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School of Graduate Studies

Market Power of Ethiopian Banks: Evidence and Explanations

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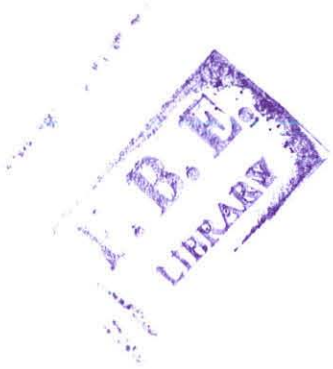

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This is to certify that the project paper presented by Hailemichael Nekatibeb, entitled: Market Power of Ethiopian Banks: Evidence and Explanations and submitted in partial fulfillment of the requirements for the Degree of Master of Arts in Economics (Competition Policy and Regulatory Economics) complies with the regulations of the university and meets the accepted standards with respect to originality and quality.

Approved by:

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Chair of Department or Graduate Programme Coordinator

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Abstract

Market Power of Ethiopian Banks: Evidence and Explanations

Hailemichael Nekatibeb

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The measurement of the degree of competition in any economic sector is of great relevance in that the level of social welfare decreases as the market power of firms' increases. In the specific case of the banking sector, the analysis of the social inefficiency associated with market power is even more important if we take into account the importance of the financial intermediation function in economic growth.

The Ethiopian banking sector is analyzed for evidence of market power by computing the Lerner Index of banks using annual data from 2002 to 2011. Using a model of oligopolistic conduct, we show that Ethiopian banks exercised market power in setting prices. The examination of the determinants of market power identifies the positive roles of operating efficiency and size. However, the results also indicate that inflation, elasticity of demand to loans and excessive size had a weakening effect on exercise of bank's market power.

As far as the study is concerned, the National bank of Ethiopia does not enjoy the luxury of implementing available policy instruments to minimize the impact of market power on social welfare and economic growth because the main explanatory variables are bank specific. Instead, it should endeavour to create an enabling environment for contestability in the sector, for example continuing with the open policy of domestic equity participation by adopting friendly and rational regulations. In addition, foreign banks should also be allowed to operate as such entry will intensify competition and propagate efficiency gains across the banking market.

Key Words: Competition, monopoly power, social inefficiency, Lerner Index

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Abbreviations

ASEAN – Association of Southeast Asian Nations

AIB – Awash International Bank S.C.

BoA – Bank of Abyssinia S.C.

BOFIT – Bank of Finland Institute for Economies in Transition

CBE – Commercial Bank of Ethiopia

CR – Concentration Ratio

CBB – Construction and Business Bank

CBO – Cooperative Bank of Oromia S.C.

CODESERIA - Council for the Development of Social Science Research in Africa

DB – Dashen Bank S.C.

DBE – Development Bank of Ethiopia

EPRDF - Ethiopian People's Revolutionary Democratic Front

EU – European Union

GDP – Gross Domestic Product

HHI - Herfindahl-Hirschamn Index

IMF – International Monetary Fund

IO - Industrial Organization

LIO – Lion International bank S.C.

MPRA – Munich Personal Research Papers in Economics Archive

NBE - National Bank of Ethiopia

NIB – Nib International Bank S.C.

OIB – Oromia International Bank S.C.

ROA – Return on Asset

SCP – Structure Conduct Performance

TA – Total Assets

UNU-WIDER – United Nations University – World Institute for Development Economic Research

UB – United Bank S.C.

US - United States

WB – Wegagen Bank S.C.

ZB – Zemen Bank S.C.

Chapter One

1. Introduction

1.1. Background of the Study

This year (2012) Ethiopia, specifically the party in government office, Ethiopian People Revolutionary Democratic Front (EPRDF) celebrates its 21 years of ascendance to the ladder of power. It has significance to the overall history of Ethiopian economy whereby the command economy principles were replaced by market economy principles. No other sector became beneficial or saw new light like the banking sector did following the economic reform measures. The reform measures included, among others, the comprehensive restructuring of government owned financial institutions and opening up the sector to local private equity participation (Getahun, 2008). The reform resulted in the establishment of 13 private banks until June, 2011.

Thereafter, the Ethiopian government, in its various policy and strategic papers, has clearly communicated that the long journey to industrialization and transformation to middle income nation should be led by agriculture, assisted by industrial and service sector development. In fulfilling this vision, the government has continued to register strong economic growth for the seventh time in a row in 2010/11, placing the country on a remarkable growth track. The economy grew 11.1 % in 2010/11. One of the pillars of such encouraging growth has been the banking sector, for instance, by disbursing 46.1% of total loans to the production sector in 2009/10 (NBE, 2010).

Accordingly finance is at the heart of boosting investment and thus growth in the economy. Achieving rapid and sustainable economic growth and development cannot be realized without vibrant, efficient and strong financial system. A competitive and efficient financial sector is a prerequisite for economic development and growth especially in developing countries. In a seminal paper, Levine (1997) suggested that financial system mobilizes and allocates savings, supports trade and by allowing easier access to investment opportunities, it affects accumulation of capital and growth. Thus policy reforms should aim at fostering competition in the financial sector (Poshakwale and Qian, 2009).

As banks play a fundamental role in the financing of the economy, banking competition impacts on economic development. A higher degree of competition in financial markets is expected to provide welfare gains through the reduction of prices of financial services and thereby accelerating investment and growth. These gains should in fact come from two channels of transmission. On the one hand, a higher degree of banking competition should result in a lower monopoly power of banks, and therefore a decrease of banking prices. On the other hand, a heightened competition should encourage banks to reduce their costs, i.e. their cost inefficiencies (Weill et al, 2007).

The issues regarding banking competition and its effects are therefore of particular interest in Ethiopia, as bank credit seems by far the largest source of finance for firms. Since investment is also particularly sensitive to the decrease of loan rates, the reduction of monopoly rents and cost inefficiencies would consequently impact on investment and economic growth.

Although the process of liberalization has created a scenario of greater competition following the implementation of measures such as the abolition of credit rationing, the liberalization of loan interest rates, freedom of establishment and private sector participation, in recent years Ethiopian banks have suffered an alteration of the competitive conditions of their markets as a consequence of various factors.

Since a competitive banking system helps lower transaction costs and risks and also helps make financial markets more efficient (Aboagye et al, 2008) and lack of competition has a negative effect on the efficiency of the banking system (Demirgüç-Kunt et al., 2003), it needs to be checked for the presence of market power.

1.2. Statement of the Problem

The importance of a well-functioning financial sector to the development of any economy is well documented. In general, financial systems tend to evolve around banking systems. As a critical financial intermediation unit, the banking system helps lower transaction costs and makes it more convenient for suppliers and users of funds to come together and transact business. Banks help potential suppliers of funds to lower the risks they bear by substituting

banks' ability to repay loans (i.e. deposits) for the ability of the ultimate borrower. Banks also help make financial markets become more efficient by reducing information asymmetry. All these make for faster economic growth (Aboagye et al, 2008).

When looking at the development of banking sector, the current economic growth, economic and regulatory climate, profitability of banking business, and interesting investment opportunities, it seems obvious that the Ethiopian economy needs more finance than ever. There will be a larger demand for financial services indicating greater opportunities for new entrants to fulfill these needs.

For instance, in its 2010 Ethiopian Banking Sector Review report, Access Capital predicted the profitability and attractiveness of the sector despite an influx of new banks, emergence of strong micro-finance institutions and unconventional policy interventions deeply unpopular among bankers like windfall taxes, credit cap and minimum paid up capital requirements (Access Capital, 2010).

Moreover, NBE in its 2009/10 annual report also indicated that the total capital of private banks showed a 16.7 percent increase to Birr 12.9 billion by the end of June 2010 compared to June 2009. As a result, the share of private banks in total capital of banks rose to 40.2 percent from 36.5 percent the previous year. Despite the continuous increase in the capital base, the Ethiopian banking industry is still very small even by African standards, suggesting the need for further efforts to enhance financial intermediation in the country.

Thus it is the duty of NBE to ensure that there is attractive, competitive and dynamic banking sector in the economy which it has been doing for the last 18 years.

But recently, despite encouraging efforts by private sector to join this attractive and profitable sector for over one and a half decade, the NBE is putting in to effect different directives and regulations which are in no means acceptable at least in the eyes of bankers and investors. One of these directives is the one that raised the required threshold capital of banks to half a billion Birr from 75million Birr. The other obstacle facing existing and new private banks is a directive which required them to allocate 27% of total loans and advances made to purchase NBE bond.

These new directives have since attracted opinions coming from two aisles. On one hand, there are experts who argue, like the central bank, that the new move would strengthen banks, making them resilient to financial shocks. On the other hand, there are those who argue that the effect of the directives would be to create an entry barrier for new banks and may have a crowding-out effect in the sector, which is still in its infancy, in both penetration and contribution to the gross domestic product (Addis Fortune, 2011).

Besides there also exist industry experts who argue that directives involving credit caps, minimum paid-up capital and credit allocation which only concerns private banks are intended to harm the performance of private banks and discourage those on the pipeline to join the sector so as to keep the dominance of state-owned banks forever. But NBE argues that the measures are intended to keep inflation low and allocate high liquidity available in private banks for long term projects which otherwise would have been allocated for short term and trade sector (The Ethiopian Reporter, 2011).

The immediate causality due to the directives is banking environment in terms of losing new entrants, participation of banks in illegal off-balance sheet activities to ensure profitability and low capital outflow to the private sector. The degree of competition in banking industry in Ethiopia is also a subject of some controversy. Lack of bank mergers and failures coupled with profit indicators for almost all banks are frequently referred to justify the popular view that banks operate under imperfect competition.

In addition, assessing bank competition in Ethiopia is important, because an extensive literature has shown that higher levels of bank competition are associated with lower prices for banking products, increased access to finance, and greater bank efficiency. At the same time, recent studies have shown that bank competition can also be good for stability by limiting the emergence of "too big to fail" institutions that take excessive risk (Anzoategui et al, 2010).

The author of this paper does not know the official position of the NBE in respect of the competitiveness of the banking industry, but looking at the true purpose of recent directives, one can surmise that the NBE seems reluctant to see new entrants in the market because it

might think open entry would lead to unstable business environment or think there is no room for improvement.

To resolve different conflicts and debates regarding the directives, one of the essential things to do is to check whether the existing banks are enjoying market power and if any what are the factors helping banks to consolidate market power. The above litmus test can be used to support or reject the appropriateness of recent NBE directives.

1.3. Objectives of the Study

The general objective of the study is to provide a rigorous investigation of the existence or otherwise of market power among Ethiopian banks, and if so, the factors that explain it using annual bank panel data.

Specifically the study tries to:

- Estimate the Lerner Index of market power of each bank.
- Determine the existence or otherwise of market power using Lerner Index.
- Analyze the evolution of market power overtime.
- Investigate the factors that explain market power if any.
- Provide suggestions and explanation on the appropriateness of recent NBE directives in connection with banking sector competitiveness.
- Present some policy recommendations.

1.4. Hypothesis

During the early 1990s the Ethiopian banking sector experienced liberalization and deregulation in terms of domestic private equity participation, foreign exchange liberalization and abolishment of credit rationing all of which have altered the conditions in which banking firms compete. But banks were not left alone. Successive directives, without full support from business community and academic circles, have been enacted with the objective of preserving financial stability.

In this context, the main hypothesis put forwarded in this paper is though the reform allowed domestic private banks to participate in the market, absence of foreign owned banks together with the increased support government banks have since received, may have increased the market power of the banks, thus decreasing the degree of competition.

Based on the literature surveyed and personal view on the area, the following hypotheses are developed:

- Ethiopian banks have market power.
- Size, efficiency and macroeconomic environment significantly explain the market power.

1.5. Significance of the Study

There has been much talks in the media and business forum but there is little empirical evidence on the restraining and discouraging effect of various directives and regulations adopted by NBE in recent times on banking sector, though the institution as the protector and regulator of the country's financial system has the obligation to enact such laws as far as they are found to be necessary and important. But the suspicion both from bankers and professionals is that NBE adopted such policies without solid empirical research. Hence this paper tries to fill part of the this gap by providing a detailed empirical analysis of competitive banking environment and if there is not, the main factors responsible for this uncompetitive business environment and finally the rationale behind directives enacted by NBE.

1.6. Organization of the Thesis

The study is organized in to six chapters. The first chapter deals with introduction. Related theoretical and empirical literatures on market power of banks and factors explaining it will be presented in chapter two. Chapter three is about methodology. The fourth chapter contains the history and overview of Ethiopian banking sector and analysis of results and discussions are presented in chapter five. The last chapter contains conclusions of the study and some policy suggestions.

Chapter Two

2. Review of Related Literatures

This section reviews the theoretical and empirical literatures of market power in banking sector, its implication and factors that explain it. There are two views on market power of banks: the first argues that banks should have market power to achieve financial stability and the second argues that banks use their market power in such a way that is detrimental to social welfare by lowering efficiency. Each of these arguments will be discussed in the following sub-sections.

2.1. Theoretical Literatures

Throughout the world, banking tends to be highly regulated to achieve both macroeconomic and sector-specific objectives. But economic theory is unclear as to the extent to which regulators should promote or limit competition within the banking sector.

The traditional industrial organization model argues that under certain assumptions perfect competition produces the greatest social welfare, a lower cost of financial intermediation, a higher volume of savings and investment, and therefore enhances economic growth. Such views are reinforced by many studies[1].

Besides, competitive markets are easier to be regulated, that is why competition is an important issue for policy makers.

On the other hand, another view argues that excess banking competition can lead to financial instability for various reasons. For instance, Keeley (1990) argued that in a situation of fierce competition, narrow banking margins cause banks to have to assume riskier projects in order to increase their profits, ending up increasing the banks' fragility.

Nevertheless, recently the inherent trade-off between efficiency (i.e. lower market power) and stability (i.e. higher market power) in the banking sector is solved in favor of market power and, thus, stability at the expense of competitive banking environment. But sometimes such policy

[1] *See for instance Maudos and Fernandez de Guevara (2006) and King and Levine (1993).*

reaction kills smaller and vulnerable banks or forces them to merge, which leads to higher and higher market power. Such market power, as theorized by traditional industrial economists would, in turn lower social welfare.

2.2. Empirical Literatures

Two views on market power of banks and their implication are dealt with in reference to empirical studies conducted both in developed and developing countries in this section. The implications are discussed along financial stability, social welfare and economic growth effects.

The first view associated greater market power with less financial stability, utilizing an argument the effect that a higher interest rate (associated with market power) has on the investment projects that reach the bank (see Boyd and De Nicolo, 2005). When the cost of financing is high, borrowers take on riskier projects with a greater probability of failure. In that case, banks' bad debt rates will be higher, increasing the probability of bank failures.

Evidence from Boyd et al. (2006) also showed the existence of a positive relationship between competition (market power) and financial stability (banking risk). In the same line, the study by Schaeck et al. (2009) also shows that stability is greater in the most competitive banking systems. Finally, the most recent study by Uhde and Heimeshoff (2009), using aggregate data for the banking sectors of the EU-25, obtains a negative impact of market concentration (proxy for market power) on financial stability.

Soedarmono et al (2010), based on a broad set of Asian banks for the period 2001-2007, found that higher degree of market power in banking increases bank risk taking and insolvency risk.

