previously high-inflation environment will result in high real interest rates that will exert a contracting influence on the economy and raise credit risk both due to shrinking profits of borrowers and increased risk incentives similar to those accompanying a rise in nominal interest rates (Mishkin 1996). In both instances, it is uncertain to conclude that inflation has a positive or negative impact on banking system stability. But in case of Ethiopia, we can expect inflation to have a negative influence on banking system stability as Ethiopia is amongst high inflation countries.

Real interest rate: refers to the inflation adjusted interest rate. It is expected that an increase in real interest rate will have a positive impact on bank returns, but will actually have a negative influence on the borrowers through increasing interest loans. That means high real interest will discourage borrowers and decrease applicants for a loan. Interest rate risk associated with changes in market interest rates constitutes a central source of market risk for banks. Besides, a rise in market interest rates, whose direct effect is an increase in bank returns for newly made or variable interest loans,

nonetheless bears a danger of increased credit risk. In the light of asymmetric information theories, higher interest rates tend to exacerbate the problem of *adverse selection* – that is, in the context of credit relationships, the selection of borrowers with high probability of adverse project outcomes, or "bad risks." High interest rates will deter potential borrowers with safe projects, so that the risk composition of the pool of loan applicants will shift toward bad risks. Moreover, a rise in interest rates will change the *ex post* incentives for borrowers inducing them to take on riskier projects (borrowers' *moral hazard*) (Stiglitz/Weiss 1981). Thus, in a setting of information asymmetries a rise in interest rates will ceteris paribus increase credit risk on banks' balance sheets. So, it is generally presumed that real interest rate and banking system stability to have a negative impact one another.

Exchange rate volatility: refers to the changes or fluctuations in the currency of one's country with respect to other countries currencies, which is calculated in most cases as the standard deviations of the 12 months exchange rates in a given year. The impact of exchange rate volatility, as it is shown unambiguously in many researchers, that it has a detrimental impact on banking system stability and the economy as well. Many argue that exchange rate volatility has contributed a significant impact on banking crisis occurred in many countries so far. The magnitude of exchange rate moves can be a risk source of its own. Excessive exchange rate volatility impairs economic and financial stability in a country and was found to have played a significant role in inducing banking crises in many countries (Lindgren et al. 1996). Given the fairly "crude" measure of exchange rate fluctuations used in subsequent empirical analysis (annual percentage change of the exchange rate), it is the meaning of these kinds of moves that our econometric model may help reveal. A sufficiently

strong depreciation of a currency can be expected to induce disintermediation and increase bank risk as depositors withdraw their money and seek to invest it in "hard" currency assets.

Money market growth: When there is a significant money market in a certain country then it is most probable that a certain adjustment of the financial system could be done by a certain entity or organization. In most countries including Ethiopia it is the central bank to exercise and execute this power. Treasury-Bills are the most powerful monetary policy instruments and securities used by central banks for such adjustments like removing excess liquidity from the financial markets. For monetary policy and liquidity management purposes, the focus is typically on treasury bills with maturities of less than a year. Such types of bills have low credit risk (virtually zero credit risk). In this research total T-Bill outstanding by both non banks and banks will be used as a proxy for money market growth. One can understand simply that, the higher the T-bills are, the higher is the probability that an adjustment is made in the financial system. It is thus theoretically expected that Treasury-securities to have a positive impact on the banking stability.

Credit growth: It can be argued that credit growth to some extent has a positive implication on current investment and economic growth. But in the long run, excessive credit boom deteriorates the banking sector balance sheet liquidity and decreases loan standards which may even lead to a financial crisis. According to Reinhart and Rogoff, 2009; credit booms have been associated with financial crises. Historically, only a minority of booms has ended in crashes, but some of these crashes have been spectacular, contributing to the notion that credit booms are at best

dangerous and at worst a recipe for disaster (Gourinchas, Valdes, and Landerretche, 2001; Borio and Lowe, 2002; Enoch and Ötker-Robe, 2007). Thus, it will be expected that credit growth has a negative impact on banking system stability.

