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Bank Capital Regulation and Its Impact on Capital and Risk of Commercial Banks in Ethiopia

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This is to certify that the thesis prepared by Abraham Fekadu, entitled: *'the Impact of Bank Capital Regulation on Capital and Risk of Commercial Banks in Ethiopia'* and submitted in partial fulfillment of the requirements for the degree of Masters of Business Administration (MBA-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 effectiveness of risk based bank capital regulation as outlined in the Basel I framework and its national diversities, has been debated. Specifically, the arguments are related to the frameworks objective of linking bank capitalization and levels of risk involved in their asset portfolio. Within this objective of the risk based capital regulation framework, this study attempted to investigate the effectiveness of the national version of the framework followed to regulate banks' capital in Ethiopia. The study is framed around the competing and yet unsettled theoretical arguments and empirical findings on bank capital and risk relationship and the role bank capital regulation plays. The partial adjustment model introduced in earlier works is applied to explain observed changes in the risk and capital levels. According to this model observed changes in the capital and risk levels are the results of short term adjustments made to achieve equilibrium target levels. Thus, in this adjustment process capital regulation comes with its intuitive influence on the speed and direction of adjustment. Instead of the simple panel OLS or TSLS estimations which are less consistent and inefficient, the model is estimated using the asymptotically more efficient system three stage least square method. The result revealed that adjustment in capital and risk are negatively related for Ethiopian banks. Besides, introducing a regulatory pressure variable defined as the size of the standardized capital buffer banks maintain above the minimum, found to be with significant effect only when consideration is made to the volatility of capital level. When this variable is interacted with the cross coordinating risk and capital variables, the result showed that the coordination between risk and capital adjustment is insignificant for banks with low capital buffer while it is negative for banks with high capital buffer. Besides, banks with low capital buffer prefer to adjust their capital than their risk level while banks with high capital buffer prefer to reduce their risk than increase their capital. The capital buffer size banks hold above the minimum fails to explain the variation in capital and risk adjustment preferences of banks in Ethiopia implying that the influence of the capital regulation framework is limited. Therefore, the regulator need to take measures that link capital requirement with level of risk aversion, direct its supervisory effort on those banks with low capital buffer standard and reconsider its use of enforcement mechanisms.

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Table of Contents

List of Figures

List of Tables

List of Acronyms

ASSETQUA	Asset Quality
BIS	Banks for International Settlement
BUFFER	Capital maintained in excess of the Minimum Requirement
CAMEL	Capital-Adequacy Asset-Quality Management and Liquidity
CAR	Capital Adequacy Ratio
DCAR	Change in Capital Adequacy Ratio
DRISK	Change in Risk Weighted Assets to Total Assets Ratio
EFFI	Efficiency
GDP	Gross Domestic Product
LIQU	Liquidity
NBE	National Bank of Ethiopia
NPL	None Performing Loan
NPLR	None Performing Loan Ratio
OLS	Ordinary Least Square
Provision	Loan Loss Provision
REG	Regulatory Pressure
RISK	Risk Weighted Assets to Total Assets Ratio
ROA	Return on Asset
TSLS	Two Stage Least Square
WTO	World Trade Organization
2SLS	Two Stage Least Square
3SLS	Three Stage Least Square

1. CHAPTER ONE: INTRODUCTION

1.1 Background of the Study

Capital in any entity's balance sheet is a residual item calculated as the difference between assets and those other liabilities which have more senior claims on the entity's revenue stream and (in case of failure) assets (Davis, 2010). Apart from such standard definition applicable to all firms, Francis (2006) identifies specifically that bank capital hedges the risk of lending to borrowers with varying creditworthiness and repayment behavior, and thus cover the gap between estimated and actual value of losses. Thus bank capital serves as a protection against unexpected losses, while estimated or predicted losses are covered by provisions maintained for the purpose like loan loss provision. Thereby capital reserves enable banks facing defaults to spread losses over several years and allow them to maintain liquidity, and as a result reducing the likelihood of their failures (Francis, 2006). However, others like Tarbert (2000), and Davis (2010) take the role of bank capital even further and claim that it inspire public confidence in the Banks' and overall payment system's viability by protecting uninsured depositors in the event of Bank insolvency and hence deterring depositors panics and disruption to the payment system. Thus as Raffer, (2006) puts it apart from aligning the incentives of bank owners and managers with those of the uninsured claimants, at the macro level bank capital aim at reducing bank insolvencies to safeguard a country's banking system, immunizing taxpayers in the event of bank insolvencies

It is because of this micro and macro level role of bank capital that regulations on bank capital adequacy are imposed so as to induce banks maintain sufficient levels of capital reserves (Francis, 2006). Adding further justification to this, as discussed in Stolz (2002), other commentators substantiate the imperatives of capital regulation arguing that moral hazard steaming from limited liability of banks and implicit or explicit deposit insurance give banks the incentive to take excessive probability of default.

However, this widely held view of bank capital regulation is not undisputed, as noted by Santomero (1976) the banking community contends the regulation inferring that it undermines the disciplining power of the market. They instead stress the notion of strengthening the disciplining power of market than government regulation. However, as discussed in the works of

Tarbert (2000), Santomero (1976), and Jackson (1999) the regulatory community asserts that the crucial but delicate role of banks as the central financial intermediaries leaves little or no room to rely on the market. In this regard, as discussed in the work of Santos (2000) several authors identify market failures like externalities and information asymmetry as making free banking sub optimal and instead call for regulation. In this line of argument authors like Benston et al. (1986) and Kane (1985) has shown that deposit insurance by eliminating depositors/creditors incentive for monitoring bank risk taking tends to compromise market disciplining. The premise is that as long as depositors are shielded from loss of their money in the event of bank failure by the implicit or explicit safety net, they will no longer be interested to the risk profile of banks.

This being the argument in the literature, frequently occurring bank failures has called for a practical shift in favor of stricter bank capital regulation. Besides, the bank failures have exposed the technical weakness and flaws of the then capital requirement which failed to link bank capital with their asset portfolio risk. In this regard Koehan and Santomero (1980) questioned the viability of such a flat capital requirement in its early period of enactment whereby a mere addition of capital in Banks balance sheet was assumed to provide buffer and reduce probability of default. Koehan and Santomero argued that the requirement was short of making capital levels sensitive to level of portfolio risk and technically incapable of deterring excessive risk taking behavior and increasing probability of default. .

Therefore, the need for putting a capital requirement that is sensitive and linked to the risks in the Banks' asset portfolio came to the attention of regulators. Then, in 1988 the Basel Risk Based Capital Standard came as the first attempt to link Bank capital with asset risk.

1.1.1 The Basle I Risk Based Capital Standard

Originally the initiative that lead to the development of the 1988 Basle risk-based capital standard, also called as Basel I, were to standardize bank capital regulation across the G10 countries (Jacques and Nigro, 1997). The need for the standardization, as discussed by Tarbert (2000), was in response to the growing international and cross border banking activities where by Banking became international in its scope while its regulation was national level. Accordingly the Basel Accord was signed by the G10 countries and was intended to apply only to internationally active banks (Stolz, 2002).

However, by 1999 Basle I framework formed part of the regime of prudential regulation not only for international banks but also for strictly domestic banks in more than 100 countries, including developing countries (Hussain & Hassan, 2005).

It established a structure that made regulatory capital to be more sensitive to differences in risk profiles and off-balance-sheet exposures among banks, while lowering the disincentives to holding liquid, low risk assets (Jackson, April 1999).

The standard accomplishes this, by explicitly linking capital to risk whereby broad categories of on- and off- balance sheet assets are assigned with separate risk weights. Specifically, the standard contain four risk weight categories: 0% for government securities like treasury bills which are considered to have no default risk: 20% for assets with low credit risk: 50% for assets with moderate credit risk, and 100% for higher credit risk assets such as commercial loans. After assigning assets to the appropriate risk-weight category, the bank calculates its total risk weighted assets as the sum of the value of the asset multiplied by its corresponding risk weight. The standard also provides two definitions of capital as Tier 1 and Tier 2. Tier 1 is mainly comprised of common stock while Tier 2 includes certain types of preferred stock, loan loss provision and subordinated debt. As a final step banks must separately hold 4% Tier 1 and 2 capitals to the total risk weighted assets and a combined 8% capital of the total risk weighted assets.

1.1.2 Shortcomings in the Basle I Risk Based Capital Standard

The 1988 Basel Accord seems to have been successful in reaching its two principle aims: ensuring an adequate level of capital in the international banking system and creating a more level playing field for internationally competing banks (Stolz, 2002). But the accord also exhibited some major shortcomings. The bucket approach linked capital requirements to economic risk only insufficiently, opening up the opportunity for regulatory capital arbitrage. This tended to reduce the average quality of bank loan portfolios (Stolz, 2002).

Hussain & Hassan (2005) in their work discussed the main criticism which include among others its failure to take in to account risk reduction achievable through diversification; the possible reduction in banks' lending leading to pro-cyclicality of bank lending; its arbitrary and undiscriminating calibration of certain credit risks

Tarbert (2000) also discussed weaknesses of the standard such as the apportionment of all assets into one of four risk categories which for instance fails to acknowledge the fact that loans within the same risk categories will never exactly possess the same amount of credit risk. Jacques & Nigro, (1997) noted that conceptual weakness in the standard may undermine the relationship between changes in portfolio risk and required capital as it primarily focuses on credit risk and excludes such risks as interest rate, market and operational risk. Jacques & Nigro also noted that the standard by itself do not limit the risk in a bank's asset portfolio, rather it dictate how much capital a bank must hold, conditional up on the estimated level of primarily credit risk in a bank's portfolio.

Besides, Tarbert (2000), contend the broader applicability of the frame work arguing that the Basle Committee felt it was the most workable proxy for identifying risks facing Banks of member countries (developed) and no consideration was given to the realities of non-member countries. For instance Davis (2010) argues that the 8 per cent chosen as an appropriate quantity of capital for the minimum requirement has never been justified on a prudential or systemic risk basis. Rather, it appears that it was a figure capable of being met by banks in all the G10 nations without too much stress, and not too distant from the G10 member countries' national average capital ratio (Davis, 2010).

In this regard, Tarbert (2000), also noted that many nations, have modified the regulatory capital definition and also made special provisions to raise the 8% ratio either in specific cases or on a universal basis. There seems a consensus that the 8% figure may not be trustworthy because "regulatory measures of 'capital' may not represent a bank's true capacity to absorb unexpected losses.

The shortcomings of the 1988 Accord led the Basel Committee on Banking Supervision to release a first consultative package on a new, more risk-sensitive accord in June 1999 and a second revised version in January 2001. Whereas the old accord focused on capital regulation, the new proposal consists of three mutually reinforcing pillars: minimum capital requirement, supervisory review process, and market discipline. Nevertheless, the calculation of minimum capital requirements is stile the focus.

1.1.3 Bank Capital Regulation in Ethiopia

The agreement reached in 1905 between Emperor Minilik II and the representative of the British owned National Bank of Egypt marked the introduction of modern banking in Ethiopia (NBE, 2009). As per the same source, following the agreement, the first bank called Bank of Abysinia was inaugurated in Feb.16, 1906 by the Emperor.

Then the Ethiopian Monetary and Banking law that came into force in 1963 separated the function of commercial and central banking creating National Bank of Ethiopia and commercial Bank of Ethiopia (NBE, 2009). Moreover, as per the NBE source, it allowed foreign banks to operate in Ethiopia limiting their maximum ownership to be 49 percent while the remaining balance should be owned by Ethiopians. The National Bank of Ethiopia with more power and duties started its operation in January 1964(NBE, 2009). Following the incorporation as a share company on December 16, 1963 as per proclamation No.207/1955 of October 1963, Commercial Bank of Ethiopia took over the commercial banking activities of the former State Bank of Ethiopia. It started operation on January 1, 1964 with a capital of Eth. Birr 20 million (NBE, 2009).

Following the declaration of socialism in 1974 the government extended its control over the whole economy and nationalized all large corporations. The financial sector under the socialist constituted only 3 banks and each enjoying monopoly in its respective market which are the National Bank of Ethiopia (NBE), the Commercial Bank of Ethiopia (CBE), and the Agricultural and Industrial Development Bank (AIDB)(NBE, 2009).

Following the demise of the Dergue regime in 1991, the new government declared a liberal economy system and in line with this, Monetary and Banking proclamation of 1994 established the national bank of Ethiopia as a judicial entity, separated from the government and outlined its main function (NBE, 2009).Furthermore, Monetary and Banking proclamation No.83/1994 and the Licensing and Supervision of Banking Business No.84/1994 laid down the legal basis for investment in the banking sector (NBE, 2009).

Following its re-establishment, the Bank has issued several directives that are intended to underlay the legal framework of its regulation and form the bank regulation regime of the country. Among the directives issued at that time the Licensing and supervision of Banking

Business Directive No. SBB/9/95 established the national version of the Basle I -like capital regulations. The frame work enacted most elements of the Basle I Risk Based Capital Standard with some modification. Among others, the directive provided the country's version of regulatory capital definition and its components. Unlike the Basel I accord it followed a single tire regulatory capital definition. This could be regarded as a revision made in recognition to the reality of the county since the components in the Basle's accord Tier 2 capital such as preferred stock and subordinated debts are non-existent in the country. However, the directive followed the Basel I accord in other respects including the classification of banks' assets in to four risk categories, off-balance sheet exposures and the 8% minimum regulatory capital to risk weighted asset requirement.

The directive has not been revised since its enactment, despite the above discussed limitation of the Basel I risk-based capital standard and subsequent revisions made to it and its final replacement in 2006 by Basle II.

1.2 Research Problem

Basle I like risk based standard is assumed to promote solvency of banks and stability of financial system mainly by linking the required amount of bank's capital to a measure of the bank's risk-weighted assets. However, in practice the requirement may not work as intended.

As discussed under the shortcomings of the Basle standard section above, the literatures have not yet reached at conclusive answers as to the effectiveness of the Basle I or its national variety. On the other hand, due to the observed weakness in the standard it was replaced in 2006 by Basle II standard,

In contrary to such developments, the standard has not been revised or replaced by new one in Ethiopia; it seems that the NBE has not felt the need for changing the standard. Given the absence of conclusive theoretical or empirical evidences and lack of local evidence on the subject, the continuation of the standard is open for questioning and warrant investigation.

Probably the requirement could be adequate in Ethiopian context. Besides, as noted by Jackson (1999) capital requirements affect bank capital dynamics differently in different economies, different stages of the business cycle and in the short, or the long run. However, in order to make any claim as to the effectiveness of the standard in Ethiopia, proof of reliable empirical investigation is needed. Hence, this study is conducted to offer the required empirical evidence and move the issue a step forward.

Therefore, the research problem is formulated as 'assessment of the impact that the risk based capital standard followed by the NBE has on the capital and risk decisions of commercial banks in Ethiopia'. .

1.3 The Research Questions

Based on the discussion, the research questions of the study are framed as:

1. How do the minimum capital requirements as set by the National Bank of Ethiopia constrain asset portfolio choice of Banks proportionate to their capital levels?
2. How do Banks respond to the pressure exerted by the minimum requirement, is it by increasing their capital levels or reducing their portfolio risk?
3. How does the size of the capital buffer banks maintain in excess of the minimum influence banks' response to the pressure exerted by the minimum requirement?

1.4 Objective of the Study

The general objective of the study is to evaluate the effectiveness of the Basel I like risk-based capital regulation implemented by the National Bank of Ethiopia in influencing the capital level and risk taking behavior of commercial banks. The specific objectives of the study are to:

- Investigate if the regulatory pressure brought by the standard induces banks to raise their capital level proportional to the added level of risk;
- Determine the interaction between capital and risk adjustment of banks;
- Determine if the size of the capital buffer that banks hold in excess of the minimum influence their risk and capital adjustment behavior;
- Investigate that Banks demonstrate uniform risk taking behavior that justifies the use of standard capital requirement than bank specific requirement; and
- Identify the need for improvements in the current bank capital regulation framework.

1.5 Hypothesis of the study

The hypothesis are formulated in a direct link to the objectives of the study outlined above and in line with the theoretical propositions discussed in the next chapter regarding the effect of bank capital regulation on banks' capital and risk adjustment, and the differential impact that bank capital regulation has on high and low buffer capital banks.

H0: An increase in regulatory pressure has no any effect on the level of bank capital and risk

H1: An increase in regulatory pressure will positively (negatively) impact the level of capital (risk) if the parameter associated with the variable REG is significant and positive (negative) on the capital (risk) equation.

HO: Adjustments in bank capital and risk levels have no impact on one another.

H2a: Adjustments in capital and risk are positively related for banks with high capital buffers as banks with high capital buffers try to maintain their capital buffers. For this hypothesis to hold, the sign of the DCAR (DRISK) variable should be positive in the risk (capital) equations.

H2b: Adjustments in capital and risk are negatively related for banks with low capital buffers as banks with low capital buffers try to rebuild their capital buffers or increase their risk hoping to build their capital from possible higher return. For this hypothesis to hold, the coefficient estimate of the variable DCAR*REG and DRISK*REG in the capital and risk equation, respectively should be negative and significant.

HO: The size of bank capital buffer has no effect on the adjustment speed of capital and risk.