The possibility of greater social welfare loss associated with the market power has been addressed by Berger and Hannan (1989) who find that reduced competitiveness in more concentrated U.S. banking market results in lower operating efficiency. This is because the market power exercised by firms in concentrated markets allows them to avoid minimizing costs without necessarily exiting the industry.

In addition, the study by Maudos & Fernandez de Guevara (2007) found out the social welfare loss attributable to market power around 0.54% of the GDP of EU15 in 2002. Unsurprisingly,

they also confirmed that the welfare gains associated with a reduction of market power are greater than the loss of bank cost efficiency, showing the importance of economic policy measures aimed at removing the barriers to outside competition.

In a stylized model of economic growth, Pagano (1993) showed that market power, by allowing banks to charge higher loan rates and compensate savers with lower deposit rates, does indeed reduce the equilibrium quantities of funds available for credit, hence generating a direct negative effect on the rate at which the economy can grow. Guzman (2000) also confirms this negative effect of market power in a general equilibrium model of capital accumulation.

As supported by studies considered above, competition typically increases efficiency, and yet, is traditionally considered a threat to stability. There is considerable evidence that weak and inefficient financial systems can be a significant obstacle to economic growth (Beck and Levine, 2004). This is due to the fact that financial intermediation – the process of channeling savings into productive investment – is an essential part of private sector development. A weak and inefficient financial sector, with limited competition, can adversely affect savings decisions and the optimal allocation of credit, thus hindering investment and economic growth.

In contrast, the alternative view argues that excess banking competition can lead to financial instability. This is due to narrow interest rate margins as a result of cut-throat competition which prompt banks to assume riskier projects in order to increase their profits, ending up increasing the banks' fragility. This thesis is supported by the empirical evidence in specific case of the United States. In this same line, other studies (e.g. Hellman et al., 2000) offer evidence that after the processes of deregulation and liberalization of the financial sectors, the increase in competition diminishes profitability, which induces riskier behaviours.

Weill and Fungáčová's (2009) study of the influence of market power on bank failures based on evidence from Russia has also supported the idea that measures that increase bank competition could undermine financial stability.

Jimenez et al. (2010) found negative relationship between market power (measured by Lerner Index) and banking risk (proxied by bad debt rate) in the Spanish banking sector in the period

1988-2003 supporting the argument that limited competition will result in lower banking risk hence financial stability.

In addition, Maudos and Fernández de Guevara (2009) also confirmed that an increase in market power leads to greater stability, which lends support to the view that excess competition in banking markets can be detrimental to financial stability.

Clearly, running through these findings is the suggestion that the banking industries even in most developed countries are characterized by prevalence of market power. Some even suggest that banks were using this to their advantage, which amounts to a loss of social welfare and lower economic growth.

2.3. Measurement of Competition and Market Power

Empirical research on the measurement of banking competition provides several tools, which can be subdivided into the traditional Industrial Organization (IO) and the new empirical IO approaches. The traditional IO approach proposes structural tests to assess banking competition based on the Structure Conduct Performance (SCP) model[2]. The SCP hypothesis argues that greater concentration causes a less competitive bank conduct and leads to greater profitability (meaning lower performance in terms of social welfare). According to this, competition can be measured by concentration indices such as the market share of the three or five largest banks or by the Herfindahl-Hirschamn Index (HHI).

The new empirical IO approach, in contrast, provides non-structural tests to circumvent the problems of measuring competition provided by the traditional IO approach. The new empirical IO approach infers banks' conduct directly. It allows considering the actual behaviour of the banks by taking contestability into account. Indeed, as observed by Claessens and Laeven (2004), the actual behavior of a bank is not only related to market structure but also to the barriers to entry influencing the likelihood of the entry of new competitors and therefore the behavior of incumbents forecasting such an entry.

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[2] *It was suggested by Bain (1951) at the time when he studied the relationship between profit rate and concentration in American manufacturing industries for the period 1936-40.*

The most commonly applied tools to assess competition emanating from the new empirical IO approach are the Panzar-Rozze model, Bresnahan-Lau test and Lerner Index measure of market power. Panzar-Rozze test[3] is based upon the estimation of the H-statistic, which aggregates the elasticities of total revenues to input prices. Bresnahan-Lau test[4] is based on the estimation of a structural model with separate demand and supply equations. These tests therefore estimate the mark-up on aggregate bank data. The Lerner index of market power, on the other hand, defines the disparity between price and marginal cost expressed as a percent of price, taking into account that the divergence between product price and marginal cost of production is the essence of monopoly power. Thus, the Lerner Index measures the relative markup of price over marginal cost. The advantage of the Lerner index over other indicators of competition (such as Panzar-Rozze test and Bresnahan-Lau test) is that it allows market power to be proxied at bank level and its' evolution over time analyzed.

However, this study requires individual measures of competition for each bank in the sample through the period 2002-2011 instead of aggregate measures for the full sample. Therefore, Lerner index will be computed for each bank of the sample instead of estimating the Rosse-Panzar model and the Bresnahan-Lau test.

The Lerner index has been computed in several empirical studies on banking competition (e.g. Angelini and Cetorelli, 2003; Maudos and Fernandez de Guevara, 2004). It is defined as the difference between price and marginal cost divided by price.

For example, Fernandez de Guevara et al. (2006) analyzed the evolution of banking market power using a panel of 18,810 observations from Germany, France, Italy, Spain and United Kingdom during the period 1992-99 based on the estimation of Lerner indices where the results show substantial differences between countries. The evolution of the Lerner index does not show an increase in the degree of competition within the countries, despite the liberalization measures implemented in order to create a single banking market.

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[3] *See Claessens & Laeven (2004), Bikker & Haaf (2002), De Bandt & Davis (2000) and Bikker et.al. (2007) to get additional information about the test.*

[4] *It was employed by Angelini & Cetorelli (2003) and Kubo (2006).*

In the case of the European banking system, several recent studies analyze the competition in banking markets. The studies by Bikker and Haaf (2002) analyzed competition in a sample of 23 countries (European and non-European) showing evidence in favour of the existence of monopolistic competition. In this same line of analysis, the results of the studies by De Bandt and Davis (2000) do not permit us to reject a situation of monopolistic competition in the principal banking sectors of Europe (Germany, France and Italy).

Anzoátegui et al. (2010) study the extent of bank competition in the Middle East and Northern Africa region during 1994-2008 using non-structural measures of competition (H-statistic and the Lerner index). Both these measures suggest that banking sector competition in the region is lower relative to other regions and has not improved in recent years. Worse credit information environment and lower market contestability are identified as the determinants of competition.

Employing Lerner Index measure of market power, Fernandez de Guevara and Maudos (2006) observed rising market power in the Spanish banking sector in the period 1986-2002 compared to the mid-1990s despite financial liberalization and deregulation.

2.4. Explaining Banking Market Power

Market power (proxied by Lerner Index) is modeled depending on bank-specific variables, the structural characteristics of the banking industry, and the macroeconomic environment including the extent of financial deepening.

Pioneer studies on determinants of market power are reviewed thoroughly to borrow factors that explain market power.

Fernandez de Guevara and Maudos (2006) in their study of market power of Spanish banking sector in the period 1986-2002 found size, efficiency and specialization as significant determinants of market power. Bank size has a significantly negative effect on market power though it is nonlinear.

When explaining net interest margins (proxy for market power), Demirguc-Kunt et al. (2004) found evidence that relatively large banks - measured in terms of market share - can exert

market power to increase net interest margins. Bank size itself has a negative impact on margins in this study similar with the above study.

Chirwa and Mlachila (2004) estimated a model which specifies interest rate spreads as a function of bank and market characteristics, the regulatory environment and macroeconomic characteristics for Malawi using monthly panel data for five Malawian commercial banks for the period 1989-1999. They found that for Malawi, observed high interest rate spreads (market power) can be attributed to high monopoly power, high reserve requirements, high central bank discount rates and high inflation.

Maudos and Nagore (2005) also examined factors that explain bank market power differences across countries and found that bank-specific variables, bank concentration and the level of financial development explain market power differences across countries.

Aboagye et al. (2008) while analyzing the market power and factors that explain the market power of Ghanaian banks have found out that:

- Size of the bank, rather than market share or concentration, significantly explained the market power of the Ghanaian banks.
- Improving macroeconomic environment has also increased the market power of banks. They suggested this may be because banks are taking advantage of higher demand for credit as the economic environment improves.

Maudos and Fernández de Guevara (2009) also confirmed an inverted U shaped relationship between the size of banks and market power, so the positive effect of size presents a maximum beyond which it has a negative effect.

Fernandez de Guevara et al. (2005) estimated Lerner indexes for the five most important banking sectors of the European Union and found out that size, efficiency of banks, default risk, and the economic cycle have a notable capacity to explain the behavior of the market power. They establish a positive relationship between bank size and market power though the relationship is not linear but quadratic. Therefore, for the specific case of the European banking

system, their results show that there exists a size beyond which market power diminishes, so that for very small banks or very big ones, market power is reduced.

Bikker et al. (2007), based on large sample of almost 18,000 banks in 101 countries over more than 15 years, showed that large banks have substantially more market power than small banks in many countries using an extended version of the Panzar-Rosse (P-R) model.

In general, bank-specific variables that have been used in the literature include bank size, bank efficiency, banking risk and bank product specialization. Market structure variables that have been used include bank concentration, market share and ownership. Measures of macroeconomic environment have included the rate of inflation, the growth rate of the economy and elasticity of aggregate loan demand. Also, the extent of financial deepening in the economy is hypothesized to have a bearing on the market power of banks.

The survey carried out, though it shows the existence of numerous studies that analyze competition in banking markets, also reveals the scarcity of studies that analyze the explanatory factors of market power. This question is especially relevant because only when the sources of this market power have been identified will it be possible to undertake the reforms necessary to achieve a reduction of the social inefficiency associated with the existence of market power.

Chapter Three

3. Methodology

The Ethiopian banking industry is analyzed for evidence of market power by computing the Lerner Index of banks using annual data from 2001/02 to 2010/11. In support of this method, Coccorese (2009), for instance, argued that Lerner Index is a true reflection of the banks' degree of market power because it represents the behavioural departure from both monopoly and perfect competition. He also acknowledges the prevalence of market power in industries dominated by a few large firms which serve as market leaders through collusive conduct as is the case in banking industry.

This study adopted the framework of Corvoisier and Gropp (2002) and Fernandez de Guevara, et al. (2005) to scrutinize the existence or otherwise of market power to influence prices and if so the main elucidating factors. This approach involved, first of all, establishing whether or not banks set prices above their marginal costs.

3.1. Analytical Framework

The analytical framework for estimation of market power in the Ethiopian banking industry draws on the influential Klein-Monti imperfect competition model[5]. This model examines the behaviour of a monopolistic bank faced with a positively-sloped deposit supply curve D (r_D) and a negatively-sloped loan demand curve L (r_L). The decision variables of the bank are D (volume of deposits) and L (volume of loans), where the level of capital is assumed to be given. The bank is assumed to be a price taker in the inter-bank market (r), so that the objective function of profit to be maximized is given as follows:

$$\pi = \pi(L, D) = (r_L(L) - r)L + \big(r - r_D(D)\big)D - C(L, D) \ldots\ldots\ldots (1)$$

, so that profit is the net interest income between deposits and loans after deducting the transformation costs C (L, D), where in r_L denotes loan rate, r_D represents deposit rate and r is money market rate. The first order conditions with respect to loans and deposits are as follows:

[5] *See a survey in Freixas & Rochet (1997)*

$$\frac{\partial \pi}{\partial L} = \frac{\partial r_L}{\partial L}.L + r_L - r - \frac{\partial C}{\partial L} = 0 \rightarrow \left[\frac{r_L^* - r - \frac{\partial C}{\partial L}}{r_L^*}\right] = \frac{1}{\varepsilon_L} \ldots\ldots\ldots (2)$$

$$\frac{\partial \pi}{\partial D} = -\frac{\partial r_D}{\partial D}.D + r - r_D - \frac{\partial C}{\partial D} = 0 \rightarrow \left[\frac{r - r_D^* - \frac{\partial C}{\partial D}}{r_D^*}\right] = \frac{1}{\varepsilon_D} \ldots\ldots\ldots (3)$$

, ε_L and ε_D being the elasticities of demand for loans and deposits, respectively.

The Lerner Index for expression (2 & 3) represents the extent to which the monopolist's market power allows it to fix a price ($r_D and\ r_L$) above marginal cost (approximated by $\frac{\partial C}{\partial D}\ and\ \frac{\partial C}{\partial L}$), expressed as proportional to the price. In the case of perfect competition, the value of the index is zero, there being no monopoly power. Starting from this extreme case, the lower the elasticity of demand, the greater the monopoly power to fix a price above the marginal cost.

The extension of the model to the case of an oligopoly (N banks) provides the following expression of the first order conditions:

$$\left[\frac{r_L^* - r - \frac{\partial C}{\partial L}}{r_L^*}\right] = \frac{1}{N\varepsilon_L} \ldots\ldots\ldots (4)$$

$$\left[\frac{r - r_D^* - \frac{\partial C}{\partial D}}{r_D^*}\right] = \frac{1}{N\varepsilon_D} \ldots\ldots\ldots (5)$$

, which differs from the case of monopoly only in that the elasticities are multiplied by the number of competitors (N). With this simple adaptation, the Monti-Klein model can be reinterpreted as a model of imperfect competition with two extreme cases: monopoly (N=1) and perfect competition (N=infinity). The model of imperfect competition suits the banking industry in Ethiopia very well as it is dominated by few firms and reflects oligopolistic market structure.

3.2. Methodological Framework for Lerner Index of Market Power

The Lerner Index approach has a firm theoretical basis in new industrial organization approach and is employed to empirically examine the banking industry in many countries. Importantly, it is suitable to examine bank level market power. It is defined as: $LI = \frac{(P-MC)}{P}$, where, P is the average price set by a bank and MC is the bank's marginal cost. The index defines disparity (mark-up) between price and marginal cost expressed as a fraction of price, taking into account that the divergence between price and marginal cost is the essence of monopoly power (Fernandez, et al, 2005).

Unfortunately, the annual reports of individual banks do not provide sufficiently detailed information for estimation of separate costs for deposits, loans and additional services. For that reason, a single indicator of banking activity i.e. total assets is used in this empirical model as is the case in Maudos and Fernandez de Guevara (2004) and Fernandez de Guevara et al. (2005). The starting assumption is that the flow of goods and services produced by a bank is proportional to its total assets.

The annual reports do not also incorporate marginal costs related to the production of any of asset items of individual banks. Therefore, an approximate measure of marginal cost has to be estimated. Given that marginal cost is not directly observable, it has to be estimated from a trans-logarithmic cost function.

But as is the case in less developed countries, where financial system is characterized by rudimentary financial markets, the main source of banks' funds in Ethiopia is also deposits. For instance, the amount of funds raised through bank deposits represents 82.2% of total liabilities in 2010/11. Recognizing that banks are multi-output firms, all bank outputs, namely loans, securities, reserves and other assets are aggregated into a single measure of bank product (total assets) which enables us to construct a single measure of marginal cost for overall production activity.