4. ANALYSIS OF THE RESULTS

4.1. Panel unit root test

Testing for unit roots in time-series studies is common practice among applied researchers. However, testing for unit roots in panels is recent (Levin and Lin (1992), Im, Pesaran and Shin (1997), Harris and Tzavalis (1999), Maddala and Wu (1999), Choi (1999a) and Hadri (1999).

In principle, the IPS test can be used in association with any parametric unit-root test, as long as the panel is balanced and all the t-statistics for the unit-root in every cross-section are identically distributed so that they will have the same variance and mean. Then the Central Limit Theorem (CLT) can be applied. Although the IPS test requires a balanced panel, it is the test most often used in practice because it is simple and easy to use. Until now, people have only used IPS with the ADF or DF estimation equation. We apply the IPS test using weighted symmetric estimation. To do this, we estimate by simulation the variances and means of the weighted symmetric t-statistic with different values of T and lag lengths of the ADF equation, and then use these variances and means to compute the test statistics which have the standard normal distribution under the CLT.

Here, null hypothesis: there is a panel unit root

Alternative hypothesis: there is no panel unit root

Rejecting the null hypothesis is desirable, because it is assumed that the presence of panel unit root would probably lead to the problem of spurious regression.

Table 2. Panel Unit root test result

Variable	***Lag(s)***	***Prob.***	
		level	***First difference***
Banking System Stability index	0	0.0000*	0.0000*
ln bank assets	0	1.0000	0.0010*
Real GDP growth	0	0.3111	0.0000*
Deficit % GDP	0	0.0000*	0.0000*
Inflation rate	0	0.0000*	0.0000*
Real interest rate	0	0.0000*	0.0000*
Exchange rate volatility	0	0.1015	0.0000*
ln T-bills	0	0.1324	0.0000*
ln credit 2 private sector	3	1.0000	0.0230*

*denotes rejecting the null hypothesis at 1%.

As can be seen from the above output table (using e-views), though some are none stationary at level; all became stationary at first difference (even at 1% significance level) confirming that there is no problem of unit root in this study.

4.2. Diagnostic tests

4.2.1. Multicollinearity test

Ethington(2005) defined multicollinearity as an econometric problem which occurs due to the existence of a nearly exact linear relationship between two or more independent variables in the same equation. Many scholars believe that there is a serious multi-collinearity problem if the correlation between the independent variables is in the range of [0.8, 1] Kennedy (2008).

Table 3. Multicollinearity test result for the tentative model

	lass	rgdpg	defgdp	inf	rir	exv	ltb	lc2p	lm2	lnfa	ldep
lass	1.0000										
rgdpg	0.3767	1.0000									
defgdp	0.2358	-0.1983	1.0000								
inf	0.4372	0.3522	0.3908	1.0000							
rir	-0.4243	-0.3445	-0.3877	-0.9980	1.0000						
exv	0.3915	0.3043	0.2208	0.4328	-0.4033	1.0000					
ltb	0.5604	0.4328	0.5226	0.4611	-0.4611	0.1983	1.0000				
lc2p	0.6560	0.4592	0.2418	0.6182	-0.5917	0.5793	0.7146	1.0000			
lm2	0.6677	0.4652	0.3133	0.6068	-0.5839	0.5731	0.7898	0.9907	1.0000		
lnfa	0.6379	0.4298	0.4190	0.5121	-0.4977	0.6324	0.8211	0.9002	0.9437	1.0000	
ldep	0.9967	0.3786	0.2427	0.4307	-0.4185	0.3907	0.5576	0.6387	0.6529	0.6304	1.0000

Just to mention, multicollinearity problem was indeed the major headache in this research. As can be seen from the above correlation matrix table total bank's asset (lass) is highly correlated with total bank's deposits (ldep) [0.9967]; money supply (lM2) is highly correlated with total domestic credit to the private sector (lcredit2priv) [0.9907] and total net foreign exchange reserve (lnfa) [0.9437]; similarly lnfa is highly correlated with lcredit2priv [0.9002]. Thus, the researcher removed total bank's deposits, money supply and total net foreign exchange reserve from the tentative model. Hence, the final correlation matrix of the independent variables that appeared in the final model is shown below.