H3a: Banks with low capital buffers adjust capital faster than banks with high capital buffers. For this hypothesis to hold, the coefficient estimate of the interactive variable CAR_{it-1} *REG should be negative and significant.

H3b: Banks with low capital buffers adjust risk faster than banks with high capital buffers. For this hypothesis to hold the coefficient estimate of $RISK_{it-1}$*REG should be negative and significant.

1.6 Scope of the Study

The scope of this study covers bank capital and risk taking behaviors as represented by the observed changes and dynamics in the regulatory specified capital levels of banks and risk weighted assets. The components of the regulatory capital are derived from the NBE's directive specifically issued for the risk-based regulation of banks' capital. Similarly, the term risk and its measure used in this study are based on the NBE's definition of risk in the same directive. It is not under the scope of this study to investigate the optimality of the regulatory required level of capital. The study has no objective of investigating the complete set of bank capital and risk levels determinants. Thus, in its scope the study mainly focuses in investigating the impact of capital regulation as one of bank capital and risk determinant variables. Finally, this study's assessment of bank capital regulation impact is limited to its micro bank level effect and doesn't embrace macro or systemic level stability impact of capital regulation.

1.7 Limitation of the Study

This study is not free from constraint and is subject to the following limitations:

- Clearly the absence of similar prior study in Ethiopia or inadequacy of such study in developing countries reduces the reliable selection of conditioning variables because most of the variables used in those studies of the developed countries are nonexistent in developing countries like Ethiopia.
- Related to the above as noted by Jackson (1999) given the difficulty of controlling econometrically for all factors even when they are identified, attributing the effects of a capitalization dummy to its influence on a bank's long run target or its short run speed of adjustments are likely to be beyond the ability of the model to discern.

1.8 Significance of the Study

As per the researcher access and knowledge there are no researches conducted in Ethiopia regarding bank capital regulation specifically focusing on the Basel I equivalent capital regulation framework followed by NBE. Therefore, by examining the issue, this study has attempted to identify the strength and weakness of the framework and improvements required.

Currently, the government of Ethiopia is negotiating for WTO membership which many commentators consider as an indicator for the possible opening of the Banking sector for foreign Banks in the near futures. In this regard, Bezabeh and Desta (2014) have noted that the relation between liberalization and Banking crises, a reason usually mentioned for not opening the sector for foreign investors, depends strongly on the strength of capital regulation. Specifically, Eshete et al. (2013) have examined the Government's economic policy and strategic direction and noted government's commitment to strengthen the regulatory capacity of the Central Bank. Therefore, the findings and implications of this study are timely relevant and provide inputs that supplement Government's effort to upgrade the regulatory capacity of the Central Bank.

In addition to the above mentioned practical significance of the study, it fills the knowledge gap regarding the regulation of bank capital in Ethiopia which is currently void in the literatures. It also adds to the existing limited empirical evidences on the effectiveness of Basel like capital regulation framework on developing countries. It lays the ground for academicians and researches for a further investigation of the subject in Ethiopian context.

1.9 Organization of the Thesis

This study is presented organized into five chapters. Chapter one presents introduction, statement of the problem, objective of the study, research question and hypothesis, scope and limitation, and significance of the study. Following on this, chapter two of the study presents review of theoretical and empirical literatures. Chapter three presents the research methodology. Then, chapter four present results and analysis of the study and finally, chapter five present conclusions and implications of the study.

2. CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter presents the existing theories and empirical works related to bank capital regulation, capital and risk levels of banks which this study attempts to investigate. It discusses the competing theoretical arguments and empirical evidences in a manner that establish the framework for examining the relationship between capital regulation and observed changes in banks capital and risk levels as well as the effectiveness of the Basle I like bank capital regulation in Ethiopia. The first part reviews theoretical papers. The second part reviews the empirical literature.

2.2 Theoretical Literature

The review of the theoretical literatures are presented organized in terms of their proposed explanations on the relation between capital regulation and bank capital dynamics, and bank capital regulation and risk taking behavior of banks. The flow of the discussion is structured to start from the general financial intermediation and its regulation to the specific bank capital regulation and bank behavior.

2.2.1 The Need for Financial Intermediation

The traditional economic theories disregard financial intermediations due to their assumptions of complete and frictionless market which leave no room for financial intermediation. In such an ideal market creditors and borrowers can directly transact without the need for any financial intermediary. However, the world we live in is quite different from that envisioned in the traditional theories and evidences the increasing influence of financial intermediaries' in the economy (Santos, 2000).

Relaxing earlier theories assumptions of frictionless market, contemporary theories of financial intermediations explain why banks and their intermediation function exist. For instance researchers like (Bryant (1980) and Diamond and Dybvig (1983)) identify liquidity provision as one of the valuable functions they provide to depositors who face uncertainty regarding their future consumption pattern. Therefore, depositors keeping their money with banks are insured on the liquidity of their deposit to meet shocks in their consumption need. In addition to this, banks are valuable as providers of monitoring services because they act as delegated monitors to investors and thus avoid the duplication of monitoring costs (Diamond, 1984). In this second line of explanation banks lend the depositors money to borrowers and relive depositors from the screening, selection and monitoring of borrowers' in the face of borrowers superior information regarding their investment. Hence, information asymmetry drives the need for liquidity and monitoring services of banks arising from depositors' incomplete information regarding their future consumption shock and prospects of borrowers' investment.

2.2.2 Rationales for Bank Regulation

As Diamond and Rajan (1998) explained in their model both depositors and borrower value the liquidity services offered by banks. Depositors value liquidity because they don't know for sure when they will need to decrease their holding of financial assets to finance their consumption or transfer in to other form of asset. Similarly, borrowers want to have continuous source of funding to mitigate uncertainty regarding their future added funding need. Therefore, banks will be there to assure the liquidity need of both parties, which technically result in banks' balance sheet with short term liquid liability used to finance less liquid medium to long-term asset.

The problem is that banks never know with certainty how many borrowers will default or how many depositors will need to make withdrawals at a given point in time. If many borrowers happen to default simultaneously or if a large number of depositors decide to withdraw cash at the same time, the bank will face a situation of capital deterioration and risk not being able to repay all of the depositors. At the extreme, the bank will become insolvent and a bank run will ensue. Ultimately, contagion of bank failures will create a systemic crisis in the economy.

Therefore, as Hellmann et. Al. (2000) put it, banking crises are important not just because of the devastation that they bring to one particular sector of the economy, but because typically the shock waves affect the entire economy. It is this risk of a system failure that forms the basis for the regulation of banking business.

Another common rationale for banking regulation comes in the works of Dewatripont and Tirole (1993a, 1993b) which build on the problems that the separation of ownership from management raises for corporate governance. Their argument is that banks, like most businesses, are subject to moral hazard and adverse selection problems. Therefore, it is important that investors monitor them. Monitoring, however, is expensive and requires, among other things, access to information. Furthermore, it is wasteful when duplicated by several parties. In the case of banking, this is complicated by the fact that bank debt is mainly held by unsophisticated depositors without the necessary information to perform efficient monitoring. In addition, because most of them hold only a small deposit they have little incentive to perform any of the functions that monitoring a bank would require. This free–riding problem creates a need for a private or public representative of depositors. That need can be met by a regulation that mimics the control and monitoring that depositors would exert if they had the appropriate information, were sophisticated and fully coordinated

2.2.3 Capital Regulation and Bank Behavior

Taking in to account the justification for regulation discussed above Bhattacharya and Thakor (1993) identifies two broad aims that many bank regulations target to achieve. In the first category we find deposit insurance, central bank lending, lender of last resort which are aimed at reducing system failure. While in the second category tools like regulatory monitoring and supervision, asset proscription, capital requirements, liquidity and reserve requirements, loan valuation and loss provisioning etc. are aimed at combating the moral hazard

Therefore bank capital regulation is one of the tools which in combination with other tools implemented to ensure that banks maintain reasonably optimum capital which absorb any unpredicted losses and ensure their solvency while indirectly limiting the incentives for excessive risk taking.

However, the view that regulatory required minimum capital levels induce prudential bank behavior and enhance solvency of banks is not theoretically undisputed. The theoretical arguments regarding higher capital requirements by regulators and their effectiveness in inducing prudential bank behaviors and ensuring solvency of banks are discussed next. The major theoretical arguments selected are those commonly referred in the ligatures as moral hazard, charter value, and capital buffer theories.

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2.2.3.1 Moral Hazard Theory

The theoretical works under this strand of the literatures are mainly concerned with explaining the moral hazard problem supposed to arise from implicit and explicit public safety net like deposit insurance, limited liability of bank shareholders and asymmetry of information. They attempt to explain how mispriced deposit insurance induce capital reduction and excessive risk taking behavior by banks and the role higher flat capital requirement play in curbing such less risk averse bank behavior and drives toward prudential bank behavior. Specifically they examined if capital requirements act as a binding constraint on bank behavior by exposing shareholders to more downside risk and reduce both incentives for risk taking and the frequency of bank failure.

The literature begin with Merton (1977), followed by other authors such as Pyle (1984) who have studied the adverse incentive effects of deposit insurance with the help of option pricing model. This strand of the literature has shown that when deposit insurance under-prices risk as is the case with flat insurance premium, banks seeking to maximize the value of their stockholders' equity will attempt to maximize the option value of deposit insurance by increasing leverage and/or asset risk thereby increasing the probability of failure.

Using the option model, Furlong and Keeley (1989) theoretically examined the effect of more stringent capital regulation on bank asset portfolio risk. In their analysis Furlong and Keeley showed that for a value-maximizing bank, incentives to increase asset risk decline as its capital increases. Thus, as long as regulatory efforts to contain asset risk and size are not reduced, more stringent capital regulation unambiguously reduces the expected liability of the deposit insurance system.

Apart from the option model, other authors analyzed the effect of flat capital requirement on the risk taking behavior of banks using portfolio models. Using this model, Koehn and Santomero (1980) argued that regulating bank capital through ratio constraints is not an adequate tool to control the riskiness of banks and the probability of failure. In their analysis, Koehn and Santomero demonstrated that the distribution of risk of failure for the banking industry will possess a higher dispersion than before the imposition of regulation. Furthering their analysis Koehn and Santomero argued that as the subject of a higher required capital are those which are less risk averse, the imposition of a higher required capital-asset ratio on these banks may well have a perverse effect. Thus they recommended some other instrument to control the probability of failure, such as asset restrictions.

Building on the Koehn and Santomero (1980) portfolio approach, Kim and Santomero (1988) evaluated the effectiveness of capital regulation in an industry that is characterized by both fixed-rate deposits insurance pricing and implicit deposit guarantees. In their analysis Kim and Santomero considered both the uniform capital ratio requirement and the then new risk-related capital plan in controlling bank risk and maintaining a "safe and sound" banking system. As a result of their analysis, they showed that the use of simple capital ratios in regulation is an ineffective means to bind the insolvency risk of banks. Then as a solution, Kim and Santomero (1988) recommended restrictions on asset composition which they claimed as a "theoretically correct" risk weights and capable of altering the optimal portfolio choice of banking firms.

Keeley and Furlong (1990) criticized that the Koehn and Santomero (1980) and the Kim and Santomero (1988) type of portfolio models is inappropriate because it mischaracterizes the bank's investment opportunity set by omitting the option value of deposit insurance and the possibility of the bank failure. In their model, Keeley and Furlong's suggest that increased capital standards will not cause banks to increase portfolio risk. This occurs because an increase in capital reduces the value of the deposit insurance put option, thereby reducing the incentive for banks to increase portfolio risk levels.

However, the evidence of Keeley and Furlong (1990)'s option models was weakened by the findings of Gennottee and Pyle (1991). Using the same option pricing framework model Gennottee and Pyle relaxed the assumption that banks invest in zero net present value assets and found that there are plausible situations in which an increase in capital requirements results in an increase of asset risk.

In summary, as discussed above, authors in this strand of the literature are not in agreement as to effect of a higher required capital on the risk behavior of banks. However, in addition to authors who used the portfolio approach, the works of the last researcher in the discussion seems to have found a more plausible positive relationship between increased capital and asset risk using the same option pricing framework.

2.2.3.2 Charter or Franchise Value Theory

Though the moral hazard theory discussed above useful as it is, it has been criticized as restrictive. For instance Milne and Whalley (1998) point out some aspects of bank behavior that the moral hazard assumption cannot explain. Milne and Whalley contemplate as to why bank shareholders only rarely gamble with depositors' money? Why bank shareholders do not always extract maximum possible payouts from banks? Besides, Milne and Whalley (2001) argues that it does not allow banks to be forward looking, taking steps as necessary to increase capitalization or adjust asset portfolios in response to the possibility of a future infringement of capital regulations. Instead a more satisfactory account of bank risk-taking emerges when allowance is made for 'franchise value' i.e. a stream of future earnings with a positive net present expected value (Milne and Whalley, 2001).

As discussed in the works of Jokipii and Milne (2008) in contrast to the predictions of the moral hazard theory, the charter value theory asserts that banks have something to lose since bankruptcy leads to a loss of future profits.

Hellman et al (2000) defines franchise value as the discounted stream of future profits for the bank, a value that can only be captured if the bank stays in operation. Demsetz et. al, (1997) identify that franchise value steam from two sources which they defined as market related and bank related sources. According to Demsetz et. al, limited competition arising from regulatory restriction on entry give banks greater access to profits, secondly bank specific efficiency differences and variations in the value of lending relationships give rise to bank related source of franchisee value.

These industry specific and bank specific sources of charter value make banks to be concerned on their solvency even in the absence of capital regulation otherwise Hellman et al. (2000) argues that if the bank gambles and fails, it loses its franchise value. Hence franchise value acts like a bond or intangible capital that can act as a substitute for tangible capital and if a bank has sufficient franchise value, it will choose to invest in the prudent asset.

Therefore according to this theory banks no longer hold the minimum allowable amount of capital; rather, they have their own preferred (target) level of capitalization. Calomiris and Kahn, 1991; Diamond and Rajan, 2000)

The analysis on the role of franchise value in the bank capital and risk decision begun with Marcus (1984) who showed that the level of franchise value a bank possess determines its incentive for risk-taking. Accordingly, Marcus (1984) predicted that Banks with very low franchise value have little incentive to maintain adequate capitalization while banks with high franchise value will have the incentive to maintain adequate capital. Therefore, bank incentives for risk-taking tend to be reduced, as leverage is increased. But this works as long as the bank remains solvent and hence once the bank is insolvent then there is a marked increase in incentive for risk-taking.

Calomiris and Kahn, 1991 similarly predict two further possible characterizations of the relationship between bank capital and risk which depends on the banks own preferred (target) level of capitalization. Jokipii and Milne (2008) noted that if this level exceeds the regulatory requirements, the resulting relationship between capital and risk, appears to be ambiguous. If however, regulatory capital requirements exceed the bank's target level of capital, then a higher degree of capitalization will lead to a reduction in risk appetite whereby the charter effects become less important. Therefore, the relation between capital and risk can either be positive or negative (Jokipii and Milne, 2008).

To sum up the discussion, it is noted that charter value or franchise value is proposed as the determinant of banks behavior. Authors in this category of the literature defined charter value as the discounted stream of future profits for the bank or growth opportunity of the bank. According to this theory the relationship between capital and risk is ambiguous and can be either positive or negative.

2.2.3.3 Buffer Theory

Within the charter value literature, the buffer theory attempts to dynamically explain why banks in practice hold a capital level above the regulatory minimum against the presumptions of the moral hazard theory. According to this theory there are costs both of altering the level of capital and allowing capital to fall below the minimum required levels (Peura and Keppo, 2006).The buffer theory predicts that banks will maintain a level of capital above the required minimum called as a buffer of capital (VanHoose, 2007). As discussed in the work of Jokipii and Milne (2008) unlike the charter value theory the capital buffer theory distinguish the long from the short run relationships between capital and risk taking and the impact of regulatory capital from observed bank capital.

To better understand the impact of regulatory capital on the observed bank capital, it is worthwhile to take a look at Berger et al. (1995) discussion on the subject. Berger et al. (1995) define a bank's market capital `requirement' as the capital ratio that maximizes the value of the bank in the absence of regulatory capital requirements (and the mechanisms used to enforce them), but in the presence of the rest of the regulatory structure that protects the safety and soundness of banks. Therefore, Berger et al. (1995) specified that regulatory capital requirements are `binding' if the capital ratio that maximizes the bank's value in the presence of regulatory capital requirements is greater than the bank's market capital `requirement'. Alternatively they called this capital ratio as the `effective' regulatory capital requirement.

However, an observed capital ratio of banks higher than the regulatory minimum requirement doesn't necessarily imply that the minimum requirement is not binding. Berger et al explained this situation by reminding that the `effective' regulatory capital requirement is difficult to measure because as it may include a buffer above the regulatory capital minimum held for several reason. For instance buffer could be held to allow the bank to exploit unexpected profitable investment opportunities and to cushion the effects of unexpected negative shocks. Besides the buffer may be substantial if the regulatory penalties for falling below the minimum are very costly and if the transactions costs of raising capital quickly are very high.