Like many authors[6], this study empirically estimated Lerner Index using a single indicator of banking activity (output), measured by total assets (TA). To compute the Lerner Index, the average price, P, of a bank's product is approximated from the ratio of total revenue (interest and non-interest income) to total assets and marginal cost is derived from trans-logarithmic cost function given below:

$$lnTC_{it} = \alpha_0 + \alpha_1 lnTA_{it} + \frac{1}{2}\alpha_2 (lnTA_{it})^2 + \sum_{j=1}^{4} \beta_j lnw_{jit} + \frac{1}{2}\sum_{j=1}^{4}\sum_{k=1}^{4} \beta_{jk} lnw_{jit} lnw_{kit} + \frac{1}{2}\sum_{j=1}^{4} \vartheta_j lnw_{jit} lnTA_{it} + \mu_1 TREND_t + \mu_2 (TREND_t)^2 + \mu_3 TREND_t lnTA_{it} + \sum_{j=1}^{4} \delta_j TREND_t lnw_{jit} + \varphi_1 lnBRANCH_{it} + \varphi_2 lnRISK_{it} + \varphi_3 INTERMED_{it} + \varepsilon_{it} \dots\dots\dots (6)$$

Where,

- TC_{it}: represents total costs including financial and operating costs.
- TA_{it}: denotes total asset as proxy of bank output.
- j: indexes actual inputs (i.e. labour, finance, physical capital and administrative & other general services),
- w_j: are input prices defined as follows:
  - Price of labor (w_L): Total personnel expenses expressed as a proportion of total assets.
  - Price of funds (w_F): Total interest expenses on deposits and other borrowed funds divided by total deposits and borrowed funds.
  - Price of physical capital (w_K): Sum of all other expenses (on building, equipment, furniture, etc.) divided by stock of fixed and other assets.

[6] *Fernandez et al (2005), Aboagye (2008) and Simpasa (2010).*

- Price of administration and other general costs (w_A): computed as a ratio of all administrative, general and other costs to total assets. Included in this category are general expenses, directors' remuneration and audit fee.

- TREND: represents time factor to account for technical change overtime.
- BRANCH: is the number of branches operated by banks. It controls for the scale of operation and the effect of branch network density on costs.
- RISK: is the ratio of a non-performing loan to total loans. It captures the impact of poor credit quality on bank costs.
- INTERMED: is intermediation ratio defined as the ratio of loans-to-deposits. The flow of deposits into the banking sector determines the amount of loans a bank can make implying relying more on deposits to finance assets brings a higher funding risk. Therefore, this variable is included to measure the effect of deposit fund utilization in financial intermediation.
- εit: is an idiosyncratic error term

The variables BRANCH, RISK and INTERMED are control variables. Symmetry and linear homogeneity in input prices restrictions are imposed. α_i, β_j, β_{jk}, δ_i and ϕ_j are coefficients to be estimated.

The cost function depicted by Equation (6) can be estimated directly using ordinary least squares in a panel data context. However, there are efficiency gains when it is estimated jointly with input cost share equations. The inclusion of the input cost share equations in the estimation procedure has an advantage of creating more degrees of freedom without adding any unrestricted regression coefficients. It also yields more asymptotically efficient parameter estimates than would otherwise be if the cost function is estimated on its own (Alaba et.al, 2010). By Shepherd's Lemma, input share equations for labour, finance, physical capital and administrative and general services are derived by partially differentiating the cost function with respect to each logged input price $\ln w_L$, $\ln w_F$, $\ln w_K$ and $\ln w_A$. Input share equations for these four inputs are given below:

$$S_L = \frac{\partial lnTC_{it}}{\partial lnw_{Lit}} = \frac{\partial TC_{it}}{\partial w_{Lit}} \cdot \frac{w_{Lit}}{TC_{it}} = X_{Lit} \cdot \frac{w_{Lit}}{TC_{it}}$$

$$= \beta_L + \beta_{LL} lnw_{Lit} + \beta_{LF} lnW_{Fit} + \beta_{LK} lnW_{Kit} + \beta_{LA} lnW_{Ait}$$

$$+ \vartheta_L \frac{1}{2}(lnTA_{it}) + \delta_L TREND_t + \omega_j \dots\dots (7)$$

$$S_F = \frac{\partial lnTC_{it}}{\partial lnw_{Fit}} = \frac{\partial TC_{it}}{\partial w_{Fit}} \cdot \frac{w_{Fit}}{TC_{it}} = X_{Fit} \cdot \frac{w_{Fit}}{Tc_{it}}$$

$$= \beta_F + \beta_{FF} lnw_{Fit} + \beta_{FL} lnW_{Lit} + \beta_{FK} lnW_{Kit} + \beta_{FA} lnW_{Ait}$$

$$+ \vartheta_F \frac{1}{2}(lnTA_{it}) + \delta_F TREND_t + \omega_j \dots\dots (8)$$

$$S_K = \frac{\partial lnTc_{it}}{\partial lnw_{Kit}} = \frac{\partial TC_{it}}{\partial w_{Kit}} \cdot \frac{w_{Kit}}{TC_{it}} = X_{Kit} \cdot \frac{w_{Kit}}{TC_{it}}$$

$$= \beta_K + \beta_{KK} lnw_{Kit} + \beta_{KL} lnW_{Lit} + \beta_{KF} lnW_{Fit} + \beta_{KA} lnW_{Ait}$$

$$+ \vartheta_K \frac{1}{2}(lnTA_{it}) + \delta_K TREND_t + \omega_j \dots\dots (9)$$

$$S_A = \frac{\partial lnTC_{it}}{\partial lnw_{Ait}} = \frac{\partial Tc_{it}}{\partial w_{Ait}} \cdot \frac{w_{Ait}}{TC_{it}} = X_{Ait} \cdot \frac{w_{Ait}}{TC_{it}}$$

$$= \beta_A + \beta_{AA} lnw_{Ait} + \beta_{AL} lnW_{Lit} + \beta_{AF} lnW_{Fit} + \beta_{AK} lnW_{Kit}$$

$$+ \vartheta_A \frac{1}{2}(lnTA_{it}) + \delta_A TREND_t + \omega_j \dots\dots (10)$$

, where S_j is input specific cost share such that $S_L + S_F + S_K + S_A = 1$and ω_j is a random error term for the j^{th} input (j = L, F, K and A).

Since the input cost shares sum to unity, one of the factor cost share equations should be dropped to obtain a non-singular covariance matrix. Therefore, only J-1 input cost share equations are estimated jointly with the cost function. The resulting parameter estimates are asymptotically equivalent to those obtained by the maximum likelihood approach and are invariant to the factor cost share equation dropped during estimation. The joint estimation of the cost function and the J-1 input cost share equations are estimated by applying Zellner's (1962) two-step iterated seemingly unrelated regression estimation (ISURE) procedure. The

cost function is normalized by the input price of administrative and general services, leaving us with three input cost share equations for labour (S_L), funds (S_F) and physical capital (S_K), respectively.

The marginal cost is then obtained by differentiating the cost function equation (6) with respect to output, TA. The rationale for estimating marginal cost from the cost function is that the flow of banking services, as output, is proportional to the total assets of the bank. The marginal cost is then derived as follows:

$$\mathbf{MC_{it}} = \frac{\partial \mathbf{lnTC_{it}}}{\partial \mathbf{TA_{it}}} = \frac{\mathbf{TC_{it}}}{\mathbf{TA_{it}}}\left(\alpha_1 + \alpha_2 \mathbf{lnTA_{it}} + \frac{1}{2}\sum_{j=1}^{4} \vartheta_j \mathbf{lnw_{jit}} + \mu_3 \mathbf{TRE_t}\right) \ldots (11)$$

Where, MC_i is the bank level marginal cost. The industry-wide marginal cost MC is obtained by $MC = \frac{(\sum_{i=1}^{N} MC_i)}{N}$, where N is the number of banks. Consistent with Fernandez de Guevara, et al. (2005), the bank specific Lerner Index measure of market power is given by:

$$\boldsymbol{LI_{it}} = \frac{\boldsymbol{P_{it}} - \boldsymbol{MC_{it}}}{\boldsymbol{P_{it}}} \ldots\ldots (12)$$

Where, P_{it} denotes output price for each bank during the sample period. Equation (13) depicts the average Lerner Index for the banking industry:

$$\boldsymbol{LI_i} = \frac{\boldsymbol{P_i} - \boldsymbol{MC_i}}{\boldsymbol{P_i}} \ldots\ldots (13)$$

, where P captures the market price for the whole banking industry, calculated by $P = \left(\frac{\sum_{i=1}^{N} P_i}{N}\right)$.

3.3. Data Sources

Data for this study is obtained from National Bank of Ethiopia, Central Statistical Authority and individual bank's annual report. These are annual data spanning 2001/02 through 2010/11. This is an appropriate period to investigate because the issues being addressed here are concerned about bank market power following domestic private capital participation and subsequent proliferation of new banks.

The sample covers all commercial banks that were present at the end of 2010/11 and had been in operation for at least three years. The study employs unique annual data gleaned from each banks' balance sheet and income statement returns reported by each bank to the public and as well as to the central bank.

3.4. Estimating Lerner Index

Lerner Index values are estimated from equation (11) and (12) after finding P and MC for each year which determine the existence or otherwise of market power.

Estimated coefficients from the cost function are then used to approximate marginal cost based on equation (11). Lerner Index is then deduced which is an inverse measure of competition, meaning that a greater Lerner Index means lower competition. The statistics of Lerner Indices per year concerns all banks. The focus of comments depending on Lerner Index to explain evolution of competition relies on the median Lerner Index values for each year.

Test on residuals is conducted to check for the existence of first order serial correlation and heteroskedasticity on cost function. Other basic tests for regression adequacy – adjusted R-squared, F-test and functional independence are conducted.

The Lerner Index is derived on the grounds that in perfect competitive equilibrium banks will set product prices equal to their marginal costs. As defined, positive values of the Lerner Index indicate capacity to set prices above marginal costs. Lerner Index values near 0 suggest product prices are close to marginal costs, while Lerner Index values near 1 suggest product prices substantially above marginal costs (high market power).

3.5. Explaining Market Power

Based on the above Lerner Index values, evidence in favour or against the existence of market power will be determined.

A major advantage of the approach adopted in estimating the Lerner Index is that it gives a better understanding of the evolution of competition over time. In this way, we can then relate the market power index to its explanatory factors. These factors could be bank-specific, structural, regulatory or macroeconomic in nature. Based on studies conducted around the

world and taking situation specific to Ethiopia, factors that explain market power of Ethiopian banks are proposed in the following section.

3.6. Empirical Model Specification

The model adopted in this study posits the Lerner Index of market power as depending on bank-specific variables, structural characteristics of the banking industry and the macroeconomic environment including the extent of financial deepening.

Thus consistent with Fernandez et al. (2005), Aboagye et al. (2005) and Simpasa (2010), investigations of the factors that explain market power of Ethiopian banks are conducted. Descriptions of dependent and explanatory variables used in the study are given below:

3.6.1. Dependent Variable

This is the annual Lerner Index that is estimated for 2002-2011.

The following factors have been identified as possible determinants of market power of banking industry.

3.6.2. Explanatory Variables

1. **Structure of the market:** The theoretical rationale for including a measure of market structure is that an individual bank exerts greater influence over the market price relative to marginal cost, thereby increasing the mark-up (Beighley & McCall, 1975); Cowling & Waterson, 1976)). It is argued that in more concentrated markets, collusion by some players may result in setting prices that are less favourable to consumers (higher loan rates). Concentration and market share variables are introduced as explanatory variables of relative margin:

   1.1. **Concentration:** measured by Herfindahl-Hirschamn Index (HHI). HHI is calculated by summing the squares of the market shares of each firm: $HHI = \sum[X_i]^2$, where, X_i is the market share of total assets, or deposits or loans of bank i. The HHI is viewed as a measure of concentration, that is, the extent to which a few banks dominate market shares in respect of total assets, loans or deposits. HHI value ranges in value from 0 to 1 whereas a value near 0 suggests existence of

many small banks, while an HHI value near 1 suggests the existence of few big banks. Decreases in the HHI suggest a loss of pricing power and an increase in competition, whereas increases suggest the opposite. Results of previous research notwithstanding, HHI are expected to have a positive effect on the Lerner Index.

1.2. **Market Share (MS):** computed as the respective ratios of bank total assets, bank total deposits and bank total loans to industry totals; it is introduced as well as efficiency, to test the efficient structure hypothesis or alternatively the collusion hypothesis.

2. **Bank Credit risk:** Banks' exposure to high credit risk could manifest itself in deterioration of the credit portfolio. To avoid incurring risk, banks may pre-screen their customers and choose to lend to less risky borrowers, even at high interest rates (Stiglitz & Weiss, 1981). Commercial banks may also increase the proportion of risk free assets such as Treasury securities thereby reducing risk premiums (Tovar et al., 2007). The riskiness of the loan portfolio (credit risk) of the bank is proxied by the ratio of loan loss provisions to total loans. It is expected that this variable will have a negative impact on market power.
3. **Size**: The size of a bank is represented by the logarithm of total assets, lnTA, to capture possible cost advantages associated with size. Preliminary investigations suggested possible non-linear relationship with Lerner Index, thus the square of this variable is also included. The variable is used as explanatory of market power for two reasons: 1) in case there are advantages in average costs associated with the possible existence of economies of scale; and 2) to test whether size, per se, confers market power.
4. **Bank Efficiency:** Firms with superior management should be more efficient and so incur lower costs per unit of revenue, hence possibly higher profits. This may translate to increased market power if the banks wish to make more profits, or it may give room to more efficient banks to lower their margins. Berger (1995) has suggested that the way to test actual bank behaviour is to introduce efficiency, concentration, market share measures as explanatory variables. This suggestion is followed here. Consistent with

issues of concern in this study, operating expenses are decomposed into staff expenses, physical capital expenses and administrative and other expenses. Each is expressed as a ratio of total revenue to capture three dimensions of efficiency. Cost inefficiency in banking is often associated with high mark-ups because banks tend to mask their operating inefficiency through wide spreads, the cost of which is borne by customers. When cost inefficiency is a binding constraint, this leads to high market power and may be exacerbated by agency problems. However, it is also possible that banks' high price-cost margins could move in tandem with better cost efficiency performance, mainly because efficient banks are able to contain costs and therefore retain wide mark-ups as predicted by the efficiency structure hypothesis. For these reasons, the relationship between cost efficiency and mark-ups is unclear.

5. **Proportion of other income to total assets (OITASS):** banks with better non-interest revenue performance would exert greater market power, and may use this as an entry barrier. A positive coefficient is therefore expected on the variable (OITASS).
6. **Ownership dummy:** considering that Ethiopian banking sector includes some banks that are government owned, it is important to control for the ownership type.
7. **Rate of inflation (INF):** Since price-cost margins vary with macroeconomic conditions and the monetary policy rule, rate of inflation is introduced to account for the impact of changing economic environment on market power. For instance, during a recession, mark-ups tend to decrease and increase in boom times. In contrast, Toolsema (2004) suggested that there is an inverse relationship between monetary conditions and market power. Thus, the impact of inflation on market power cannot be known apriori.
8. **Bank reserve:** is proxied through the ratio of cash and deposits in central banks to total deposits. A negative sign is expected for this variable, as the higher the proportion of liquid reserves (with an implicit opportunity cost as they are remunerated at an interest below the market rate), the lower the margin obtained.
9. **Financial Depth:** is included to measure the impact of financial deepening on bank market power. The variable is constructed as the ratio of total bank credit at the end of the year to GDP of the year. One reason is that more financial deepening will lower the

market power of individual banks. Taking into account that the demand elasticity for banking products will be greater when other non-banking sources of finance are more important, a hypothesis to be tested is that the higher the loans/GDP ratio, the greater the degree of dependence on banking finance, and the higher the market power will be.