Table 4. Multicollinearity test result for the final model

	lass	rgdpg	defgdp	inf	rir	exv	ltb	lc2p
lass	1.0000							
rgdpg	0.3767	1.0000						
defgdp	0.2358	-0.1983	1.0000					
inf	0.4372	0.3522	0.3908	1.0000				
rir	-0.4243	-0.3445	-0.3877	-0.9980	1.0000			
exv	0.3915	0.3043	0.2208	0.4328	-0.4033	1.0000		
ltb	0.5604	0.4328	0.5226	0.4611	-0.4611	0.1983	1.0000	
lc2p	0.6560	0.4592	0.2418	0.6182	-0.5917	0.5793	0.7146	1.0000

Hence, finally as can be seen from the above correlation matrix, the threats of multicollinearity was get rid of as the correlation between these variables is less than 0.8 in all cases.

4.2.2. Arellano-Bond estimation tests

In most instances one and/ or two post estimation procedure(s) is (are) undertaken to evaluate the Arellano-Bond model (xtabond in this research case), depending on the type of standard error one chooses to apply through.[1]

The moment conditions used by xtabond are valid only if there is no serial correlation in the idiosyncratic errors. Testing for serial correlation in dynamic panel-data models is tricky because a transform is required to remove the panel-level effects, but the transformed errors have a more complicated error structure than that of the idiosyncratic errors. The Arellano–Bond test for serial correlation is reported by estat abond tests for serial correlation in the first-differenced errors. In AR(1) models, since

[1] These are:

estat abond (test for autocorrelation)

the first difference of independently and identically distributed idiosyncratic errors will be serially correlated, rejecting the null hypothesis of no serial correlation in the first-differenced errors at order one does not imply that the model is misspecified. Rejecting the null hypothesis at higher orders however implies that the moment conditions are not valid. ***But one has to note that after the one-step system estimator, this test can be computed only when vce(robust) has been used***. Here, the null hypothesis is there is no autocorrelation.

Since the researcher is using one step system estimator and did not use vce(robust), which actually is based on the standard error GMM, the estat abond result was not reported as explained above, because it is generally assumed that using GMM as standard error of the estimate will remove the problems of autocorrelations and other problems as well. [2]

The reliability of econometric methodology depends critically on the validity of the instruments, which can be evaluated with Sargan's test of overidentifying restrictions, asymptotically distributed as $\chi 2$ in the number of restrictions. A rejection of the null hypothesis that instruments are orthogonal to the errors would indicate that the estimates are not consistent (Baum *et al*. 2010).

The estimator in xtabond can produce consistent estimates only if the moment conditions used are valid. Although there is no method to test if the moment conditions from an exactly identified model are valid, one can test whether the overidentifying moment conditions are valid. estat sargan implements the Sargan test of overidentifying conditions. For one-step non-robust /GMM/ standard error

[2] estat sargan (orthogonality) test

estimation, the Sargan statistic is reported, which is the minimized value of the one-step GMM criterion function. For one-step robust estimation and for all two-step estimation, the Hansen J statistic is reported, which is the minimized value of the two-step GMM criterion function, and it is robust. As GMM estimators, we have one- and two-step variants, with two-step estimates asymptotically more efficient. However, the dependence of the two-step weight matrix on estimated parameters makes asymptotic distribution approximations less reliable. In the xtabond command, the two-step estimates of the standard errors tend to be severely downward biased, or the t-ratios tend to be upward biased. In addition to this, one has to note that two step system estimator, is used only if there are large number of individual groups under the study, otherwise it would be seriously biased. Hence, in this research since there are only little individual groups (only 8 banks are under the study), the researcher find it crazy to use the two step method, and would thus rely on the results of one step estimator. Here, the null hypothesis is overidentifiying restrictions are valid. Rejecting this null hypothesis implies that we need to reconsider our model or our instruments.

Estat Sargan (Orthogonality) Test Result

Sargan test of overidentifying restrictions
H_0: overidentifying restrictions are valid
Chi2(67)[3]= 75.9985
Prob>chi2= 0.2113

As one can see from the above output table the probability is quite large (0.2113 which is quite greater than 0.05), implying the null hypothesis of over identifying restrictions are valid

[3] *Chi2(67) is a x^2 distribution with df=67*

is to be accepted. This intern meant that the instruments that have been undertaken are so good enough to express the given model. This confirms that the model is appropriately specified and hence, one can undertake the analysis based on this model.