An attempt to theoretically test the explanation as to why banks operate shifting their leverage above and/or closer to the regulatory capital requirement was made by Buser et al. (1981). According to Buser et al. the optimal capital level results from the value-maximization of banks which optimize over the tax advantage of deposits, bankruptcy costs and (implicit and explicit) deposit insurance premia. As a result, banks operate at leverage levels slightly above the regulatory minimum. In this model, regulatory authorities adjust implicit costs associated with asset risk and bank capital levels in order to elicit desired changes. As a result, changes in regulation allow a bank whose capital level has increased to pursue riskier investments, and a higher risk level in effect forces a bank (through regulatory pressure) to increase its capital level. Thus, regulatory action would result in de facto risk-based capital standards, and a positive association between changes in risk and capital levels among those banks for which regulatory mandates represent binding constraints.

Extending the works of Buser et al. (1981), a broader explanation was provided in Milne and Whalley (1999) and latter in Milne and Whalley (2001) in a dynamic setting with endogenous capital. In their model Milne and Whalley (2001) assumed random regulatory audit of banks and regulatory pressure on undercapitalized banks either to bear the fixed cost of new issue or to liquidate. In their analysis Milne and Whalley (2001) were able to distinguish the long from the short run relationships between capital and risk taking and the impact of regulatory capital. Accordingly, Milne and Whalley (2001) found that the short run relationship between capital buffer and risk depends on the degree of bank capitalization. For banks near their desired level (highly capitalized banks), they predicted a positive relationship, while for banks approaching the regulatory required level, they predicted a negative relationship. However, Milne and Whalley (2001) also noted that the long run relationship between the capital buffer and risk is similar to that predicted by the charter value theory, and can therefore be either positive or negative.

To sum up the discussion, the buffer theory argues that banks maintain a buffer capital above the regulatory required minimum which is a function of different factors like bank's charter value, regulatory penalty, transaction cost etc.. Besides, this theory predicts a different short term and long-term relationship between capital and risk

2.2.4 Summary of the Theoretical Literatures

In conclusion, it is noted that in the modern theories of financial intermediation, the two most prominent explanations for the existence of banks are the provision of liquidity and the provision of monitoring services. Besides, the banks' provision of liquidity services leaves them exposed to runs and this lead to depositors panic and threatens the stability of the banking system.

Building on this systemic implication of bank failure, the systemic perspective of bank regulation argues for the use of mechanisms that ensure the all time liquidity of banks and reduce their failure and systemic instability. On the other hand, the depositors' representation perspective of bank regulation is concerned on the inability of depositors to monitor banks. Therefore proposes regulation of banks by government on behalf of depositors.

Bank capital regulation is proposed as one of bank regulation tool to induce prudential bank behavior where by the capital requirement induces banks to held optimal capital commensurate with their asset risk. However, as discussed above there is no theoretical consensus as to such effect of bank capital regulation. Of the three broad theoretical categories discussed above the moral hazard theory proposes positive effect of capital requirements on risk taking of banks i.e. a higher capital requirement induces higher risk. The charter value theory argues that the determinant of bank capital and risk taking decision is the magnitude of the banks franchise value than that of the capital requirement. Building on the charter value propositions, the buffer theory proposes that it is the size of the buffer capital that determines the capital and risk taking decision on the short run. Accordingly, banks with sufficient franchise value tend to maintain sufficient buffer of capital to avoid insolvency, regulatory cost of breaching the minimum and cost of raising capital at short notice.

2.3 Empirical literatures

The discussion of the empirical literature is presented between those from the advanced economies and those from the developing and emerging economies. This will help to track differences attributable to economic developments and infer those relevant to the economic state of the study area.

The empirical papers in general investigated the impact of Basle like capital requirements on banks' capital ratios and portfolio risk. Besides, selected empirical works that in general investigate the relationship between capital and risk, bank financing decisions the role of capital regulation are also covered

2.3.1 Evidences from the Advanced Economies

The literature begins with Shrives and Dahl (1992), who used several periods of cross-section data on commercial banks in the U.S. under the simultaneous equations framework mentioned before. They found that the effectiveness of risk-based capital regulations depended on how well the regulations reflected the true risk exposure of banks

Jacques and Nigro (1997) used data from the first year the risk-based standards were in effect in US (1991). Within the partial adjustment framework and simultaneous equations model, their study used a three stage least square method (3SLS). They found that the risk-based standard was effective in increasing capital ratios and reducing portfolio risk.

Similarly, Aggarwal and Jacques (1998) used three years data from the US commercial banks. In their study, they investigated the effectiveness of the Prompt Corrective Action (PCA), which defined five capital thresholds to be used in determining what supervisory actions would be taken by bank regulators. They specifically examined the impact of the PCA standards on bank capital ratios and portfolio risk levels. They found that PCA has been effective in getting banks to simultaneously increase their capital ratios and reduce their level of portfolio risk

Ediz et al. (1998) investigated the impact of bank capital requirements on the capital ratio choices of U.K. banks. They used confidential supervisory data including detailed information about the balance sheet and profit and loss of all British banks over the period 1989-95.They concluded that capital requirements affect bank behavior over and above the influence of the banks' own internally generated capital targets. They also found that banks achieve adjustments in their capital ratios primarily by directly boosting their capital rather than through systematic substitution away from assets which attract high-risk weights in the calculation of Basle Accord–style capital requirements.

Rime (2001) examined the Swiss banks' capital and risk behavior during the period 1989-1995 and found that Swiss banks close to the minimum regulatory capital requirements tend to increase their ratio of capital to risk-weighted assets but no significant impact on banks' risk-taking. They also found no significant relationship between changes in risk and changes in the ratio of capital to risk-weighted assets. They concluded that regulatory pressure induce banks to increase their capital, but does not affect the level of risk.

On the other hand, Heidet al. (2004) investigated how German savings banks adjust capital and risk under capital regulation using supervisory data collected by the Deutsche Bundes bank over the 1993 – 2000. They found that the coordination of capital and risk adjustments depends on the amount of capital the bank holds in excess of the regulatory minimum (the "capital buffer"). Banks with low capital buffers try to rebuild an appropriate capital buffer by raising capital while simultaneously lowering risk. In contrast, banks with high capital buffers try to maintain their capital buffer by increasing risk when capital increases. They concluded that their findings support the capital buffer theory.

Unlike the above discused studies, Abreu & Gulamhussen (2008) used recent data from US banks covering the period between 2000-2007 and examined the reactions of US commercial banks to regulatory pressure in terms of capitaland risk decisions. They specifically tested the efficiency of regulatory capital requirements which they defined as the requirment's capacity to make "low" capital buffersbanks rebuilt their buffers by simultaneously raising capital and lowering risk. Contrary to previous studies on the efficiency of regulatory capital requirements in reducing banks' risk taking behavior they found no evidence that increase in regulatory pressure will impact positively the level of capital and negatively the level of risk. They concluded that after a period of adjustment of the banking system to capital levels above theminimum requirements set in the Basel I framework, regulatory pressure associated with low capitalbuffers seems to lose efficiency.

Jokipii and Milne (2009) examined the relationship between short-term capital buffer and portfolio risk adjustments using panel of United States (US) bank holdingcompany (BHC) and commercial bank balance sheet data from 1986 to 2006. They found that the relationship over the sample period is a positivetwo-way relationship. Moreover, they show that the managementof such adjustments is dependent on the degree of bank capitalization.

Durrani and Cummings (2014) investigated regulatory capital requirements and bank capital buffers for the Australian banking sector. They found that Australian banks have a targeted level of capital as predicted by buffer theory. They have also identified that bank risk and bank size and return on equity are strong capital buffer determinants.

Based on the recent theoretical argument on the determinants of banks financing decision, Gropp and Heider (2008) examined the role deposit insurance and capital regulation on the capital decision of large U.S. and European banks during 1991 to 2004. They found that mispriced deposit insurance and capital regulation were of second order importance in determining the capital behavior of banks.

2.3.2 Evidences from the Developing and Emerging Economies

The study by Mitchell (1998) was conducted on the Eastern Caribbean Central Bank (ECCB) area with the objective of examining the impact of risk-based capital standards on the indigenous banks in the ECCB area during the period December 1995 and December 1996. The study found that the implementation of risk-based capital standards had no impact on bank capital and risk levels. Banks generally had capital levels in excess of the regulatory minimum.

Nachane and Ghosh (2001) investigated the impact of risk-based capital standards on the capital ratios and portfolio risks of public sector banks in India. In their study, they identified that the risk based capital standards has brought about significant increases in capital ratios and decreases in portfolio risks of banks.

Ghosh, Nachane, & Ray (2004) they assessed the determinants of risk-weighted bank capital ratios of state-owned banks in India during 1996-2002. They took bank-specific characteristics, variables at the banking industry level and general macroeconomic factors. They found that bank specific factors play an important role in influencing bank capital ratios in India

Hussain & Hassan (2005) conducted cross country study covering eleven countries, 3 from East and South Europe, 4 from Latin America and 4 from South East Asia but no African country is included. They examined the impact of Basle I and similar capital requirement regulations on banks in developing countrise. They found that such regulations did not increase the capital ratios of banks in the developing countries but it did reduce portfolio risk of banks. They also found that capital ratios and portfolio risk are inversely related in contrast to the predictions of “buffer capital theory”, “managerial risk aversion theory”, and “bankruptcy cost avoidance theory.”

Pereira and Saito (2011) investigated the main determinants of the capital buffer managementfor Brazilian banking industry using bank data from 2001 to 2009. They found that regulatory capital requirements have influence on the behavior of those banks with more volatile earnings and higher adjustments. They also found that larger banks present lower levels of capital ratios, supervision exerts positive pressure on bank’s decision while market discipline play a minor role in driving capital ratios.

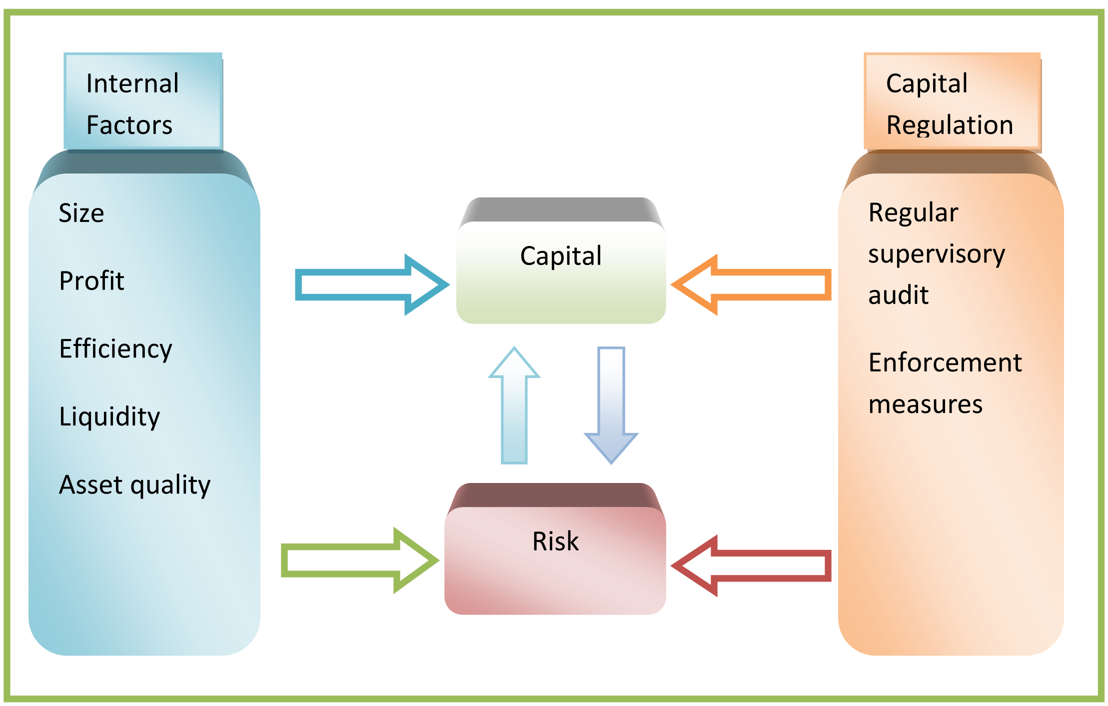
Apart from the empirical evidences from other countries, the researcher attempted to find related empirical evidences on Ethiopian banking business. However, no research work was found in general on banking business regulation of Ethiopia. The empirical works found instead are related with the determinants of bank capital structure by Shibru (2012), determinates of none performing loans by Negera (2012) and similar others which doesn’t embrace the impact of regulation in their study.

In summary of the empirical evidences discussed, it can be deduced that like the theoretical divergence regarding the relation between bank capital regulation, capital and risk, the evidences both from the advanced and developing countries are with mixed results. In the absence of conclusive theoretical explanation and empirical evidences, it is of a paramount importance to investigate to which of the arguments the Ethiopian case inclines.

2.4 Conceptual Framework

Based on the theoretical propositions discussed above the conceptual relation and interaction of bank capital regulation, capital, risk and other bank specific determinant factors can be diagrammatically framed as depicted in figure 1 below. In the framework capital and risk are simultaneously act as dependent and independent variables over one another while they are impacted by internal determinants and externally determined influences. Those proxy variables used to represent the internal factors are defined in detail in chapter there. Thus, level of bank capital and risk are the interactive results of the two variables on each other, the bank specific internal factors and the regulatory pressure brought by the capital regulation process of the regulator.

Figure 1 Conceptual framework of the interaction between capital regulation capital risk and internal factors



3. CHAPTER THREE METHODOLOGY

3.1 Introduction

This chapter provides a discussion on the methodologies used to undertake the study. First the model specification process is discussed linked with the theoretical frame work laid sown in chapter two. Then the measurement and definitions of the variables considered in specifying the model are discussed. Finally, the procedures followed in the estimation of the model are discussed.

3.2 Model Specification

The moral hazard theory discussed in the literature review section, as noted by Millen and Whilly (2001) takes capital as exogenously determined factor beyond banks own discretion. Hence, in their treatment of banks capital, authors in the moral hazard literatures maintained the conventional explanation that capital regulation constitutes the overriding departure from the Modigliani and Miller's (1958) optimal capital structure irrelevance theory. However, in the subsequent theories of charter value and buffer capital, bank capital is treated as endogenously or internally determined variable through discreet decisions of banks directed towards achieving internally determined optimal or target long term level.

In addition to the differences in the assumed internally targeted or externally determined capital levels, the three theories have also a differing propositions regarding the relation between bank capital and risk taking decision. In the traditional moral hazard literature, unlike the buffer and charter value, the presence of relation between risk and capital was not an issue of concern to theorize. Rather the issue of interest was determining the direction of the relation between the two variables as positive or negative. In other words, the focus was in explaining the possible negative or positive effect that a higher capital requirement has on the risk taking behavior of banks. However, the subsequent theories casted doubt on the widely held views that capital and risk taking decisions are interdependent either in the long-run or even in the short run period.

Hence, the empirical model of this study is specified taking the path followed by others who investigated the subject and in light of the theoretical propositions put forward in moral hazard, charter value and buffer theory.

Therefore, this study uses a simultaneous equation model first introduced by Shrieves and Dahl (1992) and subsequently modified by Jacques and Nigro (1997) to include the risk based capital standards. In this framework, observed changes in a banks' capital and its portfolio risk are assumed to be a function of two components; one part which is managed internally by the bank plus an exogenous random shock. The model, with simultaneously determined variables, can be written as follows

$$\Delta CAR_{it} = \Delta^{d}CAR_{it} + e_{it} \text{ ....(1)}$$

$$\Delta\ RISR_{it} = \Delta^{d}RISK_{it} + u_{it} \text{ ....(2)}$$

Where ΔCAR_{it} and $\Delta\ RISK_{it}$ are the observed changes in capital and risk levels, respectively, for bank i in period t or $CAR_{it} - CAR_{it-1}$ and $RISK_{it} - RISK_{it-1}$ respectively, for bank i in period t. The $\Delta^{d}CAR_{it}$ and $\Delta^{d}RISK_{it}$ represent discretionary adjustments made to capital and risk that are managed internally by the bank, and e_{it} and u_{it} are exogenously determined factors.

The framework outlined above further assumes that banks will establish an internally optimal capital and risk level that they will target over time. The long run or equilibrium, level of target capital and risk are given by:

$$CAR^{*}_{it} = \alpha(\mathcal{Z}_{it} + \mathcal{N}_{it}) \text{ --- (3)}$$

$$RISK^{*}_{it} = \beta(\mathcal{U}_{it} + \mathcal{W}_{it}) \text{ --(4)}$$

Here Z_{it} and U_{it} capture all variables (including ΔCAR_{it} in the risk equation and $\Delta RISR_{it}$ in the capital equation) that determine the banks' target level of capital; $\mathcal{N}_{it}$ and $\mathcal{W}_{it}$ represent the error term of the two equations; and α and β are the vectors of coefficients to be estimated. ΔCAR_{it} is assumed to impact the target level of risk since any short term change in the capital of the bank will affect the banks' probability of default. Similarly $\Delta RISK_{it}$ which measure a shift in the banks' risk profile will also alter the banks distance from its target level of capital.
Over time, exogenous shocks will drive actual levels away from or toward target levels. Banks will therefore need to adjust both the capital and risk level to revert back to their internally optimal long-term or equilibrium capital and risk level specified in equation 3 and 4,

respectively. This short term adjustments are depicted by $\Delta^d CAR_{it}$ and $\Delta^d RISK_{it}$. Full adjustment to the target level however, may be too costly or infeasible. The model therefore assumes partial, rather than complete, adjustment in each period. The banks discretionary adjustment can be depicted as:

$\Delta^d CAR_{it} = \alpha_0(CAR^*_{it} - CAR_{it-1})$……………………………………………………………..(5)

$\Delta^d RISK_{it} = \beta_0(RISK^*_{it} - RISK_{it-1})$……………………...(6)

Here $\alpha_0$and $\beta_0$are the speeds or the rate of adjustment of the capital level and risk respectively; CAR^*_{it} and $RISK^*_{it}$ are the target levels of capital and risk; and CAR_{it-1} and $RISK_{it-1}$capture the actual levels of buffer capital and risk in the previous period. $CAR_{it} - CAR_{it-1}$ and $RISR_{it} - RISK_{it-1}$ then represent the actual change in capital and risk between two periods while $CAR^*_{it} - CAR_{it-1}$ and $RISK_{it} - RISK_{it-1}$ denote the desired long run change. These equations highlight the fact that observed changes in the capital and risk levels in period t are a function of the differences between the target level of capital and risk in period t and previous period's actual capital and risk, and any exogenous shock.