In view of the foregoing discussion, Equation (14) below is estimated to assess the determinants of market power in the Ethiopian banking industry.

$$lnLI_{it} = \alpha_0 + \alpha_1 \sum_{k=1}^{3} lnHHI_{kit} + \alpha_2 \sum_{i=1}^{3} lnMS_{kit} + \alpha_3 lnRISK_{it} + \alpha_4 lnTA_{it} + \alpha_5 (lnTA_{it})^2 + \alpha_6 \sum_{m=1}^{4} lnEFF_{mit} + \alpha_9 lnOITASS_{it} + \alpha_{10} lnowner_{it} + \alpha_{11} lnINF_{it} + \alpha_{12} lnRESERVE_{it} + \alpha_{13} ln\frac{Loans}{GDP}_{it} + \delta t + \mu_i + \varepsilon_{it} \ldots (14)$$

Where k indexed deposits, loans and assets for which HHI and market share variables are computed for and m indexed decomposed operating expenses for labour, physical capital costs and administrative & other costs respectively. μ_i is unobserved individual specific effect which accounts for individual heterogeneity. Static panel data regression method is primarily used for estimation but other diagnostics estimation procedures are also conducted. Hausman test compares between fixed and random effect model. But to verify that using panel data approach is plausible, the existence of fixed individual effect will be checked.

Chapter Four

4. Overview of the Ethiopian Banking Sector

4.1. Brief History

Mauri (2003) classified the evolution of Ethiopian banking sector into five distinct periods. According to him, the first event was the establishment of Bank of Abyssinia in 1905, marking the advent of banking business into the country. The bank was owned and managed by the British-owned National Bank of Egypt and was given a 50 years banking monopoly including the right to issue coins and notes. However, three other banks were also established in the next ten years[7] (Belay, 1990). Because these banks were criticized for being wholly foreign owned, the Ethiopian government purchased the Abyssinian Bank in 1931 and renamed it the Bank of Ethiopia by an official decree on August 29, 1931 – making it the first nationally owned bank in the African continent. The Bank of Ethiopia was authorized to issue coins and notes and act as the government's bank (Belay, 1990; Befekadu, 1995).

The second event was due to Italian occupation in 1936, when following liquidation of the Bank of Ethiopia, a broad colonial banking network in the Horn of Africa (Eritrea, Ethiopia and Somalia) and closely linked with the metropolitan financial system, was set up in the country. During the five years of Italian occupation (1936-41), several Italian banks[8] opened branches in Ethiopia.

The third event was the establishment of the State Bank of Ethiopia in 1943, marking the rebirth of the Ethiopian independent banking system. After independence from Italy's brief occupation, where the role of Britain was dominant owing to its strategic planning during the Second World War, Barclays Bank was established and it remained in business in Ethiopia during 1941-43 (Befekadu, 1995). State Bank of Ethiopia was operating as both commercial and

[7] *These banks are Societe Nationale d' Ethiopie Pour Le Development de l'Agriculture et du Commerce, Bankue de l'Indochine and Compagnie de l'Afrique Orientale*

[8] *Banca d'Italia, Banco di Roma, Bancodi Napoli and Banca Nazionale del lavoro started operation in the main towns of Ethiopia*

a central bank until 1963 when it was remodeled into today's National Bank of Ethiopia and the Commercial Bank of Ethiopia. Since the 1963 Ethiopian Monetary and Banking law allowed foreign equity participation in banking business provided that 51% of the company is owned by Ethiopians, many banks and non-banks financial intermediaries were established and stayed in business until the 1974 revolution (Belay, 1990).

The fourth event was the revolution of 1974, which nationalized companies and shaped a "socialist banking" two-tier model suited to Ethiopia. All privately-owned financial institutions including three commercial banks and two non-bank financial intermediaries were nationalized on 1 January 1975[9]. The nationalized banks were reorganized and one commercial bank (Commercial Bank of Ethiopia), a national bank (recreated in 1976) and two specialized banks - the Agricultural and Industrial Bank (AIB) and a Housing and Saving Bank were formed.

However, the practice of banking changed fundamentally during the Derg regime. The banks' large customers became public enterprises, and the banks were instructed to lend to them in support of the government's development plans.

The fifth event was the collapse of socialist regime followed by a financial sector reform and liberalization of the banking sector due to economic policy change. Following the regime change in 1991 and the liberalization policy in 1992, public financial institutions were reorganized to work in a market-oriented policy framework. In addition, newly privately owned banks were also allowed to work alongside the publicly owned ones. The main institutional changes proposed, however, were very much less radical than elsewhere in Africa, being limited to the following:

- To allow private banks to operate, but only if 100% locally owned.
- To allow the two development banks, Agriculture and Industrial Development Bank (renamed Development Bank of Ethiopia) and the Housing and Savings Bank (renamed

[9] *The commercial banks were Banco di Napoli, Addis Bank Share, Banco di Roma (Ethiopia) Share Co. The non-bank financial intermediaries were Imperial Saving and Home Ownership Public association and Ethiopian Saving and Mortgage Share Co.*

Construction and Business Bank), to become commercial banks and to compete with the CBE and with each other.

- To give greater autonomy in lending decisions to public banks.
- To keep the three government banks in 100% government ownership.

4.2. Regulatory Environments

The period 1990s was a turning point for the development of the Ethiopian banking sector. National Bank of Ethiopia was established by Monetary and Banking Proclamation no. 83/1994 as a judicial entity, separated from the government and outlined its main functions. Monetary and Banking proclamation No.83/1994 and the Licensing and Supervision of Banking Business No.84/1994 also laid down the legal basis for private investment in the banking sector. Accordingly, the private sector are allowed (owners have to be Ethiopian nationals, however) to engage in banking businesses. Due to this policy shift, the country has witnessed a proliferation of private banks. For instance, at the end of June, 2011 there were 14 fully operational private commercial banks (NBE, 2011).

The Banking Business Proclamation no. 592/2008 identifies banking business as an operation that involves such activities like receiving funds; discounting and negotiating of promissory notes, drafts, bills of exchange and other evidences of debt; transfer of funds to other local and foreign persons; buying and selling of gold and silver bullion and foreign exchange and any other activity recognized as customary banking business. It uses the funds collected from the public, in whole or in part, for the account and at the risk of the person undertaking banking business, for loans or investments in a manner acceptable by the National Bank.

Foreign firms are not allowed to provide any financial intermediation according to proclamation number 84/1994 of the country. Such barrier to foreign firms to participate in domestic banking business helped to maintain public banks dominance. According to Kiyota, Peitsch and Stern (2007), the financial liberalization index, which measures banking security and independence from government on a scale of 10 to 100 (100 being the most liberal), is only 20 for Ethiopia (the lowest in Sub-Saharan Africa).

Moreover, since proclamation no. 84/1994, the minimum capital requirements required to establish new bank have been revised twice. At first the initial minimum capital requirements was 10 million which was revised to be 75 million in 1999 by Directive No. SBB/24/99 and the current minimum capital requirements are 500 million according to proclamation no. 23/2011.

The National Bank of Ethiopia Directive Number SBB/29/2002 also limits the aggregate loan or extension of credit by any commercial bank to any single borrower to a maximum of 25% of its total capital.

Commercial banks are also given the legal right to fix their lending interest rates, while the minimum saving (deposit) rate is fixed by National Bank of Ethiopia.

4.3. Structure of the Market

The Ethiopian banking sector is not yet opened to foreign participation and competition. Lack of competition and barriers to entry are expected to result in concentrated market. The market structure of Ethiopian banking sector is examined by the three bank concentration ratio (CR3) for assets, deposits and loans. The importance of concentration indices arises from its ability to capture structural features of the banking sector. Changes in the index reflect the changes in concentration as a result of the entry and exit of a bank from the market. Table 4.1 presents the indicators of market concentration. The table shows the continuous decline of three bank concentration index of assets, deposits and loans probably because of new entry and stiff competition between private and public banks for the same customers. In general, on average the three largest banks accounted for 73 % of assets, 74 % of loans and 66 % of deposits during the study period.

Table 4.1: Concentration in the Ethiopian commercial banking sector			
Three bank concentration ratios, CR3 (percent):2002-2011			
Year	**Assets**	**Deposits**	**Loans**
2002	83.82%	85.89%	79.02%
2003	81.27%	86.70%	71.87%
2004	79.99%	84.96%	68.33%
2005	78.33%	79.11%	70.02%
2006	75.63%	78.10%	60.49%
2007	74.11%	76.47%	58.93%
2008	73.33%	74.85%	67.65%
2009	71.15%	72.96%	68.03%
2010	70.29%	70.36%	68.22%
2011	67.52%	66.57%	68.34%
Average	**72.91%**	**74.06%**	**65.96%**
Source: Author own calculation			

Highly concentrated market especially towards public banks (particularly CBE & DBE) could bring dilemma to National Bank of Ethiopia in maintaining competitive business environment. The regulator might be tempted to ensure the profitability of such banks as they are not only major suppliers of funds to the government but are also source of revenue.

The information contained in CR3 is also substantiated by the Herfindahl Hirschman Index (HHI) which also depicted a high level of concentration (Table 4.2). The observed HHI for assets, deposits and loans far exceeded 1800 often used by regulators to measure the intensity of competition. But, one can surmise that the intensity of competition on all three aspects i.e. assets, deposits and loans have accelerated since 2002 due to the entrance of new banks in the market. The corresponding HHI values for assets, deposits and loans have shown 43%, 54% and

34% decline in 2011 compared with 2002, respectively. The highest improvement is recorded in deposits aspect which could be explained by higher deposit interest rate offered by private banks. In general, had the 500 million minimum capital requirements not been put in place in 2011, many private banks could have joined the market easily by raising public funds and improved the level of competition.

Table 4.2: Banking concentration - Herfindahl-Hirschman Index (HHI)

Year	HHI Values		
	Assets	Deposits	Loans
2002	4,944	5,984	3,501
2003	4,829	5,767	2,813
2004	4,641	5,357	2,491
2005	4,061	4,520	2,199
2006	3,804	4,237	1,724
2007	3,656	3,952	1,620
2008	3,578	3,755	2,411
2009	3,372	3,469	2,448
2010	3,108	3,220	2,291
2011	2,801	2,771	2,297
Average	3,879	4,303	2,380

Source: Author own calculation

Concentration of the Ethiopian banking system was also confirmed by Muluneh (2008), who examines the market structure of commercial banking industry in Ethiopia, and finds a highly concentrated market towards the public banks, especially in total assets and deposits. Specifically, in the above CR3 measure of competition, Commercial Bank of Ethiopia and Development Bank of Ethiopia holds more than 50% of assets and loans.

4.4. Performance of the Banking Sector

From the time of liberalization onwards (1992-2011), private banks have been allowed to operate in Ethiopia. Established at different times, at the end of June, 2011 there were 16 commercial banks in operation. Despite the slow and sometimes sluggish proliferation of private commercial banks overt time, their share in total banking sector in terms of deposit mobilization, credit disbursement and branch expansion has shown encouraging trend. Total

deposit mobilization by the banking system soared to 118,235 million Birr at the end of June, 2011 of which private banks mobilized 44% of the total deposits. In the same period outstanding loans of the banking system reached 63,596 million Birr of which 38.5% are disbursed by private banks. The total capital and reserves of the banks also reached 16,235 million Birr at the end of June 2011, of which the private banks account for 7,939 million Birr (49%) (See table 4.3).

Table 4.3. Assets, Loans and advances and Deposits of Ethiopian Banks (2002-2011) in million

Banks	2002 – 2006			2007 – 2011		
	Assets	Loans & Advances	Deposits	Assets	Loans & Advances	Deposits
Bank of Abyssinia	1,900	1,068	1,413	5,376	2,666	4,381
Awash International Bank	2,457	1,260	1,811	6,881	2,532	4,777
Commercial Bank of Ethiopia	28,729	7,029	22,808	61,702	18,563	45,596
Construction and Business Bank	1,367	738	803	2,715	1,406	1,895
Cooperative Bank of Oromia	71	26	23	1,279	527	982
Dashen Bank	2,839	1,786	1,786	10,125	4,713	8,185
Development Bank of Ethiopia	3,778	2,626	1,044	8,532	6,475	4,288
Lion International Bank	0	0	0	993	392	703
Nib International Bank	1,352	822	888	4,829	2,201	888
Oromia Int'l Bank	0	0	0	1,136	377	846
United Bank	838	472	646	4,741	472	646
Wegagen Bank	1,310	818	1,032	5,305	2,281	3,860
Zemen bank	0	0	0	1,044	399	709

Source: Author own calculation

In terms of branch expansion, bank branches have increased from 325 at the end of June, 2002 to 933 branches at the end of June, 2011. The number of private banks' branches grew from 104 in June, 2002 to 450 in June, 2011, while the state owned banks grew from 221 to 483 during the same period. This indicates that private banks have expanded rapidly. As of June 30, 2011, the ten privately-owned commercial banks included in this study owned 48% of branches in the total banking sector. Moreover, the share of total branches owned by the three biggest banks decreased from 70% in 2002 to 59% in 2011 because of the entry of five new banks (see Table 4.4).

Table 4.4 Total branches in the banking industry

Year	Number of banks in industry	Branches of 3 big banks as % of total bank branches	Total branches of all banks
2002	8	69.54%	325
2003	8	68.05%	338
2004	8	66.10%	354
2005	9	62.92%	383
2006	9	58.64%	428
2007	10	55.91%	474
2008	10	52.41%	561
2009	13	50.16%	634
2010	13	49.25%	670
2011	13	59.16%	933

Source: National Bank of Ethiopia and Individual Bank Report

With regard to the overall performance of the banking industry at the end of June 2011, total assets of banks reached 162 billion Birr; total outstanding loans reached 63.6 billion Birr and deposit liabilities of 118.5 billion Birr. However, public banks have continued to be a single industrial giant accounting for 61% of assets, 61.5% of loans and advances and 59% of deposits in the banking system.

Empirical studies on the performance of the Ethiopian commercial banks are extremely limited[10]. Kiyota, Peitsch and Stern (2007) compare the performance of state-owned and private banks in Ethiopia by using bank level data for the period 1998-2006. They used a linear regression focusing on three performance indicators; cost per total assets, return on asset (ROA) and interest rate spread. They found three important results. First, the costs per asset of the state-owned banks are significantly higher (1.6% points) than those of private banks. Second, the ROA of state-owned banks is 1.7% lower than private banks. Third, the interest spread is 1.5% points smaller for state owned banks compared to private banks.

The first two results are suggestive of the relatively better performance of private banks, while the third suggests that the state-owned banks are better placed in intermediation efficiency. However, exclusion of enough controls for the heterogeneities existing among banks makes the results less reliable. For instance, capital size, number of branch and age should have been included in the model.