4.3. Fixed effect model estimation result

Table 5. Fixed effect model estimates

Banking System Stability Index (BSSI)				
Variables	Coefficient	Std. Error	t-statistics	Prob.
C	110.9809	54.28145	2.04	0.044**
Lag BSSI	29.924	9.630347	3.11	0.003*
Ln bank assets	-16.06491	5.287528	-3.04	0.003*
Real GDP growth	.9917701	.5134609	1.93	0.057***
Deficit % GDP	-.0047529	.77615	-0.01	0.995
Inflation rate	-5.264995	3.051503	-1.73	0.088***
Real interest rate	-5.200447	3.019571	-1.72	0.089***
Exchange rate volatility	2.028143	6.091525	0.33	0.740
Ln T-bills	-4.751577	6.982005	-0.68	0.498
Ln credit 2 private sector	14.3431	6.281043	2.28	0.025**
R-sq: within = 0.3032, , between = 0.0129 overall = 0.0633		**F test that all u_i=0: F(7, 87) = 3.41 Prob > F = 0.0029**		
		corr(u_i, Xb) = -0.7650 F(9,87) = 4.21 Prob > F = 0.0002		

*, ** and *** denotes the rejection of the null hypothesis at 1%, 5% and 10% level respectively.

As can be seen from the above fixed effect model[4] result, the bias of the estimates is clearly proved at least in one variable. For instance, the coefficient of the lag of the dependent variable is so much exaggerated figure (29.924) which one can never accept, because it is generally expected that the coefficient of the adjustment parameter to lie between 0 and 1. As was well said in the model specification part, the estimates of fixed effect and random effect models will be seriously biased, as the lagged dependent variable will be correlated with the error term(s). So, the researcher was dependable on the outputs of the Arellano-Bond estimation results rather than the outputs of the fixed effect model.

4.4. Arellano-Bond estimation result

Table 6. Arellano-Bond estimates

Banking System Stability Index (BSSI)				
Variables	Coefficient	Std. Error	t-statistics	Prob.
C	113.6304	52.23182	2.18	0.030**
Lag BSSI	.2701168	.1004501	2.69	0.007*
Ln bank assets	-13.66853	5.767684	-2.37	0.018**
Real GDP growth	.9152226	.4948564	1.85	0.064***
Deficit % GDP	-.0624034	-.742488	0.08	0.933
Inflation rate	-4.998165	2.972372	-1.68	0.093***
Real interest rate	-4.940745	2.945467	-1.68	0.093***
Exchange rate volatility	1.58562	5.788759	0.27	0.784
Ln T-bills	-5.099646	6.617775	-0.77	0.441
Ln credit 2 private sector	12.3969	6.46368	1.92	0.055***
One-step results		**Number of instruments =**	**77**	
Wald chi2(9)	**= 34.88**	**Prob > chi2**	**= 0.0001**	

*, ** and *** denotes the rejection of the null hypothesis at 1%, 5% and 10% level respectively.

[4] (which of course has been chosen over random effect model using the hausman test)

Contrary to the fixed effect model, the Arellano-Bond model[5], did not seem to be biased. For instance, the coefficient of the lagged endogenous variable is found to be 0.2701168, which satisfies the required assumption (i.e, lied between 0 and 1). In addition, the probability of the chi2 is very much significant (0.0001), showing the model is quite acceptable. Similarly, the lagged dependent variable is so much significant signifying that the dynamic panel data model (Arellano-Bond model) was a good choice.

The Arellano-Bond estimation result revealed that the significant variables that affect the banking system stability in Ethiopia are total bank's assets, the growth rate of real GDP, annual inflation rate, real interest rate and total credit to the private sector whilst government budget deficit, exchange rate volatility and t-bills are found to be insignificant in affecting the banking system stability in Ethiopia.