Substituting equations (5.) and (6.) into equations (1.) and (2.) we then have:

$\Delta CAR_{it} = \alpha_0(CAR^*_{it} - CAR_{it-1}) + e_{it}$……………………………………………………(7)

$\Delta RISK_{it} = \beta_0(RISK^*_{it} - RISK_{it-1}) + u_{it}$… ……………….…………………………..(8)

We note that the observed changes in capital and risk in any given time period *t* is some fraction α_0 or β_0 of the desired change for that period. If α_0 (β_0)= 1, then the actual capital (risk) level will be equal to the desired capital (risk) level. That is, adjustment to the target level is instantaneous. If on the other handα_0 (β_0) = 0, nothing changes, since the actual level of capital (risk) at time *t* is the same as that observed in the previous period. Typically then, α_0 and β_0 will lie between these extremes since adjustment to the desired stock of capital is likely to be incomplete for several reasons like rigidities and adjustment costs. Hence the name partial adjustment model is in reflection to this. In another alternative expression of the adjustment, mechanism in equation 7 and 8 can be written as

$CAR_{it} - CAR_{it-1} = \alpha_0(CAR^*_{it} – CAR_{it-1}) + e_{it}$ ……………………………………….(9)

$RISK_{it} - RISK_{it-1} = \beta_0(RISK^*_{it} – RISK_{it-1}) + u_{it}$………………………………………..(10)

Where CAR_{it}- CAR_{it-1} and $RISK_{it}$ - $RISK_{it-1}$ representing observed changes (ΔCAR_{it} or DCAR) in capital and observed changes ($\Delta RISK_{it}$ or DRISK) in risk levels of i bank at time t, respectively. Then removing the lagged level from the dependent variables in the two equations the process will yield

$CAR_{it} = \alpha_0\, CAR^*_{it} + (1-\alpha_0)\, CAR_{it-1} + e_{it}$……………………………………………(11)

$RISK_{it} = \beta_0\, RISK^*_{it} + (1-\beta_0)\, RISK_{it-1} + u_{it}$ ……..……………………………………..(12)

showing that the observed capital and risk levels at time t are the weighted average of the desired capital and risk level at that time and the capital and risk level existing in the previous time period, $\alpha_0$and (1-α_0)in the capital equation and β_0 and (1-β_0) in the risk equations being the weights.

The target capital and risk levels are not observable but are assumed to depend upon some set of observable variables. In recognition to this, equation 11 and 12 are specified as shown below.

$CAR_{it} = \alpha_1 + \alpha_0 X_{it} + DRISK_{it} + (1-\alpha_0)\, CAR_{it-1} + e_{it}$………………………….(13)

$RISK_{it} = \beta_1 + \beta_0 Z_{it} + DCAR_{it} + (1-\beta_0)\, RISK_{it-1} + u_{i,t}$… ……………………….(14)

Where CAR_{it} and $RISK_{it}$ are the observed levels of capital and risk respectively, *i* = 1,2. . .*N* is an index of banks and *t* = 1, 2,. . . *T*, is the index of time observation for bank *i* at time *t*. The X_{it} and Z_{it} vectors capture the bank specific variables that determine the target capital and risk levels respectively.e_{it} and $u_{i,t}$ are assumed to consist of a bank specific component and white noise. In this specification the coefficient estimates of the lagged dependent variables in the capital(risk) equations will be derived by subtracting the estimated coefficient value from 1 and multiplying by(–) sine. Based on the specifications in equation 13 and 14 the selected bank specific variables that determine the target capital and risk levels captured by the vector X_{it} and Z_{it} are discussed in the next section.

3.3 Definition and Measurement of Variables

The study approached the identification of the relevant variables in terms of their influence on the bank's target levels of capital and risk and on their extraneous influence on the observed changes in the bank's capital and risk levels.

3.3.1 Dependent variables and other variables affecting the target levels of capital and risk

a) Capital (CAR)

In earlier works like Shrieves and Dahl (1992) capital is measured as the ratio of total capital to total assets. However, later works of Jacques and Nigro (1997); Ediz et al. (1998); Aggarawal and Jacques (1998); Bertrand (2000); and Abreu & Gulamhussen (2008) used the ratio of total capital to total risk weighted assets. In this study capital is measured using the later method to recognize the fact that the minimum requirement of the NBE explicitly constrains the ratio of capital to risk weighted asset than the ratio of capital to total asset. Capital represents the regulatory capital as specified in the National Bank of Ethiopia Directive No. SBB/9/95. As discussed in chapter two the relation between capital and risk is not clear and could either be positive or negative.

b) Risk (RISK)

All the previous works cited above measure risk as the ratio of risk weighted asset to total asset. The advantage of using this as Shirieves and Dahl (1992) noted is that portfolio risk is primarily determined by the allocation of assets across the different risk categories. Hence, its use better reflects bank's decision on risk taking with appropriate timeliness.

The computation of Risk Weighted Asset will follow the provision of the respective directives issued by NBE.

c) Size (SIZE)

This variable is used in all of the previous researches measured as the logarithm of total assets. It is assumed to influence target risk and capital levels due to its relation with risk diversification, investment opportunities and easy of raising new capital. Specifically, Aggarwal and Jacques (2001) pointed out that larger banks may be willing to hold less capital owing to the fact that they have better ability to raise capital if needed compared to the other banks. Besides, Hussain & Hassan, 2005 pointed out that, due to diversification benefit, larger bank will have lower risk. Therefore, the SIZE variable is included both in the capital and risk its relation with both the target level of capital and risk being subject to testing.

d) Ratio of liquid reserves to total assets (LIQUIDITY)

Unlike those studies conducted in the advanced economies, Hussain & Hassan (2005) ,who conducted their studies in developing countries included this variable both in the capital and risk equation. They noted that banks with higher liquidity ratios are faced with less risk and, hence, need to hold less capital, whereas, such banks may be willing to increase their levels of risk. Eshete et al. (2013) noted that the banking industry in ethiopia is characterzed by excess liquidity, hence this variable is included in both equations. Hussain & Hassan (2005) have also hypotheized a negative relationship between the ratio of liquid reserves to total assets and the level of a bank's capital and a positive relationship between this ratio and the level of a bank's portfolio risk.

e) Profit (ROA)

This variable is included in the capital equation by all of the empirical studies reviewed. Specifically, Aggarwal and Jacques (1998), Hussain & Hassan (2005), and Heid et al. (2004) noted that more profitable banking institutions may be able to increase their level of capital through retained hence there is a positive relationship between profit and capital. Accordingly, profitability is included in the capital equation and it is measured as the ratio of net profit to total asset in period t-1.

f) Asset Quality (ASSETQUA)

A deterioration of asset quality may put banks under pressure (Abreu & Gulamhussen, 2008). The volume of impaired or less quality assets mostly loan is expected to have implication on the lending procedure and practices of the bank and banks with high impaired loan ratio will shift their lending process to a more conservative approach. This reaction can be reflected in subsequent levels of risk as banks attempt to improve the quality of their asset portfolio by shifting from assets with 100% risk weights like loan to zero or less risk weighted asset classes. Hence, the ratio of impaired loans to total loans is used as a proxy for asset quality, with increases on this ratio putting a setback in the adjustment rate of risk towards target risk level and negatively affecting the adjustment process. Hussain & Hassan (2005) used loan loss measured as the ratio of current year loan loss provision to total nonperforming loan. In this study, the broader measurement used by Abreu & Gulamhussen, (2008) is applied, as this measure enables to capture the reaction of banks' risk adjustment from the begining stage of loan quality deteriotaion instead of at their final stage of recognition as losses.

g) Efficiency

Abreu & Gulamhussen, (2008) additionally included efficiency as the determinant variable of bank capital and risk adjustment process. Therefore in this study efficiency is included as one of the variable that determines the target level and adjustment process. Therefore, the different levels of efficiency are controlled using the cost-to-income ratio, which is modified to directly measure efficiency as 1 – (cost to income ratio) than indirectly via inefficiency. The relation between efficiency, risk and capital is not straighter but in this study its expected higher efficiency to positively impact adjustment to target level of capital and risk.

3.3.2 Regulatory Pressure (REG)

This variable is the focal of the study and needs more discussion than the others. In the literatures the regulatory pressure variable is used to measure the degree of supervisory monitoring on banks when their capital ratios approach the regulatory minimum and its effect on banks' capital and risk behavior. It is assumed that this variable takes different value according to the banks degree of capitalization.

Researchers used different ways to measure this variable for instance Jacques & Nigro (1997) measured using the dummy approach which differentiates banks' below and above the regulatory minimum. Abreu & Gulamhussen (2008)on the other hand used the inverse of the bank's capital ratio as a measure of this variable but without explicit cut-off point to differentiate low capital buffer banks from high instead they preferred to allow continuous build up of buffer. Aggarwal & Jacques (1998) used two dummy variables. One takes the value of unity if the bank is adequately capitalized according to the Prompt Corrective Action (PCA) standards and zero otherwise. The other takes the value of unity if the bank is undercapitalized, substantially undercapitalized, or critically undercapitalized, according to the PCA standards and zero.

In this study the regulatory pressure is measured in a manner close to those mentioned above using two approaches. In the first approach (here in after referred as the first approach), similar to Aggarwal & Jacques (1998) one dummy variable will be employed, but instead of the PCA standards, which is not used in Ethiopia, the CAMEL1 rating systems capital adequacy threshold is used. Accordingly, the dummy variable will be unity if the CAR level of a bank is below 15% and 0 otherwise

However, such measurement doesn't consider the volatility in the bank's capital buffer which is equally important as the distance of the ratio from the minimum as noted by Ediz et al. (1998) Therefore, the first approach is modified to form a second approach (here in after referred as the second approach) in order to measure the effect of the regulatory pressure taking in to account the volatility of a bank's CAR level. In order to capture such discriminatory effect of the regulatory pressure variable this study uses the approaches used firs by Jacques & Nigro (1997) and latter modified by Abreu & Gulamhussen (2008). Accordingly, the REG variable is measured as the inversed difference of the CAR of banks and the minimum 8%.

The interest of this study is to test two different effects of the size of the capital buffer on capital and risk adjustments. First, banks with low capital buffers may differ in the magnitude of their capital and risk adjustments from banks with high capital buffers. Hence REG is included in the capital and risk equation. Second, according to the capital buffer theory, adjustments in capital and risk are positively related for banks with high capital buffers while they are negatively related for banks with low capital buffers. In order to allow for the different relationships

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1The National Bank of Ethiopia uses the CAMEL rating system as its internal supervisory tool to monitor the solvency and overall health of banks and serves as an early warning tool for supervisory intervention. Accordingly, regulatory capital to risk weighted assets ratio > 15% is labeled as strong. Therefore, this cutoff point is applied to demarcate banks with high or low capital buffer between capital and risk based on the size of the capital buffer, ΔRISK and REG*ΔRISK (ΔCAR and REG*ΔCAR) are included in the capital (risk) equation.

And third, a test on whether banks with low capital buffers adjust capital and risk faster than banks with high capital buffers will be conducted. In order to do so, we include CAR_{it-1} *REG ($RISK_{it-1}$ *REG) in the capital (risk) equation.

In order to specify these two variables under the second approach, defining a dummy variable is required that will assume 1 for banks with low capital buffer and 0 other wise. To define this dummy a method similar to that of Heidet al. (2004) is applied. In their methods, they used the median value of the standardized buffer as cutoff point to defining low and high capital buffer banks. Accordingly, with in the second approach a dummy variable is defined as 1 for banks below the median value of the REG defined in the second approach above and 0 otherwise.

3.4 Estimation Procedures

The system of the two equations will be estimated using a three stage least squares procedures. This method is used by Jaacques and Neigro (1997), Aggarawal and Jacques (1998), and Rime (2000). This allows to take account of the simultaneity of banks' adjustments in capital and risk and to get estimates that are asymptotically more efficient than under two stage least Squares.

However, as noted by Mitchell (1998) in markets where banks hold a higher level of capital irrespective of the portfolio risk level, a simultaneous relationship may not exist between changes in capital and risk levels. Hence, it is important to test, if the data proofs the presence of simultaneous relationship between capital and risk levels using the Hausman test procedures.

If the result of the test proofs the absence of the hypothesized simultaneous relationship the two equations will be estimated separately, if however the test result is the other way round the two equations will be estimated simultaneously using a 3 stage least square methods.

As the use of the three stage least require the use of instrumental variables in place of the endogenous variables, such variables will be used for those right hand side variables found to be endogenous. For the one lagged dependent variables included in the right hand side of the structural equations, the two lagged dependent variables will be used as the instrument variables.

Then after the conduct of the tests, the estimation of the equations will be in four steps each involving separate equations specifications. The specifications in equations 13 and 14 are the baseline and estimated first denoted as specification I. the estimation result of the specification I will be used to assess the capital and risk adjustment behavior of the whole sample. Specifically the following behavior of banks could be investigated like the speed of adjustment; the interaction and coordination between the risk and capital adjustment process; and those variables identified above and their effect on the adjustment process.

In the second step the REG variable will be added to the above basic specification. The REG variable defined to see the effect that the distance of the banks' capital adequacy ratio from the minimum has on their capital and risk adjustment process is investigated using this specification. Thus this specification denoted as Specification II will be estimated to partially test hypothesis 1. In other words, estimation of specification II will help to test the effect of the regulatory pressure when banks approaching to and going far from the minimum capital adequacy ratio required by the regulator.

Then, the REG variable interacted with the lagged dependent variable i.e. CAR_{it-1} *REG and $RISK_{it-1}$ *REG will be included in specification II to form specification III. This specification is intended to measure difference in the adjustment speed of banks based on their CAR level above the minimum requirement. As REG captures adjustment effect on low buffer capital banks, the coefficient estimate of the two interactive variables reflect the adjustment speed of banks with low buffer capital. The estimation result obtained for CAR_{it-1} *REG and $RISK_{it-1}$ *REG will be applied in testing hypothesis 3a and 3b, respectively.

Finally, the interactive variables defined as DCAR*REG and DRISK*REG are included in specification III resulting in the final specification denoted as specification IV. These variables will allow capturing the coordination and interaction between CAR and RISK adjustment for banks with low capital buffer. The results obtained will be applied in testing hypothesis 2a and 2b.

The four specifications are formulated for both the capital and risk equations provided in equations 13 and 14, respectively.

3.5 Sampling Technique

The sample period covers the year from 2000 – 2014. The selection of the sample period is based on the intention to obtain estimation result that is time invariant. This in turn requires the use of longer time series. Another reason is to increase the degree of freedom and to meet the requirements of the estimation procedure. During the sample periods the total number of commercial banks that are operational is 8. From the total 8 banks, 2 of them are state owned and the remaining 6 banks are privately owned. Thus, only six privately owned and two state owned commercial banks are included in the sample. Inclusion of banks that do not have data for the whole sample period specified above would lead to unbalanced panel data which may fail to satisfy the assumptions of model which is based on balanced data. Thus, banks that are established after the year 2000 are excluded from the sample to satisfy the balanced data requirement of the model.

The data for the estimation of the model are sourced from both the NBE and the individual banks' published financial statements. The data obtained from both sources was checked for consistency and reconciled based on the published annual reports of banks.

4. CHAPTER FOUR: ANALYSIS AND RESULTES

This chapter presents the data and the descriptive analysis made on the data, estimation results of the equations specified in previous chapter, discussion, interpretation, and hypothesis test results. The first part provides descriptive statistics and their analysis which include graphical presentation of each variable and the relations with each other which provide preliminary information to understand the nature of the data, to predict the possible outcomes of the model estimation. The second part presents regression analysis and estimations of the model and the discussion and interpretation thereon.

4.1 Data Presentation and Descriptive Analysis

4.1.1 Descriptive Analysis of Dependent and Independent Variables

The descriptive statistics of the dependent variables the independent variables and other relevant variables are presented in the table 1 below. Statistics for the size of the buffer capital that banks maintain above the minimum requirement are also included in the table.