Alemayehu (2006) also compares the performance of the Ethiopian financial sector before and after liberalization. The study considered outstanding loans, deposit mobilizations, interest rate spreads and sectoral composition of loans both before and after liberalization and found the performance of the financial sector by and large in line with the target set by IMF, with occasional movement above and below the target set.

The foregoing observations have important implications. As discussed above, Demirgüç-Kunt et al. (1998) and Mattoo et al. (2006) found a positive relationship between financial sector openness and economic growth. Mattoo et al. emphasized that the key elements of financial openness are domestic market competition, foreign ownership, and limited capital controls, all of which are lacking in Ethiopia. That is, high bank concentration indicates a lack of competition in Ethiopia's banking sector.

[10] *Only studies by Alemayehu (2006) and Kiyota, Peitsch and Stern (2007) are worth mentioning.*

Chapter Five

5. Results and Discussions

5.1. Descriptive Statistics

The sample covers all commercial banks that were present at the end of June, 2011 and were in operation for at least three years. During the study period, there was neither merger nor failure. Rather due to entry of five new banks, the sample is an unbalanced panel of 108 observations. Table 5.1 presents definition of variables and the summary of descriptive statistics of variables used in estimating the translog cost function and market power model.

Table 5.1: Variables used in estimating cost function and determinants of market power

Variable Symbol	Variable Name	Description and measurement	Mean	Median	Std Dev.
TC	Total Cost	Financial plus operating expenses	211,499,136	103,369,299	303,755,97
TA	Total Asset	Stock of total assets in the balance sheet	7,334,694,339	2,719,588,048	13,870,889,
W_L	Unit price of labor	Total personnel expenses expressed as a proportion of total assets	0.00996	0.00981	0.00372
W_F	Unit price of funds	Total interest expenses on deposits and borrowed funds divided by total deposits and borrowed funds	0.02339	0.02231	0.01036
W_K	Unit price of capital	Sum of all expenses (on building, equipment, fixed assets) divided by stock of fixed and other assets	0.19658	0.18854	0.10325
W_A	Unit price of admnistration	Sum of all expenses (on stationary, general service, others) divided by total assets	0.00625	0.00613	0.00300
TREND	Time period	Represented the time factor to account for technical change	5.90741	6.00000	2.87931
BRANCH	Branches	Total number of bank branches operated by an individual bank per given period	47.22220	32.00000	57.03423
RISK	Credit Risk	Non-performing loans expressed as a proportion of total loans	0.03757	0.01069	0.13514
INTERMED	Intermediation ratio	Proportion of total loans to total deposits (Loan-to-deposit ratio)	0.71696	0.69586	0.25889
P_i	Price of bank output	Proportion of total individual bank revenue to total bank assets	0.07278	0.07456	0.02021
MC_i	Bank-specific marginal cost	Estimated from the translog cost function	0.03820	0.03878	0.01010
LI_i	Bank-specific Lerner Index	Bank-specific Lerner Index of market power	0.42958	0.51473	0.28896
HHIdeposits	Hirschman-Hirfindahl index for deposits	Summation of squares of deposit market share of each bank ina given period	0.41603	0.39522	0.10253
HHIloans	Hirschman-Hirfindahl index for loans	Summation of squares of loans market share of each bank ina given period	0.32545	0.22967	0.04764
HHIassets	Hirschman-Hirfindahl index for assets	Summation of squares of assets market share of each bank ina given period	0.37834	0.36565	0.06881
MSdeposits	Deposit market share	Computed as a ratio of banks' deposits to industry totals	0.09259	0.04009	0.17766
MSloans	Loan market share	Computed as a ratio of banks' loans to industry totals	0.09259	0.05102	0.11656
MSassets	Asset market share	Computed as a ratio of banks' assets to industry totals	0.09238	0.04331	0.16619
LABOREFF	Labor cost efficiency	Expressed as ratio of bank labor cost to total revenue	0.34732	0.12536	2.01397
CAPITALEFF	Capital cost efficiency	Expressed as ratio of bank capital cost to total revenue	0.19171	0.06777	1.01616
ADMGENEFF	Adm&gen cost efficiency	Expressed as ratio of bank total adminstrative and general cost to total revenue	0.21804	0.07619	1.23718
OITASS	Other income	Non-interest income as proportion of total assets	0.02917	0.02802	0.01565
Owner	Ownership dummy	Dummy 1 for publci banks, 0 otherwise	0.28723	0.00000	0.45490
INFLATION	Inflation rate	Changes in consumer price index (CPI), percent per annum	0.13263	0.10900	0.12392
RESERVE	Bank reserve ratio	Proxied through the ratio of cash and deposits in central banks to total deposits	0.52022	0.26132	1.52724
Loans/GDP	Loan-GDP ratio	Constructed as the ratio of total bank credit at the end of the year to GDP of the year	0.15253	0.15617	0.02379

5.2. Estimating Lerner Index

Empirical results obtained through joint estimation of equations (6) through (10) pass diagnostic tests of functional independence and coefficients for variables of interest are statistically significant and carry the expected signs. Empirical results of the ISURE estimation procedure are presented in Table 5.2. The regression command (see appendix A.1) specifies that small sample statistics be computed shifting the test statistics from Chi-squared and Z-statistics to F-statistics and t-statistics. In this formulation, although the standard errors from the three equations are computed using the degrees of freedom for respective equations, the degrees of freedom for the t-stat are all taken to be those for the cost function which allows use of t-statistics to test significance of estimated coefficients.

Table 5.2: Iterated cost function estimation results

Variables	Parameter	Coeff.	Std. error	t-stat	p-value
$Intercept$	α_0	-6.859462	2.149829	-3.19	0.002***
$lnTA$	α_1	1.547639	0.258070	6.00	0.000***
$\frac{(lnTA)^2}{2}$	α_2	-0.018615	0.022662	-0.82	0.412
lnw_L	β_1	1.004360	1.029797	0.98	0.330
lnw_F	β_2	-1.522485	0.442725	-3.44	0.001***
lnw_K	β_3	0.228516	0.401089	0.57	0.569
lnw_A	β_4	0.111360	0.373005	0.30	0.765
$\frac{(lnw_L)^2}{2}$	β_{11}	0.622237	0.172695	0.36	0.719
$lnw_L lnw_F$	β_{12}	-0.015371	0.048570	-0.32	0.752
$lnw_L lnw_K$	β_{13}	-0.022585	0.045800	-0.49	0.622
$lnw_L lnw_A$	β_{14}	-0.015799	0.090892	-0.17	0.862
$\frac{(lnw_F)^2}{2}$	β_{22}	0.000402	0.037529	0.01	0.991
$lnw_F lnw_K$	β_{23}	0.021166	0.031750	0.67	0.505
$lnw_F lnw_A$	β_{24}	-0.068039	0.035017	-1.94	0.053
$\frac{(lnw_K)^2}{2}$	β_{33}	0.038456	0.026800	1.43	0.152
$lnw_K lnw_A$	β_{34}	0.004475	0.042299	0.11	0.916

$\frac{(lnw_A)^2}{2}$	β_{44}	0.012857	0.055555	0.23	0.817
$\frac{(lnw_L lnTA)}{2}$	ϑ_1	-0.041220	0.126708	-0.33	0.745
$\frac{(lnw_F lnTA)}{2}$	ϑ_2	0.146523	0.044547	3.29	0.001**
$\frac{(lnw_K lnTA)}{2}$	ϑ_3	-0.011786	0.041030	-0.29	0.774
$\frac{(lnw_A lnTA)}{2}$	ϑ_4	-0.015351	-0.035724	-0.43	0.668
$TREND$	μ_1	-0.111841	0.067118	-1.67	0.096
$(TREND)^2$	μ_2	0.000759	0.001198	0.63	0.527
$TRENDlnTA$	μ_3	-0.000057	0.006467	-0.01	0.993
$TRENDlnw_L$	δ_1	-0.011483	-0.019294	-0.60	0.552
$TRENDlnw_F$	δ_2	-0.017992	0.007000	-2.57	0.011*
$TRENDlnw_K$	δ_3	0.001197	0.005336	0.22	0.823
$TRENDlnw_A$	δ_4	0.005017	0.007006	0.72	0.474
Control Variables					
$lnBRANCH$	φ_1	-0.023305	0.018409	-1.27	0.206
$lnRISK$	φ_2	-0.002786	0.004171	-0.67	0.504
$lnINTERMED$	φ_3	-0.120476	0.033501	-3.60	0.000***

Diagnostics

Equation	Obs.	Parameter	RMSE	R^2	F-stat	p-value
Cost	108	30	0.05426	1.00	2051.040	0.0000
Labor cost share	108	6	0.01934	0.90	158.720	0.0000
Finance cost share	108	6	0.03542	0.93	237.750	0.0000
Capital cost share	108	6	0.02944	0.76	54.010	0.0000

legend: * p<0.05; ** p<0.01; *** p<0.001

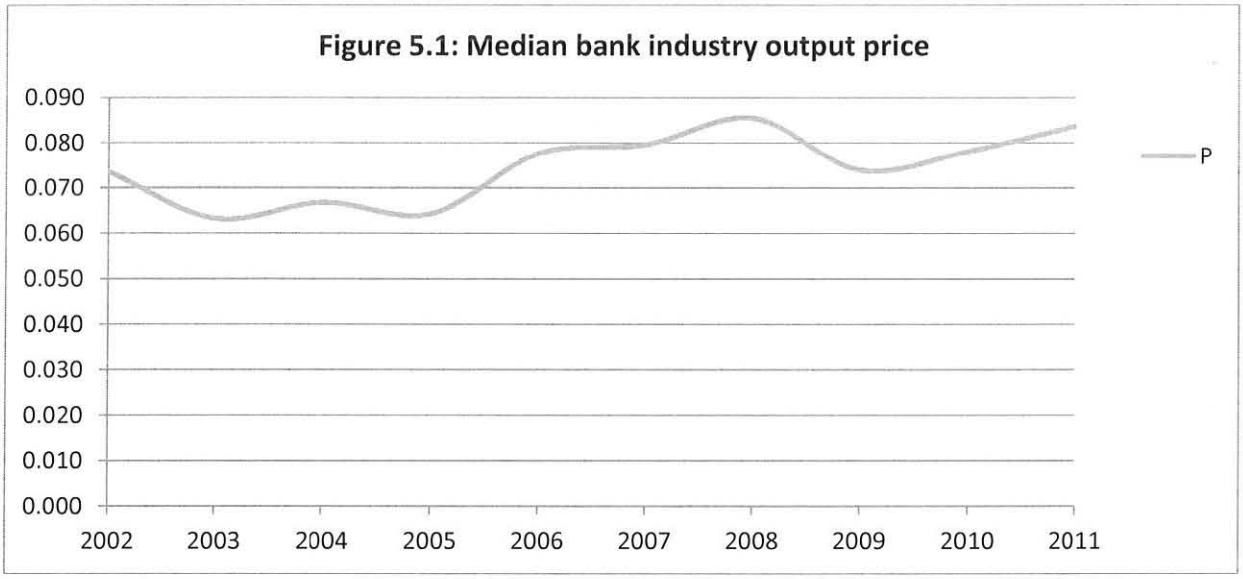
Estimation results of cost function indicate that bank-specific factors such as total assets and unit price of inputs are all significant at the 0.05 and 0.001 level of significance, suggesting significant bank-specific effects with respect to costs. Using the estimated coefficients, bank-specific marginal cost is deduced based on equation (11). The marginal cost was then used in

conjunction with the approximate measure of output price to estimate the bank specific and time variant Lerner Index (LI_{it}) based on equation (13) (see the median and average yearly output price, marginal cost and Lerner Index in appendix A.2).

5.3. Characterizing the Lerner Index and its evolution

The evolution of median industry output price, marginal cost and the resulting Lerner Index are depicted in Figure 5.1 through Figure 5.5. Figure 5.1 shows a general decline in output price from 2002 to 2005. But from 2006 onwards, bank output price has shown relative increase, more or less in consistent with economic growth recorded in the country. Since 2005 Ethiopia has been recording more than 11% economic growth which helped improve the country's business environment and investment climate. Improvement in business and investment sector coupled with growing demand for credit enabled banks to claim higher level of revenues reflected in the rising trend of the industry output price.

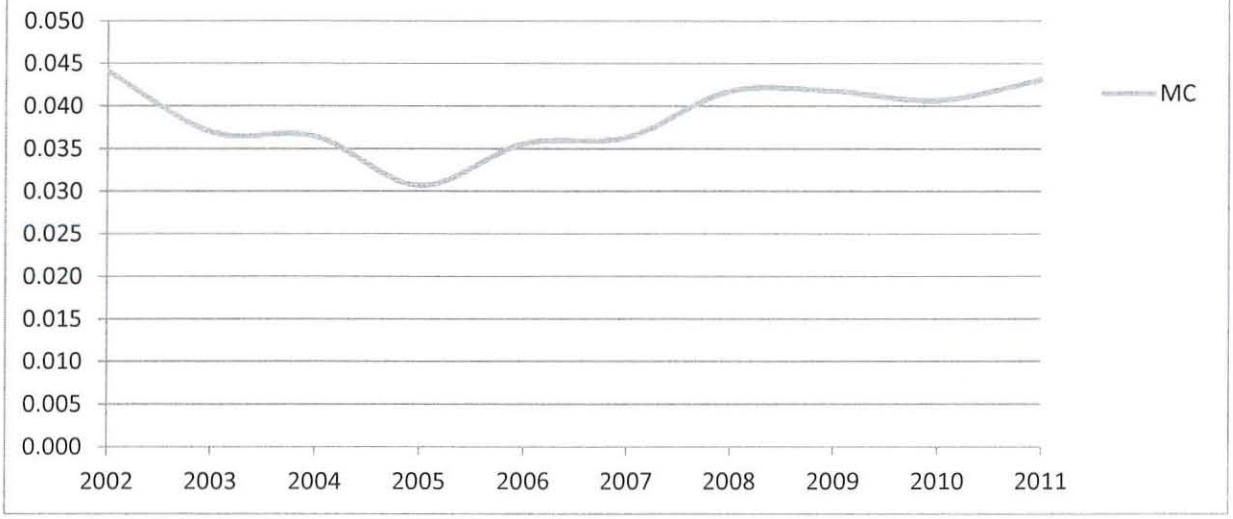
Figure 5.1: Median bank industry output price



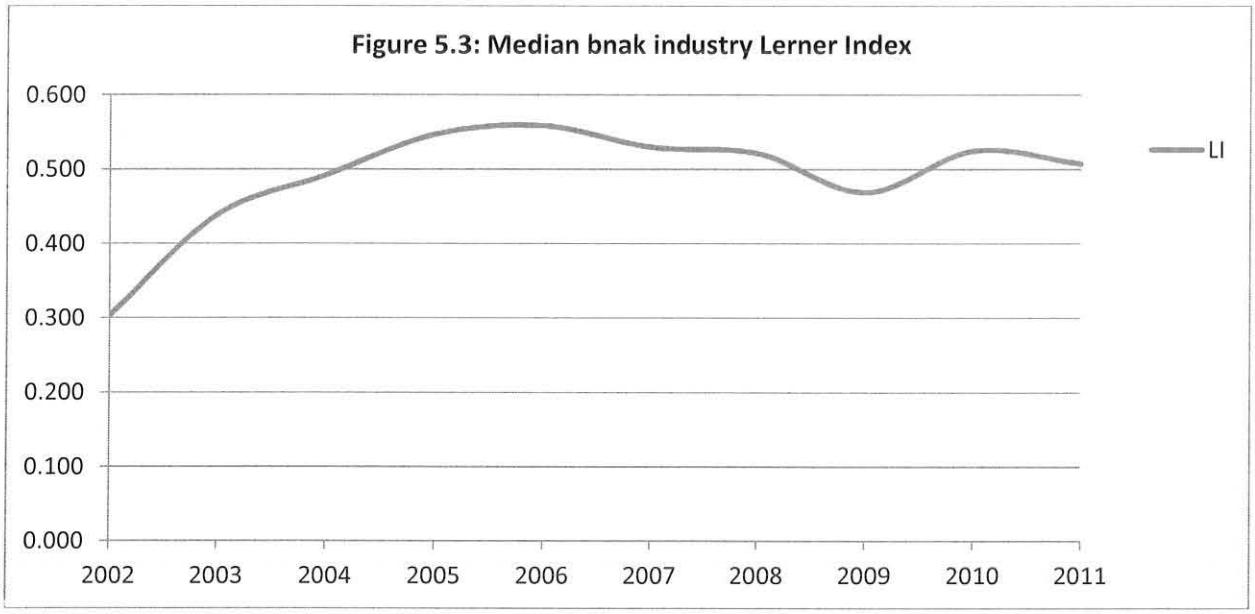
The movement in marginal cost (Figure 5.2) also mimicked that of bank output price, underpinning the banks' realization of cost adjustment in a quest to realign their cost structure with movement in the bank output price. The rise in marginal cost accelerated almost from around 2005 and persisted through to 2011, reflecting an increase in operating and financial costs. Although the deposit interest rate is pegged at 3% by the National Bank of Ethiopia, there

was a tendency by private banks to pay for their customers more than this rate. In addition, salary and benefits of employees and cost of physical capital has been historically high in banking sector because of attempts to attract educated and qualified employees to them and lack of own buildings.