As one can see from the above result the lagged dependent variable is positive and significant at 5% with probability value of 0.007 and hence was found to affect the banking system stability/ instability aspects this year in the same direction. That means if the banks are instable in the previous year, it is found that the banks in the current year will be instable as well. Similarly, if banks in the previous year are stable, it is revealed that banks this year will be stable as well. The coefficient of the lagged endogenous variable is 0 .2701168 (this finding is close to the estimate reported in Gibson (2005) for Greek banks) meaning that the speed of adjustment towards equilibrium is about 27%. According to Panayiotis Athanasoglou and Sophocles Brissimis and Matthaios Delis, june 2005; a value of γ between 0 and 1 implies that

[5] (which of course was found to be fit using sargan test)

profits persist (which in this case is banking system stability persists), but they will eventually return to their normal (average) level. In addition, according to them, a value close to 0 means that the industry is fairly competitive (high speed of adjustment), while a value of γ close to 1 implies less competitive structure (very slow adjustment).

The control variable that is, the total bank's assets (bank size); was found to affect the banking system stability in Ethiopia negatively. The coefficient of this variable in relation to the banking system stability was found to be -13.66853 which is negative and significant at 5% level with probability of 0.018. This implies that a percent increase in the total bank's assets had a downturn impact on the banking system stability by about 0.137% (bank size and banking system stability were negatively related in Ethiopia in the study period). The effect of bank size on banking system stability was reported unpredictable depending on the economies or diseconomies of scale that the specific country is experiencing. In the case of Ethiopia, there is actually a diseconomies of scale [kosmidou *et al*. (2004) found, large banks have more emphasis on reducing fixed assets in order to generate profit. In contrast to this finding, Tamiru Belete (2013) has found that Ethiopian commercial banks are incurring significant costs to acquire fixed assets in order to gain depositors reliability. This will magnify the opportunity cost difference between rent and acquisition of fixed assets.] in that larger and monopolized banks tend to experience banking system instability as compared to smaller banks. The other reason for this result may be due to the fact that it made them difficult for the larger banks, relative to smaller banks, to manage all/ most of the banking activities that are being taking place, hence making the operation inefficient. For instance, the forced mergers and

acquisitions of banks in Nigeria in 2006, where the number of banks were reduced from 89 banks to 24 groups of banks in 2006, caused the returns of the banks to decline. Shih (2003) argues, that the acclaimed synergy from banks' mergers is not automatic, and that the returns from the bank merger are more likely to be negative than positive. Similarly, the works of Staikouras and Wood (2004) and Ani *et al.* (2012) stressed that growing banks may face diminishing marginal returns which will cause average profits to decline with size which thus contribute the banking system to be unstable.

The other and most important variable that affects the banking system stability in Ethiopia was the growth of real GDP. The coefficient the growth rate of real GDP is positive and significant at 10% with probability value of 0.064 which is in line with the theoretical expectation. The value of the coefficient is 0.9152226 which can be interpreted as if growth of real GDP is increased by one unit then, the banking stability would be increased by about 0.915 unit. This result was not surprising in that Ethiopian nowadays is experiencing a robust economic growth more than a decade (which extends almost even to a double digit growth). Such growth, according to many scholars; contribute to the development of the banking performance. This is because, it is assumed that an ever increasing economic growth is accompanied by an increase in demand for money for consumption, investment and an increase in deposit of money and hence customers of the respective bank will draw more money from the banks and deposit more money to the banks at the same time. This will thus increase the profitability of the banks as they gain more interest income from lending to their customers. Economic growth affects the demand and supply of commercial bank services positively and hence profitability as well (Sufian and Habibullah, 2009),

Kosmidou (2006) and Hassan and Bashir (2003). An increase in profits of the banks implies an increase in the banking system stability.

Going to fiscal deficit, it is found with expected negative sign, though insignificant. Its insignificant in affecting the banking system stability is not surprising as the government of Ethiopia nowadays is increasingly dependent on loans and grants abroad to fill its budget deficit than borrowing from the Ethiopian commercial banks As, Collender who was managing director at Qorvis Communications in Washington, D.C., and was a frequent speaker on the budget and the economy (November 12th, 2008) indicated, in the economic environment efforts to control federal budget deficits are likely to take a back seat to federal policymakers' efforts to restore financial stability and economic growth. This justifies that government fiscal deficit and banking system stability are negatively related, though in case of Ethiopia as explained above that they have no any effect in affecting the stability of commercial banks.