Table 1 Descriptive Statistics of Selected Variables

STAT/VARIABLS	CAR	RISK	DRISK	DCAR	BUFFER	LIQU.	NPL	ROA	EFFI	SIZE
Mean	0.17	0.60	-0.01	5.14E-05	0.09	0.35	0.108	0.02	0.40	8.316466
Median	0.15	0.61	-0.009	-0.00091	0.07	0.35	0.07	0.028	0.44	8.287707
Maximum	0.49	0.87	0.24	0.15	0.41	0.59	0.54	0.048	0.70	12.41275
Minimum	0.07	0.28	-0.15	-0.28	-0.008	0.12	0	-0.021	-0.50	4.962845
Std. Dev.	0.07	0.12	0.065	0.04	0.07	0.10	0.10	0.012	0.16	1.46785
Observations	120	120	112	112	120	120	120	112	120	120

As can be seen from the table 1 above the ratio of regulatory capital of banks to their total risk weighted assets has a mean of 0.17% and a median of 15%. Both values of the statistics are well above the minimum required ratio of 8%. Besides, the maximum ratio of the series is 49% but this figure is proofed to be exceptional. The bank with this ratio was at a start up phase of business, a period characterized by fewer loans in the asset portfolio and higher capital in the balance sheet compared to the volume of deposits. Such higher startup capital ratio drops down to a bank specific target level as the operations expand and the business grows by attracting more depositors and borrowers. The minimum ratio of the series, as can be seen in the table 1 above, is below the minimum requirement. This indicates that banks if not constrained by the minimum requirement may prefer to operate at a higher leverage ratio. This figure underpins the relevancy of capital regulation. The standard deviation of the series is also higher indicating a higher level variation and dispersion among the target capital ratio of banks. The deviation also implies that a median bank with unstable operation could hit the minimum requirement.

Table 1 above shows that the maximum risk weighted asset to total asset ratio of the sample banks is 87% while the minimum is 28%. The minimum ratio was registered by a bank which was at its business startup phase. As the mean and median value indicates in their normal states banks operate at a higher risk levels. This is due to the limited opportunities for diversified assets in the economy. Most of the risk assets ratio is accounted by loan while deposit in foreign banks is the next contributor to the risk weighted asset ratio of banks. This two asset classes are the major source of income for banks. This fact explains the observed higher risk level in the sample banks. The standard deviation of the series indicates that the risk level varies from its mean level across the sample banks and periods on a 12% basis.

The observed changes in the risk level banks denoted in table 1 above as DRISK indicates that banks experience both an upward and down ward adjustment in their risk level. The mean value of the risk adjustment indicates that the banks are characterized by a downward adjustment in their risk level on a 1% basis. The median value is also below zero at 0.09% indicating that the risk adjustment process of banks is dominated by downward shift. The maximum observed changes of the banks' risk level is 24% upward while the minimum observed change is 15% down ward. The observed changes in the risk level varies about the mean value on 6% basis

The mean value of the observed changes in the capital level of banks is closer to zero indicating that banks do in fact have a long term target capital level. In an effort to remain at their target capital level banks make an upward (downward) adjustment on 15% (28%) basis to offset shock that drive their observed capital level below (above) their target level. The deviation of adjustment across the sample bank and over the sample period is also lower at 4%. This indicates the relative stability in the banks' capital level.

The buffer capital level above the minimum required 8% has a mean value of 9% above the minimum which exceeds the minimum at about 112% basis. This implies that the mean bank maintains a strong buffer level above the minimum. The median value of the capital buffer is also makes 87% of the minimum requirement. However, the variation in the buffer size is also as large as the median value indicating the relative volatility of the capital buffer size of banks.

The mean and median ratio of liquid assets constitutes 35% of the total asset. This is a large amount compared to the minimum 15% requirement of the regulator NBE (2014) and indicates that banks are highly liquid and sufficiently with stand liquidity shock before affecting their capital basis. The 10% standard deviation about the mean value is also doesn't affect their liquidity base as the mean value is situated relatively at a higher level. However, banks operating at the minimum observed liquidity ratio of 12% are not in a good position to with stand possible liquidity shock yet this depends on the bank's specific volatility of liquidity.

The 10% mean value and the 7% median value of the impaired loan ratio to total loan is high above the minimum 5% requirement of the regulator NBE(2008) and significantly affects their assets value and may put pressure on their capital basis. The maximum observed ratio of the non performing ratio is 54% which is abnormal and indicating a poor lending practice. However, the minimum 0% ratio of the non performing loan also indicates a good lending practice. A detailed look at the raw data, which is not available in table 1 above, indicates that the ratio is in a continuous decline.

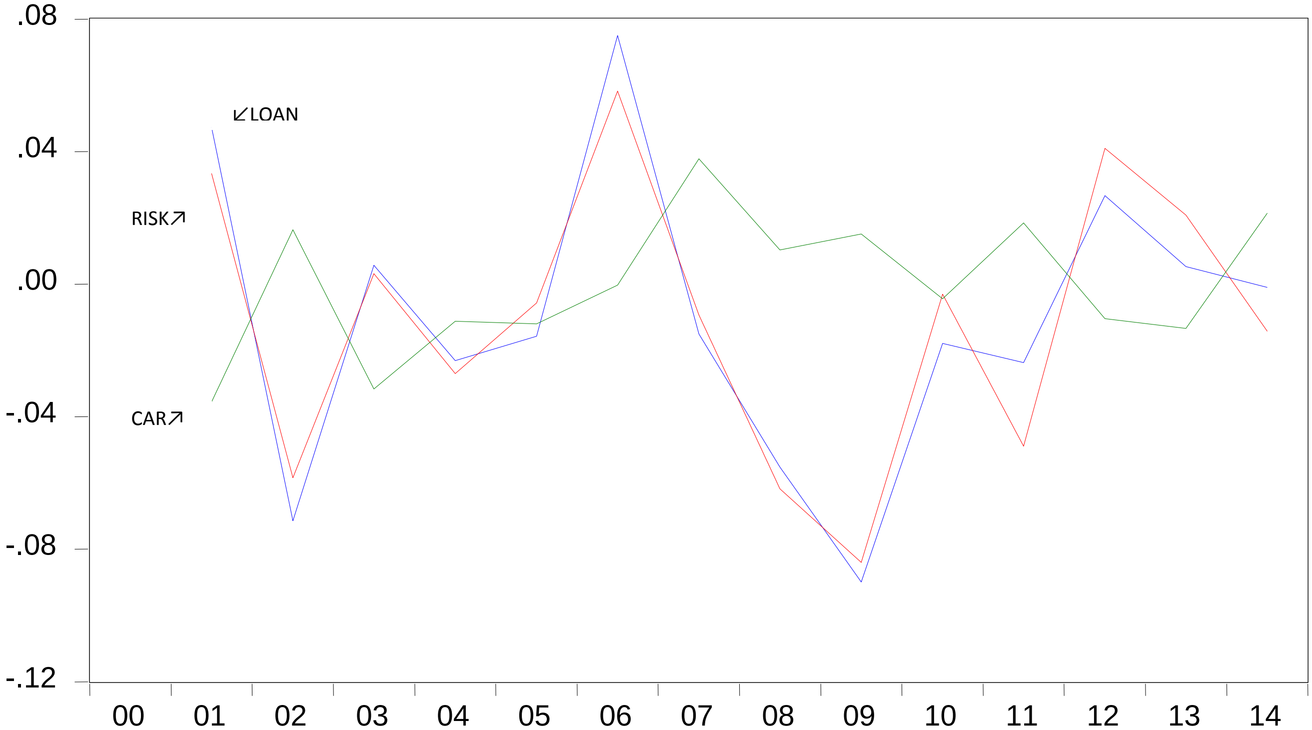
The profitability of banks measured by the return on assets of banks has a mean value of 2% and a median value of 2.8% which implies banks are highly profitable. Besides the 1.2% standard deviation of the banks' profitability is also relatively small to make the banks' profitability unstable. The stable and higher value of this variable is also positively influences the adjustment of banks capital towards their target level, as this is the main source of boosting banks capital available at their disposal.

Measured as the marginal difference of total income over total cost, the efficiency variable has a mean of 40% and 44%. A look at the minimum, maximum and the standard deviation of the variable, indicates that there is a considerable variation in the efficiency level of banks. The variation in this bank specific variable could possibly create disparity in the adjustment pattern of capital and risk towards the target level.

4.1.2 Further Analysis of the Relation between Capital and Risk

Graphically analyzing the simple relation between variables provides insight in to the possible estimation results of the model. Therefore, the relation between the two dependent variables CAR and RISK are graphically analyzed and presented below. To have clear understanding of the relations, the variables are interacted in view of the four hypothesis provided in chapter one. Hence, in addition to analysis of the whole sample data, sub-sample analysis of small capital buffer and large capital buffer banks are also made to see a possible difference in the adjustment behavior of the two sub-samples. The demarcation of the data in to the two sub-samples follows the two approaches adopted to measure the regulatory pressure variable discussed in chapter three.

Figure 2 Relative Mean Annual Change in the Loan, CAR and RISK Level of the Sample Banks

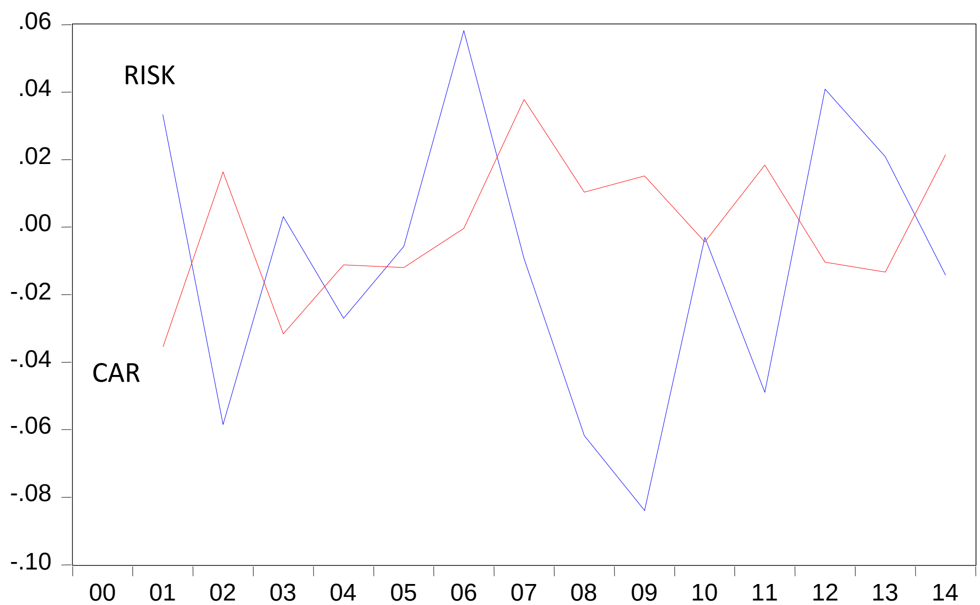


The graphical relation between the changes in loan, cap and in risk depicted in figure 1 above provides some insight how banks adjust to shocks in their target capital and risk levels. As can be seen, the adjustment in risk between the year 2000 and 2002 encountered a downward shock. This could be attributed to a shrink in loan volumes possibly due to the sharp drop in the GDP which, as per the data from the national bank of Ethiopia, reduced from 7.4 in 2000 to 1.6 in 2001 and further down to -2.1 in 2003 (NBE, Annual Report , 2013). In support of this, as can be seen from the graph, the shock first affected the risk level due to the possible reduction in the domestic credit. Lately between 2002 and 2003 the effect prevailed in the capital level of banks possibly due to the gradual transmission of the shock in loan to interest income and then to the retained earnings of banks. Then, following the revival of the GDP from 2004 onwards at 11 percentage point, as per the NBE source, the risk level of banks again faced an upward shock for obvious reason of the observed increase in bank loan. Again the upward shocks in loan and risk level of banks in 2006 are reflected in the capital level of banks after a year in 2007.

Despite the continued growth of GDP at a stable rate, the change in the risk and loan level of banks seemed to have been encountered with another shock which is also reflected in the capital levels of banks but at a slower rate and magnitude. The downward shock continued to prevail starting from 2006 up to 2009. The shock exactly coincided with the monetary policy measures taken by the National Bank of Ethiopia between those periods in response to the soaring inflation rate. First the National Bank raised the minimum reserve requirement from 0.05% in 2004 to 10% in 2007 and then to 0.15% in 2008 (NBE, 2004, 2007, 2008). Then in 2009 the bank placed a credit cap on banks to bring down the aggregate credit supply in an attempt to reduce the inflation (Access Capital, 2010). As can be seen in the graph, the effect of the credit restriction on the growth of loan seemed to be prevalent in between 2010 and 2011. Then in the immediate years following the lifting of the restriction in 2011 both the change in loan and risk weighted assets of banks registered sharp increase. However, the upward shift in the two variables was not sustained to the following year, which could be the result of another requirement enacted by the NBE requiring banks to purchase bill from the central bank proportional to 27% of new loans they disburse (NBE, 2011).

The graph also provides an important insight regarding the speed at which banks adjust towards their target risk and capital levels after facing a shock. As can be seen from the graph the rate at which the redline rise and fall is higher than the green line. For instance the change in the capital level in 2006 for the mean bank was 5.8% (upward shift) while the change in the capital level in the same year was 1.2% (upward). Similarly, the change in the risk level of the mean bank in 2007 was 6.7% downward shift while the change in the capital level for the mean bank in the same period was 3.8% upward. The observed change in the capital and risk levels during 2007 reveals another important fact that observed changes in the risk level is reflected in the capital level after a year. This behavior is observed more clearly in figure 2 below which contain only the two variables. A closer look at the movements in the two lines in fact proofs that this behavior holds true in all the sample periods except for 2013 when down ward change in the two variables coincided and in 2014 when a further down ward change in the risk level was inversely followed by an upward change in the capital levels. The fact that an upward (downward) move in the risk level of banks at time t being followed by an upward (downward) move in the capital level of banks at time t+1, implies that the two variables do not positively adjust at the same time. Rather this can possibly be interpreted as either adjustments in risk and capital are a simultaneous negative relations or upward adjustments in risk without any simultaneity leads to a subsequent upward move in the capital levels. The second alternative is equivalent to a prudent bank behavior. However, this second interpretation requires a temporal precedence as to which variables come first and which one follows. If we let capital to come first in the temporal precedence, the interpretation will lead us to an opposite conclusion which is equivalent to one of the two arguments under the moral hazard theory. That means upward adjustment in capital will lead to downward adjustment in risk levels as the upward moves in the capital levels put more of the banks' owners stake at risk they react by bringing down their risk level down to their acceptable level.

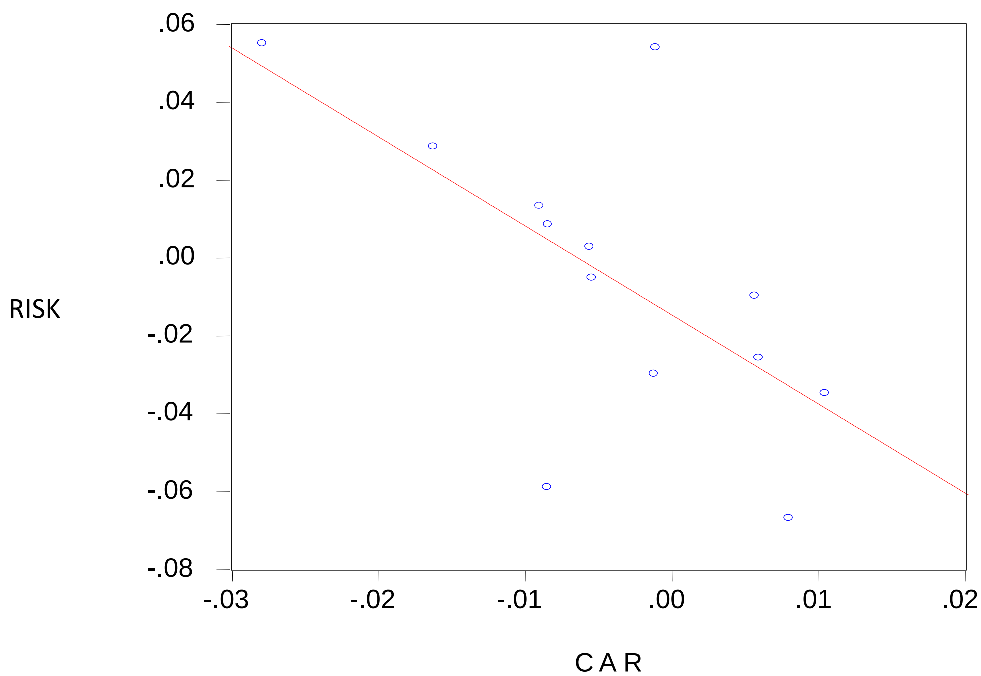
Figure 3 Relative Mean Annual Changes in the CAR and RISK level of the Sample Banks



However, these are an indications found after conducting a simple statistical procedures. To reach at any of the conclusions, we need to first conduct a test for the simultaneity of capital and risk adjustment decisions of banks which is addressed in the upcoming section. If the test proofs the absence of simultaneity the equations specified for the two variables will be estimated and concluded separately.