Figure 5.2: Median bank industry marginal cost



Theoretically, the net effect of increase both in the price of bank output and marginal cost does not necessarily translate into a higher price-cost mark-up. Rather, it depends on which one rises faster. In the case of Ethiopian banks, however, the rise in output price was more rapid relative to the rise in marginal cost. As a result, the Lerner Index assumed an upward trend for most part of the sample period (see, Figure: 5.3). For the full sample, the median Lerner Index is estimated as 49 percent, indicating that banks priced above marginal cost by 49 percent.

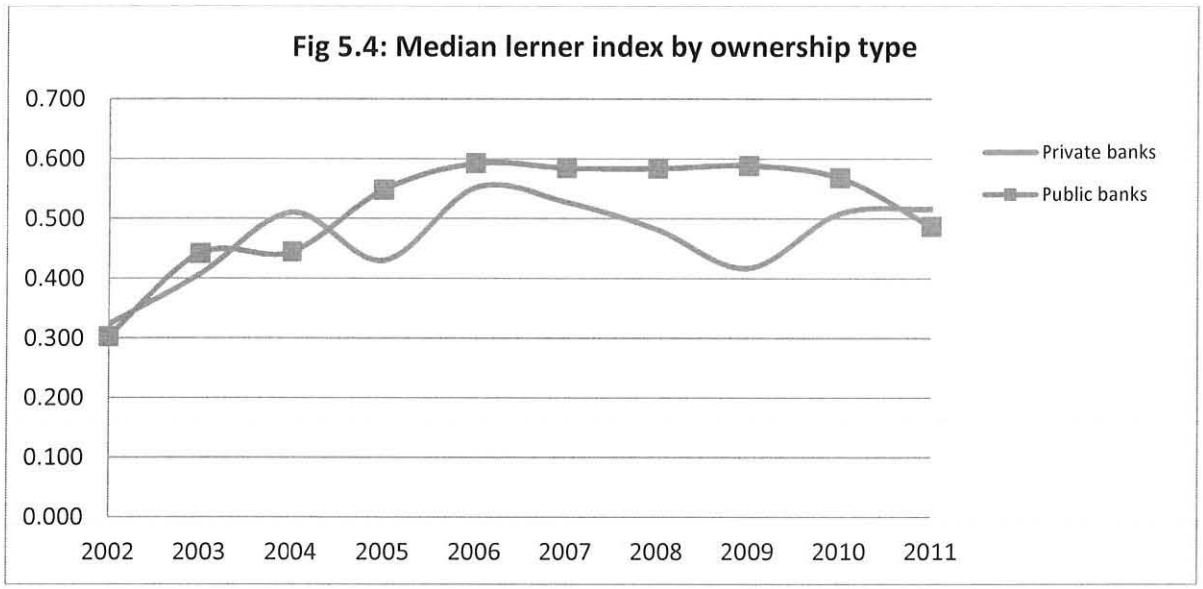


All Lerner Index values are positive in the study period in particular showing steady rise since 2002 only showing declining trend in 2007 – 2009, when three banks (Lion International Bank, Zemen Bank and Oromia International Bank) joined the market. In general, the preponderance of positive values which are greater than 0.5 suggests that Ethiopian banking system is characterized by the existence of market power. During the study period, there is only one distinct episode in the movement of the price-cost margin when average mark-up price decreased from 52 percent in 2008 to 47 percent in 2009 only to return to 52 percent in 2010.

The above analysis shows that between 2002 and 2011, Ethiopian banks indeed enjoyed greater power in setting prices, which helped them maintain significant market power. During this period, the Lerner Index was therefore largely driven both by the high price of bank products and services and rising costs.

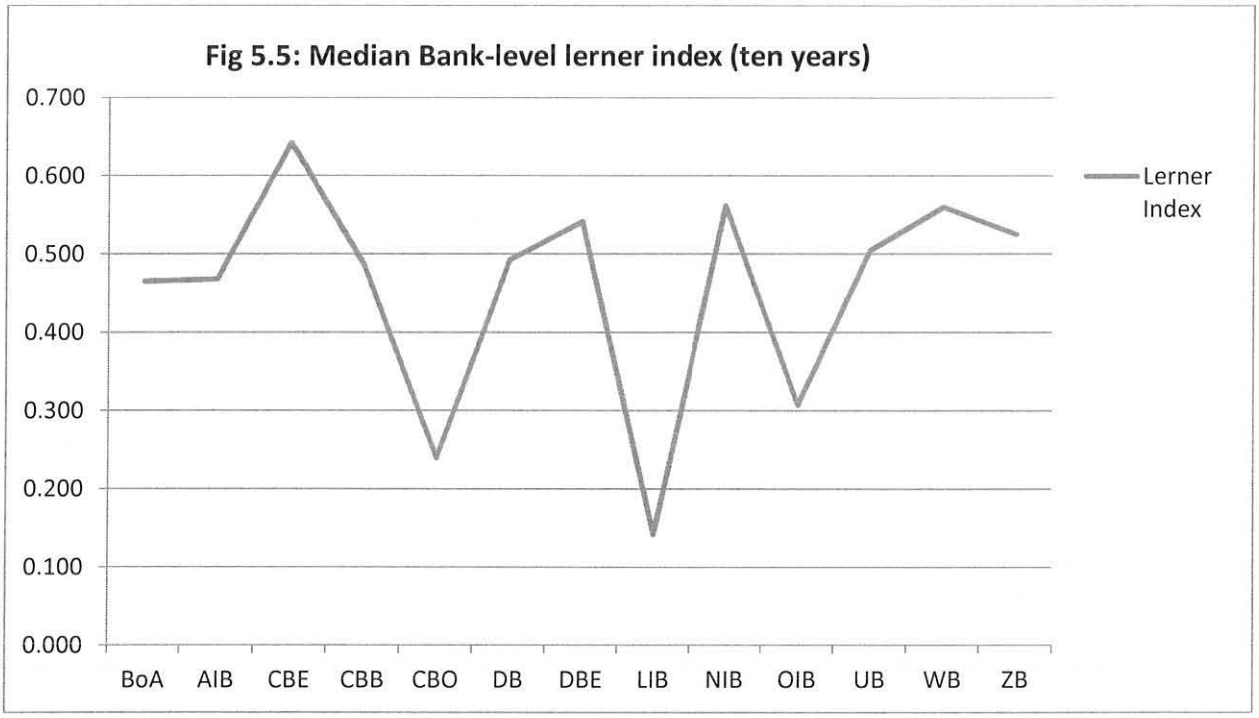
The estimates of Lerner Index suggest that Ethiopian banks operate in an imperfectly competitive environment defined by oligopolistic conduct. This behaviour may be due to risk aversion or inadequate predatory strategies that prevent a majority of banks from engaging in intense competition. This finding is more compelling for public banks (see Fig 5.4) which, for reasons of poor credit risk screening mechanisms resulted in high proportion of bad loans,

shielded away from engaging in further risky lending. This is evidenced by the relatively higher median Lerner Index for this group of banks compared with private banks.



What is more intriguing is that the entry of new banks in 2009 eroded the market power of private banks heavily compared to public banks. This shows that the banking competition is limited among private banks for deposits and loans and targets the same kind of customers.

Median bank-level Lerner Index also shows relatively higher level of market power during the last ten years (see Fig 5.5). All banks had more than 45 percent price-cost margin except Lion International Bank, Oromia Cooperative Bank and Oromia International Bank. Intensified and deep desire to join the banking sector by private investors and professionals in the last four or five years through raising the minimum paid-up capital by public tender floatation can be attributed to this higher level of price-cost margin. Any new entrant can reap profit after a year in operation without building a premise or setting up a factory. The National Bank of Ethiopia's decision to increase the minimum paid-up capital can be explained by the government desire to divert public finance investment in other productive and manufacturing sectors. The recent decision of Tsehay Bank S.C. (abandoned because of the directive) to invest the equity contributions of its shareholders in the metal industries can be a witness to the presumed government intention.



In a nutshell, the implication of higher Lerner Index values is that Ethiopian banks may have the potential to engage in unilateral uncompetitive behaviour, for example, setting product and service prices above marginal costs. If they did, since the consequences would be a loss of social welfare, the factors that explain it significantly need to be identified to take actions. The next section deals about attempts of identifying the main explanatory factors of market power in the Ethiopian banking sector.

5.4. Explaining Market Power

Having found evidence in favour of the existence of market power, based on formula specified under equation (12), the main factors that explain the market power of Ethiopian banks will be identified in accordance with model specified in equation (14). Identifying these sources is essential to devising polices to reduce the potential for loss of social welfare and slow economic growth that is associated with the existence of market power.

In order to explore the determinants of market power of Ethiopian banks, we use the unbalanced panel data set and relate the bank level Lerner Index with bank-specific, market structure, regulatory and macroeconomic variables.

The quality and fitting of the data is assessed by looking at the correlation coefficients among explanatory variables before going directly to estimation. The correlation coefficients of explanatory variables in the market power model are reported in appendix A.3. Size is found to be highly correlated with market structure variables (HHI and market share) and HHI and market share variables are also highly correlated among themselves. Thus, considering the fact that there is only stiff competition among Ethiopian banks for deposits, only HHI-deposits and MS-deposits are considered for the analysis. In addition, the trend variable is also omitted due to high correlation with bank-specific and market structure variables (see Ramlall, 2009). The correlation coefficients of the data after dropping the above two variables looks well (see appendix A.4), though asset is still highly correlated with other variables. But dropping asset will create conflicts with conventional models of market power which accepted asset as a main explanatory variable accounting for the effect of size and hence retained (Simpasa (2010), Aboagye (2008) and Fernandez et.al. (2007)).

Consequently, the Lerner Index model takes the form of

$$\begin{aligned} lnLI_{it} = {} & \alpha_0 + \alpha_1 lnHHI_{dep} + \alpha_2 lnMS_{dep} + \alpha_3 lnRISK_{it} + \alpha_4 lnTA_{it} \\ & + \alpha_5 (lnTA_{it})^2 + \alpha_6 lnlabeff_{it} + \alpha_7 lncapeff_{it} \\ & + \alpha_8 lnadmgeneff_{it} + \alpha_9 lnOITASS_{it} + \alpha_{10} owner_{it} + \alpha_{11} lninf_{it} \\ & + \alpha_{12} lnreserve_{it} + \alpha_{13} ln\frac{loans}{GDP}_{it} + \mu_i + \varepsilon_{it} \dots\dots (15) \end{aligned}$$

The above model can be estimated directly using panel data approach which the data is. But panel data sometimes does not require panel data estimation techniques unless there is individual heterogeneity among study units. If there is no individual heterogeneity across the sample, pooled OLS estimation is preferred to panel data approaches as it brings unbiased and consistent and/or efficient estimates. Therefore, the presence of bank fixed effect and year fixed effect tests are conducted to determine the poolability of the data.

Accordingly, least square dummy variable estimation technique is employed whereby the F-test is conducted to examine the null hypothesis (pooled OLS) of joint significance of N-1 bank dummies, where δ is a coefficient of the bank dummy variables.

$$H_0 = \delta_1 = \delta_2 = \cdots = \delta_{12} = 0$$

The regression outcome[11] (see appendix A.5) confirmed the existence of bank fixed effect implying fixed effects regression produces consistent estimates.

In addition, the existence of time fixed effects are also examined by introducing year dummies and running F-test to test the null hypothesis (year dummies are not needed) of joint significance of T-1 year dummies, where ϑ is a coefficient of the year dummy variables.

$$H_0 = \vartheta_1 = \vartheta_2 = \cdots = \cdots = \vartheta_9 = 0$$

The regression outcome[12] (see appendix A.6) does not reject the null hypothesis that year dummies (time fixed effects) are not needed. This outcome hence does not suggest for inclusion of year dummies which in turn paves the way for fixed effects regression technique.

The above F-tests helped us to discover the existence of fixed effect which in turn calls for the use of fixed effects regression technique, but we need to also perform Breusch and Pagan Lagrangian multiplier test of random effects. If the test rejects the null hypothesis that there are no random effects and random effects model is chosen, Hausman test is required to determine whether random effect estimator (RE) or fixed effect estimator (FE) is to be chosen for estimation. The Breusch-Pagan Lagrangian multiplier test of random effects[13] (see appendix

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[11] *Upon running F-test to examine the joint significance of all N-1 bank dummies, we found Prob>F equals 0.0348. Therefore, we reject the null of no significant bank fixed effects (pooled OLS) exist. Thus, under the alternative hypothesis the fixed effects regression estimation is chosen.*

[12] *Upon running F-test to examine the joint significance of all T-1 year dummies, we found Prob>F equals 0.3304. Therefore, we failed to reject the null of no significant time fixed effects exists. Thus, no need to include year fixed effects in our model.*

[13] *Upon running the Breusch and Pagan Lagrangian multiplier test to examine Var (u) = 0, we found Prob>chi2 equals 0.8001. Therefore, we failed to reject the null hypothesis that there are no random effects and subsequently ruled out random effects regression model.*

A.7), however, did not reject the null hypothesis that there are no random effects. Therefore, without performing Hausman test, it is possible to choose fixed effects model based on F-test conducted earlier. But the fixed effects model is one-way error component static model with bank fixed effect only.