Inflation, as can be seen from the above Arellano-Bond estimation result, was appeared to be significant at 10% level with probability 0.093 and with expected negative sign. The coefficient of inflation with respect to the banking system stability is found to be -4.998165, implying that a unit increase in an annual inflation by one unit would result in an around –4.998 decrease in the banking system stability in the country. Some researchers like, Xiaoxi Zhang and Kevin Daly (*September 2013),* had reported the same (negative and significant) result. Ethiopia, in the study periods, was experiencing severe/ rampant inflation. This type of inflation would have a negative impact on the banking system stability in Ethiopia. One reason may be through why

this happened may be due to the fact that, the high inflation make difficult for the borrowers to return back the money to the bank, thus increasing the credit risk. The other reason is suspected to be due to the fact that high inflation in Ethiopia exerts upward pressure on the national bank of Ethiopia to increase the interest rate, hence decreasing the demand for money to borrow from the Ethiopian banks [According to (Staikouras and Wood, 2003) inflation may have direct effects, for example, increases in the price of labour and indirect effects or changes in interest rates and asset prices on the profitability of banks]. In addition, as Boyd et al (2001) outlined, an increased rate of inflation diminishes real rates of return on bank assets and therefore induces credit rationing; as a result, high inflation countries will have less financial intermediation Taking all the above effects of inflation in to account, it can be said that the increased inflation would have resulted in dwindle of the banking system stability in Ethiopia.

The researcher found real interest rate as a negative determinant of banking system stability. The coefficient is found to be -4.940745 with expected sign and is also significant at 10% margin of error. This can thus be interpreted as, a unit increase in the real interest rate, would decrease the banking system stability by around -4.941. This negative impact is not a good result for the commercial banks due to the fact that their revenue generation is dependent on a larger extent on the interest income. The Ethiopian commercial banks are unlucky to gain the real returns from lending money to their customers since in these study periods on average the increase in inflation overtakes the increase interest rate. Researchers like Olga Bohachova (September 2008) also reported the negative impact of interest rate on the banking performance. But he had reasoned for this negative result as, a rise in interest rates whose direct

effect is an increase in bank returns for newly made or variable interest loans, nonetheless bears a danger of increased credit risk which tend to exacerbate the problem of adverse selection – that is, the selection of borrowers with high probability of adverse project outcomes, or "bad risks." That is simply to say that high interest rates will deter potential borrowers with safe projects, so that the risk composition of the pool of loan applicants will shift toward bad risks. On the other hand, (Stiglitz/Weiss 1981) had reasoned the negative output in a little different way as, a rise in interest rates will change the *ex post* incentives for borrowers inducing them to take on riskier projects (*borrowers' moral hazard*). Thus, by taking in to account the above arguments and inflationary pressure, it can be said that in a rise in interest rates will ceteris paribus increase credit risk on banks' balance sheets and hence on banking system stability in Ethiopia.

The above empirical result also shows that exchange rate volatility was found to have a positive impact on the banking industry in Ethiopia, but of course is insignificant. That means, the exchange rate volatility, though it has a positive sign, had had no impact on the banking system stability in Ethiopia. This was not in line with the researcher's priori expectation sign and significance. But it can be argued that, unlike many other countries (use market oriented floating exchange rate policy), Ethiopia is using the managed floating exchange rate policy approach which is set by the national bank of Ethiopia by considering different economy wide effects of currency depreciation. The positive sign of exchange rate volatility thus gives an assurance that the national bank is outlining good exchange rate policies that are comfortable for commercial banks in Ethiopia. Its insignificance in affecting the banking system stability is also acceptable because, though the Ethiopian birr is increasingly

appreciated from year to year, the appreciation within each year is not that much significant. This is in contrast to the findings of Lindgren et al. (1996) who actually found significant and negative impact of exchange rate volatility on banking performance.

Turning to treasury bills, it was found insignificant and negative. This result did not in line with the researcher's prior expectation as it was assumed that treasury bills will affect the banking system positively. The national bank of Ethiopia, in most cases, sales treasury bills to remove excess liquidity in the banking system and fill government budget deficit and it may have been effective in this respect especially in filling government budget deficit than controlling excess liquidity (as inflation was rampant). The insignificance of treasury bills in affecting the banking system stability can be guessed to be the low return nature of the treasury bills as compared to other means of generating revenue such as through lending. The negativity of treasury bills is not that much extent surprising since these types of securities has very low interest rate that it would have been better for the banks to invest their money in other high interest income generating systems like lending and purchasing bonds. In addition to this, since there was high inflation in the study periods, the real return of these low interest securities would be quite low and even negative. Studies by Yitbarek Takele, (March 2013) had reported similar result [he found that there is a negative relationship between the 6-month Treasury bill yield and financial system stability].