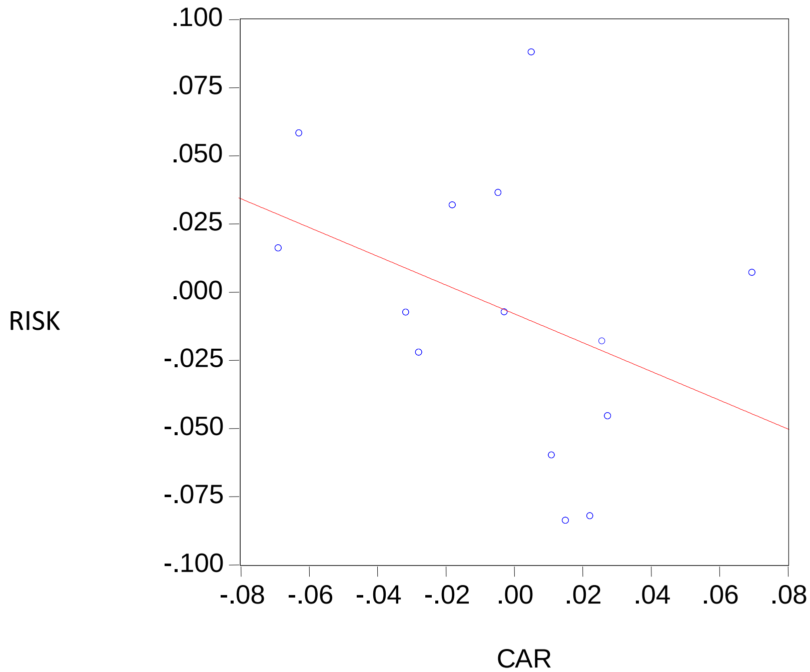
As per the propositions of the capital buffer theory, it is argued that the relation between risk and capital adjustment depends on the size of the capital buffer. The graphical presentation in figure 1 and 2 are based on the whole sample and do not allow us to see the proposed differences between small capital buffer and large capital buffer banks. Therefore, figure 3 and 4 depicts the relation between capital and risk adjustment behavior of banks differentiated as small and large buffer capital banks based on the 15% CAR level.

Figure 4 Relationship of the Cange in CAR and RISK Level of Low Capital Buffer Banks



As can be seen in figure 3 above the relation between adjustments in capital and risk is negative. This simple indication of the relation between the two variables for small capital buffer bank is in line with the propositions of the capital buffer theory. The theory, as discussed in chapter two, explains this situation as the effect of the minimum requirement. Hence, banks with small capital buffer either reduce their risk level or increase their capital to avoid the danger of hitting the minimum requirement. Conversely, smaller banks could also increase their risk level while their capital is dropping down in an expectation of making higher profit by taking higher risk.

Figure 5 Relationship of the Cange in CAR and RISK Level of High Capital Buffer Banks

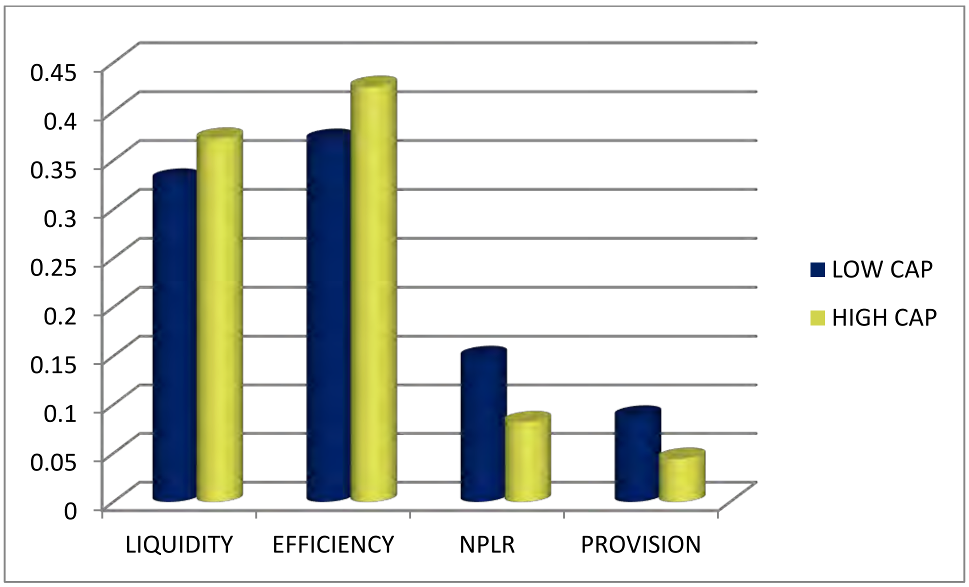


The result in figure 4 is at odd with the theoretical explanation that adjustment in capital and risk are positively related for large capital buffer banks. Rather, the graph indicates a negative relationship even for high capital buffer banks. This is difficult for interpretation as the possible interpretations are counter intuitive. For instance it could possibly be interpreted as lack of prudential behavior by high capital buffer banks since they reduce their capital while their risk level is increasing. Conversely, high capital buffer banks reduce their risk as their capital level encounter an upward shock to protect their increased stake in the bank. However, banks may differ in their risk aversion and even at a higher capital buffer banks may tend to be highly risk averse and at some specific point in time may face shock that drives their risk level high above their target level to which they may react by bringing down their risk level and increasing their capital level as explained by (Jacques & Nigro, 1997).

4.1.3 Comparative Analysis of High and Low Capital Buffer Banks

On the other hand one may argue that the regulatory pressure is not only the function of the changes in the risk and capital levels of banks, instead consideration to other factors that inflict on the risk and capital changes are also considered. Therefore, the performance variation between high capital buffer banks and low capital buffer banks are discussed in terms of other determinant variables.

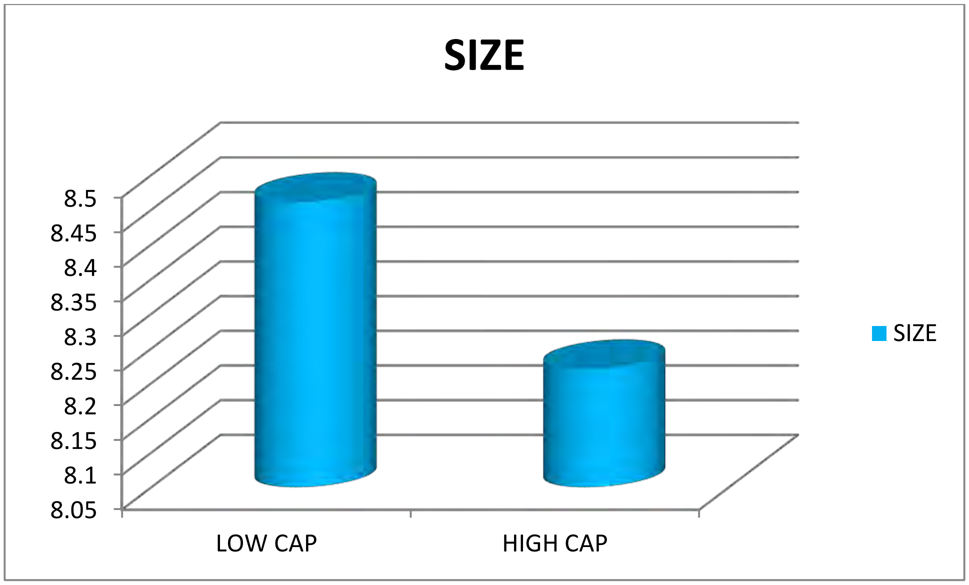
Figure 6 Comparisons between Low and High Capital (CAP) Buffer Banks



As can be seen in figure 5 above banks with high capital buffer out performs the low capital buffer counter parts. Among others low capital before banks has higher non performing loans and higher provision the held for non-performing. Besides, in terms of liquidity high buffer capital banks outperform the low buffer banks. The high capital buffer banks are also more cost efficient than their low capital buffer counterparts. These are interesting statistics and imply inadequate capitalization is associated with under performance in the variables considered in figure five. Besides, when we consider the fact that the CAR level of banks differ over time and whenever banks face a reduction in their CAR level, they also face the same reduction in those parameters considered in figure 5.

This doesn't give any room to the regulator to make an excuse or tolerate banks operating at lower capital levels. The figure above indicates, these banks are also poor performers in other parameters which contribute to prudential bank behavior.

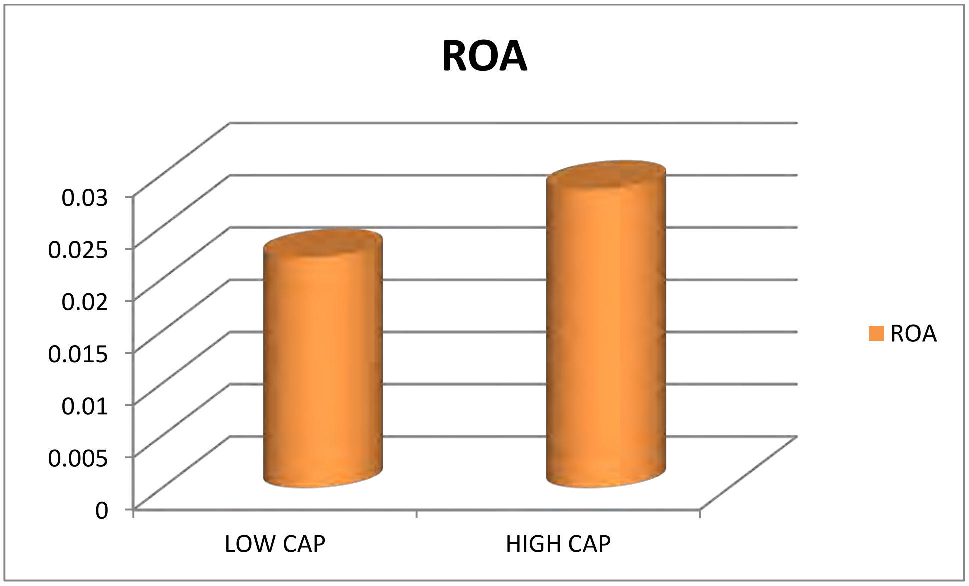
Figure 7 Size Comparison of High and Low Capital Buffer Banks



As can be seen in figure 6 above, larger banks maintain relatively low buffer capital than smaller banks. This is consistent with the data from other countries covered in the empirical papers covered in this study. It also supports the theoretical propositions that larger banks are less exposed to difficulty of raising their capital level when they face capital reduction. Hence they maintain less level of capital buffer above the minimum than smaller banks.

As can be seen in Figure 7 below, high capital buffer banks slightly outperform their low capital buffer counter parts in terms of profitability. This indicates that higher capitalization is the result of higher profitability and that banks increase their buffer capital by retaining their profit.

Figure 8: Comparisons of High and Low Capital Buffer Banks in terms ROA



4.2 Regression Analysis and Discussion

As outlined in the methodology part, the estimation procedure involves tests for the presumed simultaneous relation between the CAR and RISK variables; endogenous test on the explanatory variables; identification and definition of instrument variables for the right hand side variables that are deemed to be endogenous to the dependent variable. After undergoing the stated prerequisite tests and taking measures commensurate with the results obtained, the subsequent model estimation process involve sequential specification and estimation of four separate equations. The immediate following section presents and discusses the test process carried out, outcomes of the test and specification measures taken before running the regression. Then, this will be followed by another section that present the estimation results obtained, discussion of the results, and hypothesis tests made.

4.2.1 Simultaneity and Endogenity Test and Instrument Variables

The dynamic nature (the presence of the lagged dependent variable as explanatory variable) of the model specified in equation 13 and 14, leads to the violation of at least two important assumptions of the ordinary least square. These two assumptions and how the partial adjustment model used in this study violet them and the possible solutions available to estimate such model are addressed here in brief.

In order to estimate the capital and risk equations using the appropriate estimation method, it is important first to conduct a hausman test and ensure if there are any endogenous variables among the explanatory variables in the right hand side of the two equations. Accordingly, all the right hand side regressors were subjected to the test. The result obtained regarding the presupposed simultaneous relation from capital to and from risk to capital is mixed. The test on the possible simultaneity between capital and risk decisions is conducted using the residual and the fitted value of CAR_{it} derived from the reduced capital equation. The coefficient estimate of the residual and the fitted value of CAR_{it} are not found to be statistically significant even at the 10% level of significance. Further test on the coefficients of the fitted residual and the fitted CAR_{it} using the wald coefficient restriction test is not able to reject the null hypothesis that the coefficients are not different from zero. On the other hand, the test result for the risk variable indicates that risk is simultaneously related with capital. The test is conducted in a similar fashion using the fitted residual values and the fitted value of $RISK_{it}$ obtained from the reduced risk equation.

Extending the test on the other explanatory variables in both equations, it was found that all other variables in the capital and risk equations, except the lagged dependent variables, are found to be strictly exogenous.

Since the lagged dependent regressors are endogenous and are therefore likely to be correlated with the disturbance or error term, alternatives to OLS must be found.

Direct use of OLS in a partial adjustment model where the structural equations contain the lagged dependent variable in the right hand side, would obviously result in biased and inconsistent estimate. This is because one of the OLS assumptions requires the errors to have a constant variance; however the lagged dependent variable in the right hand side has correlation with the error. Instead authors like Gujarati (2004) recommend the use of indirect least square, instrumental technique or two stage least square. The indirect least square and the instrumental technique are argued to be inappropriate for over-identified equations (Brooks, 2008). Rather, the three-stage least square is asymptotically more efficient than 2SLS as it provides a third step in the estimation process that allows for non-zero covariances between the error terms in the structural equations (Wooldridge, 2004). While the two stage least square ignores any information that may be available concerning the error covariances (and also any additional information that may be contained in the endogenous variables of other equations).

Thus, the three stage least square method is preferred in this study over the two stage counterpart. However, in order to obtain a better result under these methods, it is important to have instrumental variable for the lagged dependent variables CAR_{it} and $RISK_{it}$ as well as for the DCAR and DRISK. The instrument variables need to be highly correlated with the variable they are intended to substitute in the reduced form equation while having nearly zero correlation with error term of the structural equation (Gujarati, 2004). Accordingly, the second lags of the dependent variables are found to have high correlation with the lagged dependent variable while at the same time they have the lowest correlation with the residuals of the structural equations. Regarding the DCAR and DRISK variable based on the simultaneity test result discussed above putting restriction on the DCAR as endogenous variable resulted in a biased estimation. Besides the correlation test of this variable and the residuals from the structural equation resulted in correlation coefficient of 0.001 Therefore this variable is used as instrument variable for itself. For the DRISK the first difference of a separate variable measured as the ratio of non-liquid 100% risk weighted assets to total asset was used as the instrument variable. The test conducted regarding the correlation of this instrument variable with DRISK and with the residual of the structural equation resulted in correlation coefficients of 0.94 and 0.00012, respectively. This variable is used along with the other instrument variables and denoted as $RISK2_{it}$.

4.2.2 Model Estimation Results and Discussion

As indicated above, the model estimation process involves specification of four sequential equations and their separate estimation. Besides, the use of the two separate approaches of measuring the regulatory pressure variables denoted as REG, require the estimation of the specifications separately for the two approaches. Hence, the first estimation will be based on the first approach of REG variable measurement, and the second estimation will be based on the second approach of REG variable measurement.

Estimating the four separate progressive specifications instead of estimating only the final specification better enables to see the effect of REG and the interactive variables on the capital and risk adjustment behavior of banks. This intention of estimating separate specifications would again be best achieved, if the specifications were further modified to include only one of the interactive variables at a time and exclude the other and the REG variable, however this increase the number of equations rendering them to be unmanageable. Yet such equations were specified and estimated to check the reliability and robustness of the model specifications. The results indicate that the coefficient estimates are more or less stable. Hence, they are excluded from the discussion to follow.

The estimation results obtained after running the four specifications under the two approaches are presented in table 3 and 4 below. Table 3 presents estimation results under the first approach for both the capital and risk equations while table 4 presents estimation results under the second approach for both the capital and risk equations.

4.2.2.1 Results for Size Variable

As shown in table 2 and 3 below, the results for the size variable indicates that size is negatively related with risk. The estimates across the specifications are highly significant at 1% significance level. However, its estimated effect on capital adjustment is insignificant. The estimated results are unexpected and imply that larger banks tend to hold lesser risk assets in their portfolio than their small counterpart. The estimate remain unchanged even after excluding the largest state owned bank which its asset portfolio is largely dominated by securities issued by government and public companies. The result is against the buffer theory and the standard corporate finance capital structure theories which predict positive relation of the size variable with risk level and negative relation with capital levels.

4.2.2.2 Results for Profitability Variable

Regarding the effect of return on asset, which is used as a measure of bank's profitability, it has a positive effect on capital adjustment of banks. This result is as expected and indicates that banks raise their capital level by retaining part of their profit. The maximum value of the coefficient estimate is 0.98while the minimum is 0.84 and significant at 1% level in all the specifications.