Post estimation diagnostics test too shows no endogenous variables, no serial correlation[14] and homoscedastic error terms[15] (see appendix A.8 – 10 for the tests, respectively).

The fixed effects regression estimation results are presented in Table 5.3. The F-statistic for model adequacy is statistically significant at 5 percent. The independent variables also explain 59 percent of the Lerner Index. Rho (ρ) shows that 66.7% of the variance in the model is due to differences across panels.

[14] *The Baltagi-Wu (1999) locally best invariant (LBI) test statistics which is the equivalent of the Durbin-Watson statistics, but applies to unbalanced panels is near two (1.8393277) (the exact critical values are not available in the literature until now); it indicates that serial correlation is not a problem.*

[15] *Auxiliary regression is performed after generating residual squares (uifixed2) from FE effects regression and runs upon suspected heteroscedastic terms. The test statistics* $N * (T - 1) * R^2_{Aux}$ *is supposed to have an asymptotic chi-squared distribution with J degrees of freedom from the auxiliary regression. From the table, Chi2 (5) at 10% equals 15.086 and hence lower value of calculated test statistics (13.096) does not allow us to reject the null that the errors are homoscedastic.*

Table 5.3: Estimated coefficients of variables explaining Lerner Index values of Ethiopian Banks (2002 - 2011) – Fixed Effects Regression

	Coeff.	Parameter	t-stat	p-value
$Intercept$	α_0	-45.62603	-2.67	0.009*
$lnHHIdep$	α_1	-0.3479023	-0.66	0.514
$lnMSdep$	α_2	0.1052295	0.93	0.355
$lnrisk$	α_3	-0.0493576	-1.67	0.108
$lnTA$	α_4	4.042073	2.57	0.012*
$lnTA^2$	α_5	-0.1007479	-2.67	0.009**
$lnlabeff$	α_6	-0.5773977	-2.47	0.016*
$lncapeff$	α_7	-0.5727288	-2.73	0.008**
$lnadmgeneff$	α_8	-0.1621302	-1.19	0.237
$lnOITASS$	α_9	0.0693615	0.60	0.549
$owner$	α_{10}	dropped		
$lninf$	α_{11}	-0.1090284	-2.64	0.100*
$lnreserve$	α_{12}	-0.0043618	-0.06	0.956
$ln\left(\frac{loans}{GDP}\right)$	α_{13}	-0.7419905	-2.00	0.050*
σ_u		0.335788		
σ_e		0.237257		
ρ		0.66701		
$No.of\ Obs.$		94		
F (12, 69)		8.25		
$Prob. > F$		0.0000		
R^2		0.5892		

legend: * p<0.05; ** p<0.01; *** p<0.001

5.5. Interpretation of Results

Table 5.3 presents coefficient estimates of the determinants of Lerner Index from the fixed effects regression. The significance of individual coefficients in explaining the market power of Ethiopian banks is discussed below.

The banking market structure variables i.e. HHI and market share are not significant at any level of significance. HHI is negative while market share is positive; the negative sign in HHI is unexpected as positive relationship between concentration and market power is prescribed in most traditional industrial organization literatures. The evidence might suggest, in Ethiopia, bank market share and concentration per se do not translate in to significant market power. Therefore, one can decide that the structural conduct performance hypothesis does not work in the Ethiopian banking sector. The outcome is in consonance with the evidence offered in Fernandez de Guevara et al. (2005) and Aboagye et.al. (2008) for European banking system and Ghanaian banking sector respectively.

Individual bank credit risk, measured by the ratio of provision for bad debt to total loans and advances is negative but insignificant at any reasonable level. The suggestion therefore is that the proportion of current bad debts is not important in explaining the market power; but increases in this variable have the tendency to lower market power.

Of the bank-specific variables, the size of the bank, measured by the logarithm of total assets, is positive and significant at the 0.05 level. Thus, increases in bank size translate into more market power, resulting probably from cost advantages or capacity to impose higher fees. The relationship is however non-linear with negative sign of the significant quadratic term ($lnTA^2$) at 0.01 level. This suggests that increasing bank size enhances market power up to a certain point beyond which greater size becomes detrimental for market power. In other words, small-sized banks and larger banks should have less market power than medium-sized banks. This finding has several implications. First, being big is not enough to acquire market power. Second, it suggests that economies of scale may not be strong enough to motivate to increase size beyond a certain level and finally, larger banks resulting from mergers and acquisition may not necessarily hamper competition.

Staff expenses measured as a ratio of total bank revenue is negative and significant. This is consistent with intuition. Decreases in this variable translate to more market power because such decreases results in lower marginal cost. Physical capital expenses as a ratio of total bank revenue is also negative and significant at 0.10 level. The importance of physical capital cost as a ratio of bank revenue as a determinant of market power is explained from a particular point of view. In Ethiopia, almost all banks do not have their own buildings and operated from rented premises with skyrocketing rents. Thus, lowering this proportion of costs automatically translates into higher level of market power. The other components of operating expenses, which is expressed as ratio of administrative and general services expenses to total bank revenue, has negative sign but has insignificant impact on market power. In general, since the Lerner Index value of Ethiopian banks is a direct manifestation of rising costs, lowering any form of costs would significantly help to increase bank market power. This result deserves special mention in light of the ambiguity in the market power-efficiency relationship discussed in the literatures. The intuition behind this result is that conceptually cost efficient banks (lower value of the cost to income ratio) have the ability to exert market power in the Ethiopian banking sector, almost certainly as a consequence of their lower marginal costs, as propagated by proponents of the efficiency structure hypothesis.

The coefficients of OITASS is also positive but insignificant lending support to the idea that banks who earned a higher proportion of non-interest income compared to interest income to total assets enjoy higher level of market power. This is consistent with the view that competition is higher in the traditional task of intermediation (taking deposits and granting loans) than in other banking activities (such as off-balance-sheet activities that generate non-interest income).

The table also suggests that changes in the rate of inflation have significant negative impact on market power. Thus, the effect of rising inflation in Ethiopia since 2007 has resulted in banks losing some form of market power. A possible explanation is that with almost constant interest rates in the face of inflation, more people have been inclined to borrow. But as they do, banks may feel they are making money, but this is not the case as the real interest rate is much lower

compared to the previous years. The suggestion is that improving economic environment reduces bank market power. Some support for this view is given by the impact of the variable measuring economy wide demand for credit, CREDIT/GDP, on market power. Its impact is negative and significant. Another reason why CREDIT/GDP has negative sign is that with expanded loan, private banks are required to buy NBE bonds equivalent to 27 percent of total loans. Thus, private banks are not benefited from expansion of loans. Comparatively, Aboagye, et al. (2008) and Simpasa (2010) also found a negative impact of inflation on market power for Ghanaian banks and Zambian banks respectively. The negative coefficient on the inflation variable also indicates that banks operating under conditions of macroeconomic uncertainty tend to enjoy relatively less market power.

Although insignificant, the coefficient of reserve is also negative showing the more banks are required to save in cash and deposits by National Bank of Ethiopia, the less market power they would have. The higher the proportion of liquid reserves in the National Bank of Ethiopia, the lower the margin obtained by banks as the deposits are compensated at an interest rate below the market rate.

In summary, the evidence obtained in relation to concentration and efficiency is in line with the results of other studies (e.g. Aboagye, 2008) in that the traditional structure-conduct-performance hypothesis is rejected for the Ethiopian banking system, the evidence being favourable, on the other hand, to the efficient structure hypothesis. From these, one derives an important implication for economic policy. The fact that concentration lacks significance in the explanation of differences in market power shows the inadequacy of using it as proxy for the intensity of competition, as is done in some countries (Federal Trade Commission and Anti-Trust Division of US Department of Justice of USA and Competition Commission of South Africa) to assess the competitiveness of the banking sector.

The study confirms that the size of bank and efficiency has a positive impact, while Inflation and higher elasticity of demand to loans have been found having adverse impact on market power of banks.

Chapter Six

6. Conclusions and Policy Recommendations

6.1. Conclusions

The measurement of the degree of competition in any economic sector is of great relevance in that the level of social welfare decreases as the market power of firms' increases. In the specific case of the banking sector, the analysis of the social inefficiency associated with market power is even more important if we take into account the importance of the financial intermediation function in economic growth. Thus, the greater the market power of financial intermediaries the higher will be the cost of financial intermediation and, in consequence, the lower economic growth.

From the economic policy point of view, measuring the degree of competition in banking sector is as important as analyzing the determinants of market power. Only when such factors have been clearly recognized will it be possible to implement appropriate measures to diminish the market power of banks.

Taking in to account the significance of efficient and effective banking system, the study has tried to offer empirical evidence on the evolution of competition in the Ethiopian banking sector through the estimation of Lerner indices and the analysis of their determinants. The sample used contains 108 observations for the period 2002-2011. The findings can be summarized as follows. First, bank competition only slightly improved since 2006. Between 2002 and 2005, the Lerner Index values show steady rise but beginning from 2007 due to entry of three new banks, the competition seems to have improved. Empirical results also show that the average Lerner Index for the full sample was 49 percent, indicating that banks priced above marginal cost by more than 49 percent, indicating departure from both monopoly behaviour and perfect competition. Second, public banks have more degree of market power compared to private banks. In contrast, intensive competition is observed among private banks. Third, examination of the determinants of market power identifies the significant roles of operating

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efficiency, inflation, elasticity of demand to loans and nonlinear influence of size; and insignificant roles of concentration, risk, reserve and proportion of non-interest income.

Measures of market structure variables (HHI and market share) are not significant in the explanation of differences in market power. This result allows us to conclude that studies and approaches which use concentration variables to proxy the degree of competition or market power lack foundation. Nevertheless, it should not be forgotten that these implications are derived from the Ethiopian banking sector data, and it does not necessarily reflect trends in other countries too.

The findings in respect of bank efficiency with respect to staff costs and physical capital expenses also lend support to the contention that banks may use efficiency gains arising from control over staff costs to acquire or increase market power. However, it is difficult to see how government or central bank policy will work in this respect.

6.2. Policy Recommendations

Although the results suggest that banks' conduct was not characteristic of monopolistic behaviour, they also indicate a lower level of competitiveness in the Ethiopian banking system. Therefore, there is justification for National Bank of Ethiopia to intervene in the market to exploit the possibilities of strengthening the degree of competition in order to diminish the banks' exercise of market power. But, surprisingly according to this study, adjusting economic policy instruments under the direct influence of National Bank of Ethiopia will only enhances the market power of commercial banks. For instance, abating inflation will only increase the market power of banks when it is expected to bring macroeconomic stability suggesting economic stability and bank market power have positive relationship.

Size and efficiency was found to be the main significant factors in explaining the market power of Ethiopian banks. As far as efficiency is concerned, there is nothing the National Bank of Ethiopia can do about rather it should encourage the efficiency that comes from the sector. But regarding the size of banks, the National Bank of Ethiopia has the opportunity of divesting excess assets from a single bank by adopting different regulations.

In a nutshell, the central bank should design measures aimed at creating further incentives for enhancing competitiveness in the banking sector. In particular, the central bank should endeavour to create an enabling environment for contestability in the banking industry, for example continuing with the open policy of domestic equity participation and allowing foreign banks to operate in the sector by adopting favourable and rational policies. This will enhance competition and propagate efficiency gains across the banking sector.

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Appendix A

1. Seemingly unrelated regression command for estimating the translog cost function and test of functional independence

sureg (cost asset assetsqu laco fico caco adgeco lacosq lafico lacaco laadgeco ficosqu ficaco fiadgeco cacosqu caadgeco adgecosqu asslaco assfico asscaco assadgeco tre tresqu treass trelaco trefico trecaco treadgeco bra risk intermed) (laborinputshare laco fico caco adgeco tre assethalve) (financeinputshare laco fico caco adgeco tre assethalve) (capitalinputshare laco fico caco adgeco tre assethalve), small dfk corr

Tests of functional independence

```
. sureg ( cost asset assetsqu laco fico caco adgeco lacosq lafico lacaco laadgeco ficosqu ficaco fiadgeco cacosqu caadgeco adgecosqu
> asslaco assfico asscaco assadgeco tre tresqu treass trelaco trefico trecaco treadgeco bra risk intermed) ( laborinputshare laco
> fico caco adgeco tre assethalve) ( financeinputshare laco fico caco adgeco tre assethalve) ( capitalinputshare laco fico caco a
> dgeco tre assethalve), notable noheader corr
```

Correlation matrix of residuals:

	cost	laborinputshare	financeinputshare	capitalinputshare
cost	1.0000			
laborinputshare	-0.5107	1.0000		
financeinputshare	0.2345	-0.2406	1.0000	
capitalinputshare	0.2630	-0.4598	-0.5134	1.0000

Breusch-Pagan test of independence: chi2(6) = 99.122, Pr = 0.0000

2. Output price, marginal cost and the Lerner Index (industry median)

Year	P	MC	LI
2002	0.0735671	0.0440785	0.3028603
2003	0.0632276	0.0369606	0.4387074
2004	0.0667359	0.0364111	0.4924598
2005	0.0642502	0.0306813	0.5470363
2006	0.0775909	0.0355741	0.5584837
2007	0.0796061	0.0363355	0.5295931
2008	0.0854390	0.0417455	0.5211638
2009	0.0739165	0.0417643	0.4686632
2010	0.0780620	0.0406590	0.5246086
2011	0.0836426	0.0430903	0.5073314

3. Correlation Coefficient of determinants of market power

```
. corr lnhhidep lnhhiloans lnhhiassets lnmsdep lnmsloans lnmsassets lnriskit lnta lnta2 lnlabeff lncapeff lnadmgeneff lnoitass owner
>  lninflation lnreserve lnloansgdpit trend
(obs=94)
```

	lnhhidep	lnhhil~s	lnhhia~s	lnmsdep	lnmslo~s	lnmsas~s	lnriskit	lnta	lnta2	lnlabeff	lncapeff	lnadmg~f	lnoitass
lnhhidep	1.0000												
lnhhiloans	0.1578	1.0000											
lnhhiassets	0.9982	0.1795	1.0000										
lnmsdep	0.0244	-0.0864	0.0249	1.0000									
lnmsloans	0.2426	-0.1003	0.2409	0.8650	1.0000								
lnmsassets	0.1153	-0.0551	0.1149	0.9387	0.9550	1.0000							
lnriskit	0.3314	0.1103	0.3327	-0.3883	-0.1566	-0.2781	1.0000						
lnta	-0.3366	-0.0832	-0.3364	0.8759	0.7921	0.8937	-0.4121	1.0000					
lnta2	-0.3304	-0.0787	-0.3301	0.8790	0.7910	0.8959	-0.4209	0.9994	1.0000				
lnlabeff	-0.1839	0.1292	-0.1746	-0.3548	-0.5900	-0.4891	-0.1600	-0.3718	-0.3649	1.0000			
lncapeff	0.1929	0.1821	0.1943	-0.7403	-0.7525	-0.7945	0.1161	-0.8334	-0.8328	0.6089	1.0000		
lnadmgeneff	-0.0580	-0.0045	-0.0569	-0.1263	-0.4820	-0.3627	-0.2326	-0.3198	-0.3063	0.5973	0.3899	1.0000	
lnoitass	-0.3701	0.0133	-0.3753	0.0136	-0.3189	-0.1878	-0.2162	-0.0072	-0.0096	0.1480	0.0116	0.4829	1.0000
owner	0.0849	-0.0118	0.0847	0.3309	0.5050	0.4990	0.2408	0.4323	0.4390	-0.3787	-0.6361	-0.3861	-0.4064
lninflation	-0.1627	0.0192	-0.1245	0.0253	0.0040	0.0133	-0.0116	0.0594	0.0581	0.1199	-0.0494	-0.0148	-0.0847
lnreserve	-0.5437	0.0048	-0.5317	0.0288	0.0544	0.1064	-0.0874	0.3470	0.3464	-0.0446	-0.2709	-0.3409	-0.2979
lnloansgdpit	0.7637	-0.3289	0.7451	0.0726	0.2457	0.1280	0.2051	-0.2422	-0.2396	-0.2708	0.0515	-0.0527	-0.2908
trend	-0.9907	-0.0845	-0.9869	-0.0377	-0.2571	-0.1256	-0.3173	0.3301	0.3243	0.2138	-0.1744	0.0595	0.3671

	owner	lninfl~n	lnrese~e	lnloan~t	trend
owner	1.0000				
lninflation	-0.0022	1.0000			
lnreserve	0.4345	0.1838	1.0000		
lnloansgdpit	0.0783	-0.3680	-0.4659	1.0000	
trend	-0.0882	0.1499	0.5532	-0.8133	1.0000