Regarding credit to private sector, the above output revealed that it was found to positively affect the banking system stability in Ethiopia as expected and was significant at 10% level with probability value of 0.055. The coefficient of credit to

the private sector was 12.3969, which can thus be interpreted as a one percent increase in credit to the private sector would increase the banking system stability by about 0.124%. This result is consistent with the previous finding (Sastrosuwito and Suzuki, 2011 and Belayneh, 2011); though they use total loans and advances and conclude the positive impacts on banks profitability and hence banking system stability. The positive and significant impact of credit to private sector on banking system stability was indeed expected and was of course found as such, since incase in those days on average there was a tremendous economic growth which is accompanied by an ever increasing in investment which intern was accompanied by an ever increasing in loan growth to the private sector. Thus, it can be said for sure that the Ethiopian commercial banks were indeed benefited from this loan growth through in receipt of high amount of interest income. Therefore, it can be said that, credit to the private sector in those study periods, had had contributed positively to the stability of the commercial banking system in Ethiopia.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1. Major Conclusions of the research

The research output revealed that the significant variables that affect the banking system stability in Ethiopia are: the growth rate of real GDP, last year banking system stability, total bank's assets, inflation, real interest rate and loan growth to the private sector. Real GDP growth, last year banking system stability and credit to the private sector growth were found in favor of the banking system stability; whilst total bank's assets, inflation and real interest rate were found antagonistic to the banking system stability in Ethiopia. On the other hand, the researcher found government budget deficit, exchange rate volatility and treasury bills powerless in affecting the banking system stability in Ethiopia. Though insignificant it was revealed that government budget deficit and treasury bills having a negative sign to the banking system stability; whilst exchange rate volatility having a positive sign to the banking system stability in Ethiopia .

5.2. Recommendations of the study

It is not as such hard to believe that with failure in the banking system stability, there would most probably be a failure in the economy as a whole; the effect of the financial crisis can be a prove of this argument as it resulted in world economic crisis [banking system stability and economic growth are not separable]. Hence, for the country to grow as fast as possible and to maintain this sustained growth, the national bank in its jurisdiction should: formulate good policies to the banking system, supervise and make appropriate correction measures timely and follow up the implementations of the rules and regulations consistently. Since the Ethiopian banking system is at the infant stage of development, so much work should still be done to maintain its growth and to grow even at a much faster rate to reach rural population.

The important variables that the researcher found in affecting the banking system stability positively include: lag of the dependent variable, real GDP growth and credit to the private sector growth. So based on these results, to see the Ethiopian commercial banks stable enough, it is highly advisable that we need to keep and maintain the economic growth of the country; increase the bank's loan growth so that they are able to generate more interest income; and most importantly as the current year banking system stability is highly dependent upon the last year's stability it is advisable to exert maximal effort and is useful to maintain the banking system stability for ever and a day, otherwise the effect would be severe and catastrophic (as the degree of persistence is relatively high).

On the contrary, the output of the model revealed that total bank's assets, inflation and real interest rate was found to affect the banking system stability negatively. The national bank in one way or another is able to affect and correct (at least minimize) the effects of these variables; through proposing relevant policies that is able to rush the negativity of this result. In this respect the national bank has done and is doing as such good; for instance, currently the Ethiopian annual inflation is registered to be a single digit and it is supposed that this single digit inflation would actually contribute positively not only for the banking system, but also for the economy as a whole (as inflation is directly or indirectly interconnected with many of the macroeconomic variables).

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APPENDIX

The codes of each bank in the given study are given below:

Banks	**Code**
Commercial bank of Ethiopia	1
Construction and business bank	2
Dashen bank	3
Awash international bank	4
Bank of Abyssinia	5
Wogagen bank	6
United bank	7
Nib international bank	8