4.2.2.3 Results for the Liquidity Variable

The estimated result obtained for the liquidity variable is again against the expected sign. The value of the coefficient is significant at 5% in all of the specifications of the capital equations except in specification II under the second approach where it is significant at 10%. The estimated value ranges between 0.05 and 07 and implies that a percentage increase in the liquid asset to total asset ratio results in up to 7% increase in the capital to risk weighted asset ratio of banks. Similarly, the variable took unexpected negative coefficient sign in the risk equation with estimated values ranging from 0.31 to 0.35 significant in all specification at 1%. . Such result is against the theoretical predictions and previously similar result has been found by Pereira & Saito (2011) in a research they conducted at the brazilian banks. In their study,Pereira & Saito, tried to explain the exception stating that one reason for such unexpected result is that the variable, as it was built, has not fully captured the underlying liquidity of the bank's portfolio. Thus, they reestimated the model including in the liquidity proxy other riskier liquid assets (stocks, quotes of investment funds, and other securities), but the signal remained significantly positive. Expecting such possible weaknesses of defining the variable in the usual formulation, in this study the required precaution was applied by balancing the components of liquid assets between zero risk weighted assets like cash in hand, Treasury bills, reserves with the central bank and those with risk weights like deposits at local banks and foreign banks. Yet the results remained unchanged, and this can be due to the marginal higher growth of zero risk weighted assets compared to risk weighted liquid asset.

On the other hand, a consideration to a theoretical proposition by Berger and Bouwman (2009) makes a positive relation between capital and liquid asset consistent with another theoretical argument. Berger and Bouwman note that two hypothesis largely frame the relation between capital and liquidity creation. They refer the first hypothesis as financial fragility hypothesis which represent a fragile state a bank may face as a result of using or dependency on large volume of deposit to offer liquidity to its borrowers or create loan. Accordingly, the bank tends to take informational advantage over depositors regarding the profitability of its borrowers whereby the bank might extort rent from its depositors by claiming a larger share of income from loan. In response depositors may refuse to pay the higher cost which results in an agency conflict leading the bank to withhold its loan monitoring and collection effort. Being aware of the bank might abuse their trust; depositors start to exercise their power by withdrawing their deposit. This lead the bank to be financially fragile inducing a bank behavior that strive to win depositors confidence while at the same time maintaining its loan making ability (higher liquidity creation power through the continued flow of deposit). Then the consideration of a higher bank capital ratio means less fragile bank with enhanced bargaining power and less liquidity creation/loan making effort and asset portfolio of bank dominated by liquid asset.

4.2.2.4 Results for the Efficiency Variable

The coefficient estimate for efficiency, measured as total income to total operating costs, is insignificant in the capital equation. However, in the risk equation the coefficient estimate is significant at 1% in all the specifications except in specification IV of the second approach. The insignificance of the variable in the capital equation could be attributed to the use of the simple conventional method. In the risk equation the coefficient estimate has a positive sign, indicating that cost efficiency has positive effect on risk.

4.2.2.5 Results for the Asset Quality Variable

The estimated coefficient value of asset quality measured as the ratio of non-performing loan to total loan is statistically insignificant. Similar estimation result was found by Abreu & Gulamhussen (2008).

4.2.2.6 Results for the Changes in the Risk and Capital Variables

Regarding the coordination of risk and capital adjustments, the result is among the exceptional ones found in some of similar other studies. The coefficient estimate of the risk variable in the capital equation is negative and significant at 1% in all the specifications of both approaches. The implication of the finding is that adjustments in capital and risk are negatively related. In other words, an upward (downward) adjustment of risk leads to downward (upward) adjustment of capital. Similar to the risk variable, the coefficient estimate of the capital variable in the risk equation is with negative sign and significant at 1, 5, and 10% across the specifications. This result is against the predictions of the capital buffer theory.

Table 2: Estimation Results Using 15% CAR Level as REG Variable Measurement (*denotes10%, **5%, ***1% significance)

Results for the Capital Equation								
	Specification I		**Specification II**		**Specification III**		**Specification IV**	
	Coefficient	t-Statistic	Coefficient	t-Statistic	Coefficient	t-Statistic	Coefficient	t-Statistic
CONSTANT	-0.017463	-0.73845	0.005839	0.22014	-0.004593	-0.159763	-0.011859	-0.396292
SIZE	0.000416	0.171266	0.000623	0.263407	0.00088	0.372193	0.001702	0.684495
ROA	0.984115***	3.172764	0.843479***	2.789138	0.88786***	2.917349	0.861256***	2.82701
LIQUIDITY	0.068784*	2.105698	0.064008**	2.016851	0.071388**	2.197826	0.0695**	2.142823
EFFICIENCY	0.005831	0.251546	0.003713	0.163809	0.003528	0.156972	-0.000568	-0.025167
DRISK	-0.222763***	-3.81176	-0.18999***	-3.139863	-0.185177***	-3.08275	-0.222632***	-3.108552
CARit-1	0.767245***	12.78567	0.700478***	9.462849	0.721764***	9.381467	0.735364***	9.250538
REG			-0.017106**	-2.067713	0.008485	0.27816	0.016721	0.528218
CARit-1*REG					-0.186402	-0.868683	-0.238558	-1.084667
DRISK*REG							0.124509	1.076764
R-squared		0.797047		0.806941		0.810111		0.812019
Adjusted R-squared		0.784493		0.792864		0.79412		0.79402
Results for the Risk Equation								
CONSTANT	0.634902	5.8292	0.666488	6.361518	0.675497	6.618287	0.675819	6.638577
SIZE	-0.034175***	-5.22775	-0.037036***	-5.840214	-0.034966***	-5.605831	-0.034989***	-5.627781
ASSETQUA	-0.019997	-0.47136	-0.063698	-1.4921	-0.034486	-0.798094	-0.03194	-0.679869
LIQUIDITY	-0.348885***	-7.33753	-0.331575***	-7.31308	-0.313628***	-7.004328	-0.313759***	-7.020244
EFFICIENCY	0.087011***	2.912531	0.082067***	2.883718	0.089897***	3.222905	0.090463***	3.208757
DCAR	-0.249247**	-2.11849	-0.206116*	-1.820701	-0.246991**	-2.21457	-0.243439**	-2.171735
RISKit-1	0.559233***	7.352556	0.531863***	7.237891	0.465824***	6.115165	0.464906***	6.127475
REG			0.024258***	3.083108	-0.075808*	-1.843399	-0.07725*	-1.778332
RISKit-1*REG					0.163271**	2.477298	0.165318**	2.396221
DCAR*REG							-0.06151	-0.148375
R-squared		0.902242		0.911546		0.916115		0.916115
Adjusted R-squared		0.896195		0.905096		0.909051		0.908084

Table 3: Estimation Results Using the Second Approach to the REG Variable Measurement (*denotes10%, **5%, ***1% significance)

Results for the Capital Equation								
	Specification I		**Specification II**		**Specification III**		**Specification IV**	
	Coefficient	t-Statistic	Coefficient	t-Statistic	Coefficient	t-Statistic	Coefficient	t-Statistic
CONSTANT	-0.017463	-0.73845	-0.005563	-0.222611	-0.048877	-1.798059	-0.049881	-1.816466
SIZE	0.000416	0.171266	-0.000187	-0.076342	-0.00029	-0.123129	-0.000221	-0.093407
ROA	0.984115***	3.172764	0.978309**	3.181904	0.926724***	3.136919	0.928148***	3.135918
LIQUIDITY	0.068784**	2.105698	0.058555*	1.761481	0.076763**	2.330498	0.077068**	2.332878
EFFICIENCY	0.005831	0.251546	0.006523	0.28382	0.009447	0.426616	0.009373	0.422662
DRISK	-0.222763***	-3.81176	-0.22655***	-3.903785	-0.206414***	-3.637543	-0.219713***	-3.29029
CARit-1	0.767245***	12.78567	0.771431***	12.95821	0.710985***	11.4262	0.701295***	8.51437
REG			-0.008216	-1.391993	0.049516**	2.546882	0.050678**	2.525435
CARit-1*REG					-0.331248***	-3.113517	-0.334899***	-3.098109
DRISK*REG							0.034703	0.352594
R-squared		0.797047		0.800614		0.814844		0.814346
Adjusted R-squared		0.784493		0.786076		0.799252		0.79657
Results for the Risk Equation								
CONSTANT	0.634902	5.8292	0.640623	5.899057	0.645146	5.975832	0.669249	6.018702
SIZE	-0.034175***	-5.22775	-0.034422***	-5.284861	-0.032003***	-4.881035	-0.033476***	-4.951207
ASSETQUA	-0.019997	-0.47136	-0.021568	-0.51042	-0.035581	-0.833428	-0.037249	-0.883904
LIQUIDITY	-0.348885***	-7.33753	-0.354762***	-7.441272	-0.343544***	-7.221029	-0.344074***	-7.316053
EFFICIENCY	0.087011***	2.912531	0.086897***	2.921981	0.075754**	2.507468	0.073648**	2.467637
DCAR	-0.249247**	-2.11849	-0.263668**	-2.237749	-0.300583**	-2.537885	-0.435022***	-2.839738
RISKit-1	0.559233***	7.352556	0.563753***	7.438022	0.523155***	6.54355	0.50805***	6.242595
REG			-0.00819	-1.077895	-0.082332*	-1.884446	-0.080502*	-1.859667
RISKit-1*REG					0.123036*	1.722166	0.118912*	1.677303
DCAR*REG							0.265926	1.230301
R-squared		0.902242		0.903128		0.90454		0.906906
Adjusted R-squared		0.896195		0.896065		0.896502		0.897993

It contradicts with the charter value theory that proposes no relationship between risk and capital adjustment. It also contradicts with capital buffer theory which predicts short term positive relationship between capital and risk. Rather, the result seems to support Keeley and Furlong's type of moral hazard theory which suggest that increased capital standards will lead banks to decrease portfolio risk. However, their explanation for such behavior of banks is based on the incentive effect of mispriced deposit insurance to less risk- adverse banks. However, there is no explicit deposit insurance in Ethiopia to induce such bank behavior.

However, authors like Hellmann, Murdock and Stiglitz (2000) argues that it makes little difference whether countries have a formal system of deposit insurance since, in the event of a financial crisis, there will be a bail-out. Moreover, the fact that there have been financial crises in countries with and without formal deposit insurance systems suggests that eliminating formal deposit insurance by itself does not solve the moral hazard problem.

In a similar empirical study, Jacques & Nigro (1997) found similar inverse relation between risk and capital. In explaining their finding they stated that banks may have exploited the mispricing of deposit insurance. Hussain & Hassan (2005) has also found similar inverse relation using data taken from sample developing countries and they concluded that higher capital ratios did not lead to higher credit risk, and did not endanger financial stability of the sampled developing countries.

A more contextual explanation is offered by Lindquist (2003) who found an inverse relation between risk and capital in Norwegian banks. In explaining the finding, Lindquist stated that this negative relationship does not imply that high-risk banks are poorly capitalized relative to the risk in their portfolio; it may rather be due to too much capital in low-risk banks. This may reflect that banks evaluate and react very differently to risk, depending on how risk-adverse they are.

Coming to this study's case, Lindquist's explanation become more apparent when we consider the estimation results of DRISK and DCAR together with results of the interactive variables DRISK*REG and DCAR*REG in the capital and risk equations, respectively. These variables are introduced in specification IV to allow for variation in the coordination of risk and capital adjustments between banks with high capital buffer and small capital buffer. In contrary, to the expected positive coordination of risk and capital adjustment for banks with high capital buffer, the estimation result indicates a negative relation (estimates for DRISK and DCAR in specification IV). On the other hand, the estimation result of the interaction variables in specification IV (DRISK*REG and DCAR*REG in capital and risk equation, respectively) are with positive sign against the hypothesized negative sign. This implies that banks with large capital buffer that are not constrained by the minimum capital requirement oddly decrease (increase) their risk while increasing (decreasing) their capital. Such behavior is against all the theories considered so far, because capital buffer theory predicts such behavior for banks operating with capital ratio near to the minimum requirement. On the other hand the moral hazard theory from its very start is based on the assumption that capital regulation constitutes the overriding departure from the Modigliani and Miller (1958) capital structure irrelevance propositions, and doesn't expect banks to operate with capital above the minimum requirement.

Therefore, the most appealing explanation to such exceptional behavior of banks is that of the Lindquist's alternative which states that bank evaluate and react very differently to risk, depending on how risk-adverse they are. As long as their risk (capital) level is below (above) their appetite, no matter the size of their capital buffer above the minimum or compared to other, they tend to increase (decrease) their risk (capital) level. This become more substantial when we look at the gap between the minimum and maximum capital to risk weighted assets ratio of the sample banks over the sample period which are 11% and 24%, respectively.

Besides, the negative relation between the coordination of capital and risk adjustment also supports the weak level of simultaneity in their adjustment. This can be due to the several reasons discussed in chapter three such as lack of developed financial market or at least interbank market to quickly and easily transform assets such as liquid assets and loan through loan selling between banks. Hence, as shown in the graph in the descriptive analysis a positive (negative) shock in the bank's risk level at time t is followed by a positive (negative) adjustment in capital at time t+1. The persistent 1% significance level of the coefficient estimates for the DRISK across all specifications under both approaches are also in favor of the argument that shocks in risk level consistently reflect on capital levels. In support of this, the significance level of the coefficient estimates for DCAR are highly inconsistent and fluctuates between 5% and

10% for most specifications, while 1% significance level is found only in specification IV under the second approach.

Earlier in this line of research, Shrieves and Dahl (1992), have also found a negative correlation between levels and a positive correlation between first differences of risk and capital. They argue that the negative correlation between levels is due to cross-sectional variation in risk preferences: Banks with low risk aversion would choose low capital ratios and high risk, whereas banks with high risk aversion would choose high capital ratios and low risk.

Therefore, the combined results obtained for DCAR and DRISK and DRISK*REG and DCAR*REG doesn't support hypothesis 2a and 2b which states that adjustment in risk and capital are positively related for large capital buffer banks (DCAR and DRISK) and negatively for small capital buffer banks (DRISK*REG and DCAR*REG). Because DCAR and DRISK are with negative sign against the hypothesized positive sign and DRISK*REG and DCAR*REG are with positive sign against their hypothesized negative sign.

4.2.2.7 Results and Discussions on the Regulatory Pressure Variable (REG)

Regarding the REG variable, the results obtained are mixed. This variable is included in specification II, to allow for banks with low capital buffers to differ in their capital and risk adjustments by a certain amount from banks with high capital buffers. This measurement technique assumes that the regulator takes actions that put banks with low capital buffer under pressure to increase their capital buffer size. Furthermore, the REG variable is included in specification III and IV with the intention of measuring the effect of regulatory pressure on the magnitude of capital and risk adjustments while controlling for its effect on the adjustment speed and risk/capital adjustment coordination, respectively. In this regard, the estimation result obtained under the first approach for the capital equation is significant at 5% in specification II but with unexpected negative sign. While the coefficient estimates of the variable in specification III and IV are with the expected positive sign but they are far from statistical significance. The difference in the sign of the coefficients in specification II, III, and IV is due to the negative sign of low capital buffer banks' adjustment speed which its effect is not controlled under specification II while in specification III and IV a specific variable ($REG*CAP_{it-1}$) is introduced to control the speed effect. Hence, the coefficient estimates of the REG variable took their desired positive sign in specification III and IV though statistically insignificant. This implies that the regulatory pressure measured under the first approach has no any effect on the capital adjustment behavior of the bank. This result can be either due to the weakness in the measurement of the variable under the first approach or due to the absence/inadequacy of regulatory action taken in response to a decrease in the size of capital buffer.

To arrive at specific conclusion the results obtained under the second approach need to be considered. In this regard, as discussed in the methodology part, the second approach is introduced to mitigate any estimation bias arising from measurement weakness of the first approach. The second approach, unlike the first one, takes in to account volatility of capital levels which is as important as the size of the capital buffer. Accordingly, the regulator is assumed to respond differently between banks with stable and unstable capital levels since breaching of the minimum is highly probable for banks with unstable low capital levels. Consistent with this, the estimated value of the variable under the second approach is positive and significant at 5% level in specification III and IV with the exception of the estimation in specification II which is negative but insignificant. The explanation provided above regarding the exceptional results of specification II holds true for the second approach as well. The variation in the estimation results between the two approaches is anticipated. Heid, Porath, & Stolz (2004) has also found similar result and concluded that the counterintuitive result may be related with the use of simple measure of the regulatory pressure. Hence, based on its relative measurement strength the results obtained from the second approach are more efficient and reliable than the results from the first approach. Therefore, it's possible to conclude that regulatory pressure induces undercapitalized banks to increase their capital as they approach to the minimum by 4 or 5% point basis.

Regarding the results obtained for the risk equation, the estimates are with the expected negative sign and significant at 10% even under the first approach. Yet the exceptional result of specification II has continued and the explanation made above can again explain this situation. Coming to the results under the second approach, the estimations are significant at 10% level in specification III and IV. Regarding the results in specification II, the coefficient estimate took the expected negative sign but not statistically significant and this is due to the weak effect of the regulatory pressure on the risk adjustment speed of low capital buffer banks. Hence, it can be said that the regulatory pressure induces under capitalized banks to reduce their risk level on an 8% basis while controlling its effect on the speed of their risk adjustment.

Therefore, measures taken by the regulator in response to a decrease in the size of capital buffer has impact on the capital and risk adjustment decision of banks. In response to the regulatory actions, banks with low capital buffer reacts both by increasing (decreasing) their capital (risk) levels, respectively. However, the size and significance of the adjustment are not sufficient enough to generalize that the regulatory actions in duce banks to enhance their capital buffer. Rather the regulator seems to tolerate banks with stable capital buffer size even if they are below the CAMEL's strong capitalization threshold. Even for those banks with volatile capital buffer, the effect of the regulatory pressure is significant at the conventional level in the banks' capital adjustment decision than in the risk adjustment. These results are consistent with the findings of Jacques & Nigro (1997) who found limited effect of the risk based capital regulation on the risk adjustments of undercapitalized banks. It is also consistant with Rime (2001) findings of higher impact of regulatory preasure on capital than on risk adjustment of undercapitalized banks.

Therefore, it can be concluded that hypothesis 1 regarding the effect of the regulatory pressure variable is supported under the second approach of measuring the regulatory pressure variable, which additionally takes in to account the volatility of banks capital level.

4.2.2.8 Results and Discussions on the Rate of Adjustments

With regard to the lagged capital (risk) levels, the partial adjustment is estimated as $(1 - \alpha\ (\beta))$ instead of directly estimating α (β) coefficient for the capital (risk) variables in the risk and capital equations, respectively. Hence, to obtain the speed of adjustment we need to subtract 1 from the estimated coefficient values and multiply by -1. Under the first approach specification II and IV resulted in the maximum and minimum coefficient values of 0.77 and 0.70, respectively for the capital equation. While specification II under the second approach and specification IV under the first approach resulted in the maximum and minimum estimates of 0.56 and 0.46, respectively for the risk equation.

The estimated speed of capital (risk) adjustment lies in the range [0.23; 0.30] and [0.44; 0.64], which means that banks take 3 to 4 years to adjust for shocks to capital and adjust shocks to risk in less than two years. The speed of risk adjustment is higher and this might be due the dominancy of short term loan in the risk weighted assets.

Besides, specification III includes additional interactive variable REG*CAP_{it-1} to allow banks with low capital buffers to adjust capital and risk faster than banks with high capital buffers. With respect to the speed of capital adjustment for low capital buffer banks, the coefficient of REG*CAP_{it-1} under the second approach has the expected negative sign and significant at 1%. However, the coefficient estimate under the first approach is not statistically significant which again indicate the weak measurement strength of the first approach. The result implies that low capital buffer banks adjust their capital at a marginal 33 % basis higher than high capital buffer banks. As high capital buffer banks are with sufficient capital reserve than their low counterparts it is normal to find that low capital buffer banks register higher speed of adjustment. Besides, it is also consistent with bank capital regulation objectives. The finding is in line with the predictions of the capital buffer theory and the different empirical results considered in this paper.

Therefore, it can be concluded that hypothesis 3a which predicts higher capital adjustment speed for low capital buffer banks is supported.

Regarding the risk adjustment speed of low capital buffer banks measured by the interactive variable denoted as $RISK_{it-1}$*REG, the results are against the expectation of this study. The coefficient estimates are with positive sign and are significant at 10% under the first approach and at 5% under the second approach. This implies that small buffer banks adjust their risk level marginally up to 16% lower than high capital buffer banks. The slower risk adjustment rate of low capital buffer banks indicates that these banks do not want to increase their capital buffer by reducing their risk weighted asset. Instead, as the results of the capital adjustment speed for these banks indicated above shows, they tend to build up their capital buffer by directly increasing their capital level. Conversely, banks already with high capital buffer do prefer to maintain their higher buffer by indirectly reducing their risk weighted asset. The finding of a lower risk adjustment speed by low capital buffer banks is in line with the literature Shrieves and Dahl

(1992); Ediz et al (1998); Aggarwal and Jacques (2001). The results of higher risk adjustment for small capital buffer banks is in line with the buffer theory

The result doesn't support hypothesis 3b which states that banks with small buffer capital adjust their risk faster than banks with high buffer capital.

5. CHAPTER FIVE: CONCLUSION AND IMPLICATIONS

5.1 Conclusion

The imperatives of capital and its implication to the overall health of individual banks and the entire financial system of a nation can easily be observed by the recent global financial crisis and the level of efforts and attempts being exerted by nations collectively or individually to find the optimal ways of its regulation. This study attempted to investigate the effectiveness of the capital regulation framework followed by the National Bank of Ethiopia in inducing bank capitalization proportionate to the portfolio risk.

Accordingly, the study found that the effect of the capital regulation framework is more prevalent on those banks with low and volatile capital buffer than on low capital buffer banks as a whole. Besides, the effect of the framework is more significant on capital adjustment than risk adjustment of banks. The study also found that level of bank capitalization doesn't explain the coordination in the capital and risk adjustment decisions of banks. In this regard adjustment in risk and capital for banks with high capital buffer are found to be negatively related although these banks are not capital constrained to follow such conservative adjustment behavior. In contrary for banks with low capital buffer, adjustments in capital and risk have no significant effect on one another. With regard to the adjustment speed differences between banks of different capital buffer size, the study found that less capitalized banks tend to adjust their capital faster than well capitalized banks. While they follow slower risk adjustments speed than their well capitalized counterparts. Therefore, the study concludes that the capital regulation regime followed by the National Bank of Ethiopia influences the capital adjustment magnitude and rate of banks that have low and volatile capital buffer. Yet its effect on the risk adjustment of the same banks is limited to the magnitude of adjustment and not the rate or speed of adjustment. Besides, the relation between bank capital and risk adjustments is not determined by the level of bank capitalization or size of banks' capital buffer.

5.2 Implications

The most important implication of the findings of this study is that the capital and risk adjustment behavior of banks is not explained by the size of the capital buffer that banks hold above the minimum capital requirement. This is not only true for highly capitalized banks, which the regulator may not expect to be affected by, rather it also holds true for those banks that operate at a mean capital adequacy ratio as lows as 11%. This implies that the capital regulation regime is less effective in aligning the changes in banks' capital/risk and vice versa at least for banks that operate at capital level closer to the minimum. Theoretical and empirical works in the subject area predict such bank behavior to arise either from risk aversion differences between banks or methodological flaw in the regulator's risk measurement technique that fail to reflect true or economic risks of banks. Therefore, the regulator might need to consider the use of bank specific capital adequacy requirement that flexibly responds to banks' risk aversion behavior. As the low capital buffer banks tend to raise their capital than adjust their risk, the regulator needs to closely monitor and direct its supervisory effort towards these banks. Besides, the effect of the regulatory enforcement actions are not observed in the adjustment behavior of low capital buffer banks other than in those banks with volatile capital, thus the regulator needs to take sufficient enforcement measures that align undercapitalization with sufficient level of regulatory pressure.

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Annex 1 Estimation Result Using 15% CAR level of CAMEL Rating System as Cutoff Point to Measure the REG Variable

Estimation Method: Three-Stage Least Squares																
Sample: 2002 2014																
Included observations: 104																
Total system (balanced) observations 208																
Linear estimation after one-step weighting matrix																
Results for the capital equation																
	Specification I				**Specification II**				**Specification III**				**Specification IV**			
	Coefficient	Std. Error	t-Statistic	Prob.	Coefficient	Std. Error	t-Statistic	Prob.	Coefficient	Std. Error	t-Statistic	Prob.	Coefficient	Std. Error	t-Statistic	Prob.
CONSTANT	-0.017463	0.023648	-0.73845	0.4611	0.005839	0.026522	0.22014	0.826	-0.004593	0.028747	-0.159763	0.8732	-0.011859	0.029925	-0.39629	0.692
SIZE	0.000416	0.002429	0.171266	0.8642	0.000623	0.002367	0.263407	0.7925	0.00088	0.002364	0.372193	0.7102	0.001702	0.002487	0.684495	0.495
PROFIT	0.984115	0.310176	3.172764	0.0018	0.843479	0.302416	2.789138	0.0058	0.88786	0.304338	2.917349	0.004	0.861256	0.304653	2.82701	0.005
LIQUIDITY	0.068784	0.032666	2.105698	0.0365	0.064008	0.031736	2.016851	0.0451	0.071388	0.032481	2.197826	0.0292	0.0695	0.032434	2.142823	0.033
EFFICIENCY	0.005831	0.02318	0.251546	0.8017	0.003713	0.022665	0.163809	0.8701	0.003528	0.022477	0.156972	0.8754	-0.000568	0.022587	-0.02517	0.98
DRISK	-0.222763	0.058441	-3.81176	0.0002	-0.18999	0.060509	-3.13986	0.002	-0.185177	0.060069	-3.08275	0.0024	-0.222632	0.071619	-3.10855	0.002
CARit-1	0.767245	0.060008	12.78567	0	0.700478	0.074024	9.462849	0	0.721764	0.076935	9.381467	0	0.735364	0.079494	9.250538	0
REG					-0.01711	0.008273	-2.06771	0.04	0.008485	0.030505	0.27816	0.7812	0.016721	0.031656	0.528218	0.598
CARit-1*REG									-0.186402	0.21458	-0.868683	0.3861	-0.238558	0.219937	-1.08467	0.28
DRISK*REG													0.124509	0.115633	1.076764	0.283
R-squared				0.797				0.806941				0.810111				0.812019
Adjusted R-squared				0.7845				0.792864				0.79412				0.79402
Durbin-Watson stat				1.8386				1.722539				1.762728				1.729958
S.E. of regression				0.03				0.029423				0.029334				0.029341
Mean dependent var				0.175				0.174971				0.174971				0.174971
S.D. dependent var				0.0646				0.064649				0.064649				0.064649
Sum squared resid				0.0874				0.083109				0.081745				0.080923
Determinant residual covariance				1E-06				0.000000972				0.000000913				0.000000905

Annex 1 continued

Results for the Risk Equation

	Specification I				Specification II				Specification III				Specification IV			
CONSTANT	0.634902	0.108918	5.8292	0	0.666488	0.104769	6.361518	0	0.675497	0.102065	6.618287	0	0.675819	0.101802	6.638577	0
SIZE	-0.034175	0.006537	-5.22775	0	-0.03704	0.006341	-5.84021	0	-0.034966	0.006237	-5.605831	0	-0.034989	0.006217	-5.62778	0
ASSETQUA	-0.019997	0.042425	-0.47136	0.6379	-0.0637	0.04269	-1.4921	0.1373	-0.034486	0.043211	-0.798094	0.4258	-0.03194	0.04698	-0.67987	0.497
LIQUIDITY	-0.348885	0.047548	-7.33753	0	-0.33158	0.04534	-7.31308	0	-0.313628	0.044776	-7.004328	0	-0.313759	0.044693	-7.02024	0
EFFICIENCY	0.087011	0.029875	2.912531	0.004	0.082067	0.028459	2.883718	0.0044	0.089897	0.027893	3.222905	0.0015	0.090463	0.028192	3.208757	0.002
DCAR	-0.249247	0.117653	-2.11849	0.0354	-0.20612	0.113207	-1.8207	0.0702	-0.246991	0.11153	-2.21457	0.028	-0.243439	0.112094	-2.17174	0.031
RISKit-1	0.559233	0.07606	7.352556	0	0.531863	0.073483	7.237891	0	0.465824	0.076175	6.115165	0	0.464906	0.075872	6.127475	0
REG					0.024258	0.007868	3.083108	0.0024	-0.075808	0.041124	-1.843399	0.0668	-0.07725	0.043439	-1.77833	0.077
RISKit-1*REG									0.163271	0.065907	2.477298	0.0141	0.165318	0.068991	2.396221	0.018
DCAR*REG													-0.06151	0.414557	-0.14838	0.882
R-squared				0.9022				0.911546				0.916115				0.916115
Adjusted R-squared				0.8962				0.905096				0.909051				0.908084
Durbin-Watson stat				1.8401				1.943137				1.983795				1.978057
S.E. of regression				0.0383				0.036621				0.03585				0.03604
Mean dependent var				0.5856				0.585608				0.585608				0.585608
S.D. dependent var				0.1189				0.118876				0.118876				0.118876
Sum squared resid				0.1423				0.128748				0.122097				0.122097
Determinant residual covariance				1E-06				9.72E-07				0.000000913				0.000000905

Annex 2 Estimation Results Using the Median Standardized Capital Buffer of Banks as Cutoff Point to Measure the REG Variable

Estimation Method: Three-Stage Least Squares																
Sample: 2002 2014																
Included observations: 104																
Total system (balanced) observations 208																
Linear estimation after one-step weighting matrix																
Results for the capital equation																
	Specification I				**Specification II**				**Specification III**				**Specification IV**			
	Coefficient	Std. Error	t-Statistic	Prob.	Coefficient	Std. Error	t-Statistic	Prob.	Coefficient	Std. Error	t-Statistic	Prob.	Coefficient	Std. Error	t-Statistic	Prob.
CONSTANT	-0.017463	0.023648	-0.73845	0.4611	-0.00556	0.02499	-0.22261	0.8241	-0.048877	0.027183	-1.798059	0.0738	-0.049881	0.02746	-1.81647	0.071
SIZE	0.000416	0.002429	0.171266	0.8642	-0.00019	0.002447	-0.07634	0.9392	-0.00029	0.002359	-0.123129	0.9021	-0.000221	0.002368	-0.09341	0.926
PROFIT	0.984115	0.310176	3.172764	0.0018	0.978309	0.30746	3.181904	0.0017	0.926724	0.295425	3.136919	0.002	0.928148	0.295973	3.135918	0.002
LIQUIDITY	0.068784	0.032666	2.105698	0.0365	0.058555	0.033242	1.761481	0.0797	0.076763	0.032938	2.330498	0.0208	0.077068	0.033035	2.332878	0.021
EFFICIENCY	0.005831	0.02318	0.251546	0.8017	0.006523	0.022983	0.28382	0.7769	0.009447	0.022144	0.426616	0.6701	0.009373	0.022177	0.422662	0.673
DRISK	-0.222763	0.058441	-3.81176	0.0002	-0.22655	0.058033	-3.90379	0.0001	-0.206414	0.056746	-3.637543	0.0004	-0.219713	0.066776	-3.29029	0.001
CARit-1	0.767245	0.060008	12.78567	0	0.771431	0.059532	12.95821	0	0.710985	0.062224	11.4262	0	0.701295	0.082366	8.51437	0
REG					-0.00822	0.005902	-1.39199	0.1655	0.049516	0.019442	2.546882	0.0117	0.050678	0.020067	2.525435	0.012
CARit-1*REG									-0.331248	0.10639	-3.113517	0.0021	-0.334899	0.108098	-3.09811	0.002
DRISK*REG													0.034703	0.098423	0.352594	0.725
R-squared				0.797				0.800614				0.814844				0.814346
Adjusted R-squared				0.7845				0.786076				0.799252				0.79657
Durbin-Watson stat				1.8386				1.805724				1.848589				1.837694
S.E. of regression				0.03				0.029901				0.028966				0.029159
Mean dependent var				0.175				0.174971				0.174971				0.174971
S.D. dependent var				0.0646				0.064649				0.064649				0.064649
Sum squared resid				0.0874				0.085833				0.079707				0.079922
Determinant residual covariance				1E-06				0.00000108				0.00000097				0.000000941

Annex 2 continued

Results for the Risk Equation																
	Specification I				Specification II				Specification III				Specification IV			
CONSTANT	0.634902	0.108918	5.8292	0	0.640623	0.108597	5.899057	0	0.645146	0.107959	5.975832	0	0.669249	0.111195	6.018702	0
SIZE	-0.034175	0.006537	-5.227749	0	-0.034422	0.006513	-5.284861	0	-0.032003	0.006557	-4.881035	0	-0.033476	0.006761	-4.951207	0
ASSETQUA	-0.019997	0.042425	-0.471355	0.6379	-0.021568	0.042256	-0.51042	0.6103	-0.035581	0.042692	-0.833428	0.4057	-0.037249	0.042142	-0.883904	0.3779
LIQUIDITY	-0.348885	0.047548	-7.337527	0	-0.354762	0.047675	-7.441272	0	-0.343544	0.047575	-7.221029	0	-0.344074	0.04703	-7.316053	0
EFFICIENCY	0.087011	0.029875	2.912531	0.004	0.086897	0.029739	2.921981	0.0039	0.075754	0.030211	2.507468	0.013	0.073648	0.029845	2.467637	0.0145
DCAR	-0.249247	0.117653	-2.118493	0.0354	-0.263668	0.117827	-2.237749	0.0264	-0.300583	0.118439	-2.537885	0.012	-0.435022	0.153191	-2.839738	0.005
RISKit-1	0.559233	0.07606	7.352556	0	0.563753	0.075793	7.438022	0	0.523155	0.07995	6.54355	0	0.50805	0.081384	6.242595	0
REG					-0.00819	0.007598	-1.077895	0.2824	-0.082332	0.04369	-1.884446	0.061	-0.080502	0.043288	-1.859667	0.0645
RISKit-1*REG									0.123036	0.071443	1.722166	0.0867	0.118912	0.070895	1.677303	0.0951
DCAR*REG													0.265926	0.216147	1.230301	0.2201
R-squared				0.9022				0.903128				0.90454				0.906906
Adjusted R-squared				0.8962				0.896065				0.896502				0.897993
Durbin-Watson stat				1.8401				1.871855				1.985821				2.044912
S.E. of regression				0.0383				0.038324				0.038244				0.037967
Mean dependent var				0.5856				0.585608				0.585608				0.585608
S.D. dependent var				0.1189				0.118876				0.118876				0.118876
Sum squared resid				0.1423				0.141				0.138945				0.135502
Determinant residual covariance				1E-06				0.00000108				0.00000097				0.000000941