4. Correlation coefficients of market power model

```
. corr lnhhidep lnmsdep lnriskit lnta lnta2 lnlabeff lncapeff lnadmgeneff lnoitass owner lninflation lnreserve lnloansgdpit
(obs=94)
```

	lnhhidep	lnmsdep	lnriskit	lnta	lnta2	lnlabeff	lncapeff	lnadmg~f	lnoitass	owner	lninfl~n	lnrese~e	lnloan~t
lnhhidep	1.0000												
lnmsdep	0.0244	1.0000											
lnriskit	0.3314	-0.3883	1.0000										
lnta	-0.3366	0.8759	-0.4121	1.0000									
lnta2	-0.3304	0.8790	-0.4209	0.9994	1.0000								
lnlabeff	-0.1839	-0.3548	-0.1600	-0.3718	-0.3649	1.0000							
lncapeff	0.1929	-0.7403	0.1161	-0.8334	-0.8328	0.6089	1.0000						
lnadmgeneff	-0.0580	-0.1263	-0.2326	-0.3198	-0.3063	0.5973	0.3899	1.0000					
lnoitass	-0.3701	0.0136	-0.2162	-0.0072	-0.0096	0.1480	0.0116	0.4829	1.0000				
owner	0.0849	0.3309	0.2408	0.4323	0.4390	-0.3787	-0.6361	-0.3861	-0.4064	1.0000			
lninflation	-0.1627	0.0253	-0.0116	0.0594	0.0581	0.1199	-0.0494	-0.0148	-0.0847	-0.0022	1.0000		
lnreserve	-0.5437	0.0288	-0.0874	0.3470	0.3464	-0.0446	-0.2709	-0.3409	-0.2979	0.4345	0.1838	1.0000	
lnloansgdpit	0.7637	0.0726	0.2051	-0.2422	-0.2396	-0.2708	0.0515	-0.0527	-0.2908	0.0783	-0.3680	-0.4659	1.0000

5. Least Square Dummy Variable Estimation Results – test for bank fixed effect

Table A.5 Least Squares Dummy Variables estimation results (bank

	Coeff.	Parameter	t-stat	p-value
Intercept	α_0	-46.14176	-2.67	.009**
lnHHIdep	α_1	-0.3479023	-0.66	0.514
lnMSdep	α_2	0.1052295	0.93	0.355
lnrisk	α_3	-0.0493576	-1.63	0.108
lnTA	α_4	4.042273	2.57	.012*
$lnTA^2$	α_5	-0.1007479	-2.67	.009**
lnlabeff	α_6	-0.5773977	-2.47	.016*
lncapeff	α_7	-0.5727288	-2.73	.008**
lnadmgeneff	α_8	-0.1621302	-1.19	0.237
lnOITASS	α_9	0.0693615	0.60	0.549
owner	α_{10}	1.264398	1.17	0.247
lninf	α_{11}	-0.1090248	-2.64	.010*
lnreserve	α_{12}	-0.0043618	-0.06	0.956
ln(loans/GDP)	α_{13}	-0.7419905	-2.00	.050*
bankdum1	ϑ_1	0.411871	0.87	0.386
bankdum2	ϑ_2	0.5808133	1.14	0.257
bankdum3	ϑ_3	omitted		
bankdum4	ϑ_4	-0.979503	-1.33	0.188
bankdum5	ϑ_5	0.5761776	1.74	0.087
bankdum6	$\vartheta 6$	0.6272188	1.15	0.256
bankdum7	ϑ_7	-0.9646619	-1.42	0.160
bankdum8	ϑ_8	-0.1382825	-0.43	0.670
bankdum9	ϑ_9	0.4480415	1.00	0.323
bankdum10	ϑ_{10}	0.4288507	1.26	0.214
bankdum11	ϑ_{11}	0.5264501	1.29	0.200
bankdum12	ϑ_{12}	0.5892306	1.25	0.216
No of Obs.		94		
F (13, 80)		10.18		
Prob > F		0.0000		
R^2		0.7797		
Adj R^2		0.7031		
Root MSE		0.2373		
RSS		3.8841		
MSS		13.7499		

legend: * p<0.05; ** p<0.01; *** p<0.001

```
. test bankdum1 bankdum2 bankdum3 bankdum4 bankdum5 bankdum6 bankdum7 bankdum8 bankdum9 bankdum10 bankdum11 bankdı

 ( 1)  bankdum1 = 0
 ( 2)  bankdum2 = 0
 ( 3)  o.bankdum3 = 0
 ( 4)  bankdum4 = 0
 ( 5)  bankdum5 = 0
 ( 6)  bankdum6 = 0
 ( 7)  bankdum7 = 0
 ( 8)  bankdum8 = 0
 ( 9)  bankdum9 = 0
 (10)  bankdum10 = 0
 (11)  bankdum11 = 0
 (12)  bankdum12 = 0
       Constraint 3 dropped

       F( 11,     69) =    2.06
            Prob > F =    0.0348
```

6. Least Square Dummy Variable Estimation Results – test of year (time) fixed effect

Table A.6 Least Squares Dummy Variables estimation results (year

	Coeff.	Parameter	t-stat	p-value
Intercept	α_0	-24.25216	-2.19	.032*
lnHHIdep	α_1	0.565557	1.43	0.157
lnMSdep	α_2	0.0553227	0.48	0.633
lnrisk	α_3	-0.0192948	-0.63	0.533
lnTA	α_4	2.122455	2.18	.032*
$lnTA^2$	α_5	-0.051226	-2.38	.020*
lnlabeff	α_6	-0.0248014	-1.64	0.106
lncapeff	α_7	-0.8148798	-5.01	.000***
lnadmgeneff	α_8	-0.0754161	-0.72	0.471
lnOITASS	α_9	0.1570273	1.96	0.054
owner	α_{10}	-0.3510749	-1.52	.010*
lninf	α_{11}	-0.0663181	-1.52	0.133
lnreserve	α_{12}	-0.1068339	1.62	0.110
ln(loans/GDP)	α_{13}	omitted		
yeardu2	ϑ_2	-0.0303258	-0.26	0.795
yeardu3	ϑ_3	-0.0799904	-0.69	0.491
yeardu4	ϑ_4	-0.0323112	-0.29	0.772
yeardu5	ϑ_5	0.0211831	0.21	0.833
yeardu6	ϑ_6	-0.1971465	-1.97	0.053
yeardu7	ϑ_7	omitted		
yeardu8	ϑ_8	omitted		
yeardu9	ϑ_9	0.1025546	0.88	0.383
No of Obs.		94		
F (13, 80)		11.16		
Prob > F		0.0000		
R^2		0.7282		
Adj R^2		0.663		
Root MSE		0.2528		
RSS		4.7927		
MSS		12.8413		

legend: * p<0.05; ** p<0.01; *** p<0.001

```
. test yeardum2 yeardum3 yeardum4 yeardum5 yeardum6 yeardum7 yeardum8 yeardum9

 ( 1)  yeardum2 = 0
 ( 2)  yeardum3 = 0
 ( 3)  yeardum4 = 0
 ( 4)  yeardum5 = 0
 ( 5)  yeardum6 = 0
 ( 6)  o.yeardum7 = 0
 ( 7)  o.yeardum8 = 0
 ( 8)  yeardum9 = 0
       Constraint 6 dropped
       Constraint 7 dropped

       F(  6,    75) =    1.17
            Prob > F =    0.3304
```

7. Breusch and Pagan Lagrangian multiplier test for random effects

```
. xttest0

Breusch and Pagan Lagrangian multiplier test for random effects

        lnliit[bankid,t] = Xb + u[bankid] + e[bankid,t]

        Estimated results:
                         |       Var     sd = sqrt(Var)
                ---------+------------------------------
                  lnliit |   .1896129        .4354457
                       e |    .056291        .2372573
                       u |           0               0

        Test:   Var(u) = 0
                                 chi2(1) =     0.06
                              Prob > chi2 =   0.8001
```

8. Endogenous test

```
. ivregress 2sls  lnhhidep lnmsdep lnriskit lnta lnta2 lnlabeff lncapeff lnadmgeneff lnoitass owner lninflation lnreserve lnloan
> it

Instrumental variables (2SLS) regression          Number of obs =      94
                                                  Wald chi2(12) =  720.90
                                                  Prob > chi2   =  0.0000
                                                  R-squared     =  0.8846
                                                  Root MSE      =  .07599
```

lnhhidep	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
lnmsdep	.2074112	.0255921	8.10	0.000	.1572517	.2575708
lnriskit	.0086397	.0089145	0.97	0.332	-.0088324	.0261118
lnta	-.9541326	.2697091	-3.54	0.000	-1.482753	-.4255124
lnta2	.0166654	.0060943	2.73	0.006	.0047208	.0286099
lnlabeff	-.0814178	.0421125	-1.93	0.053	-.1639569	.0011212
lncapeff	.1540931	.043692	3.53	0.000	.0684583	.2397279
lnadmgeneff	-.1188583	.0277875	-4.28	0.000	-.1733209	-.0643957
lnoitass	-.0639449	.0226742	-2.82	0.005	-.1083855	-.0195043
owner	.1484428	.0345007	4.30	0.000	.0808227	.216063
lninflation	.000567	.0122816	0.05	0.963	-.0235044	.0246385
lnreserve	-.0927035	.0159174	-5.82	0.000	-.123901	-.061506
lnloansgdpit	.2054631	.1054334	1.95	0.051	-.0011825	.4121087
_cons	12.60872	3.037228	4.15	0.000	6.655865	18.56158

(no endogenous regressors)

9. Autocorrelation test

xtregar lnliit lnhhidep lnmsdep lnriskit lnta lnta2 lnlabeff lncapeff lnadmgeneff lnoitass owner lninflation lnreserve lnloansgdpit, fe lbi

modified Bhargava et al. Durbin-Watson = 1.2009545
Baltagi-Wu LBI = 1.8393277

10. Heteroskedasticity test

```
. predict uifixed, u

. gen uifixed2 = uifixed^2

. reg uifixed2 lnhhidep lnmsdep lnlabeff lncapeff lnadmgeneff
```

Source	SS	df	MS
Model	.972248655	5	.194449731
Residual	1.99766652	88	.022700756
Total	2.96991517	93	.031934572

Number of obs = 94
F(5, 88) = 8.57
Prob > F = 0.0000
R-squared = 0.3274
Adj R-squared = 0.2891
Root MSE = .15067

uifixed2	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lnhhidep	.0405213	.0821864	0.49	0.623	-.1228068	.2038495
lnmsdep	.0464828	.0229928	2.02	0.046	.0007895	.0921762
lnlabeff	.1090902	.0772988	1.41	0.162	-.0445251	.2627054
lncapeff	-.1367006	.0603415	-2.27	0.026	-.2566168	-.0167845
lnadmgeneff	.056816	.0373322	1.52	0.132	-.0173738	.1310059
_cons	.2756765	.1809682	1.52	0.131	-.0839598	.6353127

```
. dis 5*8*.3274
13.096
```

The above auxiliary regression is conducted after generating residual squares from the fixed effects regression (uifixed2) and running upon suspected heteroskedastic terms. The test statistics $N * (T - 1) * R^2_{Aux}$ is supposed to have an asymptotic chi-squared distribution with J degrees of freedom in the auxiliary regression. From the table, Chi2 (5) at 10% equals 15.086 and hence lower value (13.096) of calculated test statistics does not allow us to reject the null that the errors are homoscedastic.

Declaration

I, the under signed person, declare that this thesis is my original work and has not been presented for a degree in any other university and that all sources of material used for the thesis have been duly acknowledged.

Declared by:

Name: Hailemichael Nekatibeb

Signature: _____

Date: 11/06/2012

Confirmed by:

Name: Adane Tuffa

Signature: _____

Date: 11/06/12

7. Breusch and Pagan Lagrangian multiplier test for random effects

```
. xttest0

Breusch and Pagan Lagrangian multiplier test for random effects

        lnliit[bankid,t] = Xb + u[bankid] + e[bankid,t]

        Estimated results:
                     |       Var     sd = sqrt(Var)
             ---------+------------------------------
              lnliit |    .1896129        .4354457
                   e |     .056291        .2372573
                   u |           0               0

        Test:   Var(u) = 0
                             chi2(1) =      0.06
                          Prob > chi2 =      0.8001
```

8. Endogenous test

```
. ivregress 2sls  lnhhidep lnmsdep lnriskit lnta lnta2 lnlabeff lncapeff lnadmgeneff lnoitass owner lninflation lnreserve lnloan
> it

Instrumental variables (2SLS) regression          Number of obs =      94
                                                  Wald chi2(12) =  720.90
                                                  Prob > chi2   =  0.0000
                                                  R-squared     =  0.8846
                                                  Root MSE      =  .07599

------------------------------------------------------------------------------
   lnhhidep |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
------------+-----------------------------------------------------------------
    lnmsdep |   .2074112   .0255921     8.10   0.000     .1572517    .2575708
   lnriskit |   .0086397   .0089145     0.97   0.332    -.0088324    .0261118
       lnta |  -.9541326   .2697091    -3.54   0.000    -1.482753   -.4255124
      lnta2 |   .0166654   .0060943     2.73   0.006     .0047208    .0286099
   lnlabeff |  -.0814178   .0421125    -1.93   0.053    -.1639569    .0011212
   lncapeff |   .1540931    .043692     3.53   0.000     .0684583    .2397279
 lnadmgeneff |  -.1188583   .0277875    -4.28   0.000    -.1733209   -.0643957
   lnoitass |  -.0639449   .0226742    -2.82   0.005    -.1083855   -.0195043
      owner |   .1484428   .0345007     4.30   0.000     .0808227     .216063
 lninflation |    .000567   .0122816     0.05   0.963    -.0235044    .0246385
   lnreserve |  -.0927035   .0159174    -5.82   0.000     -.123901   -.061506
 lnloansgdpit |   .2054631   .1054334     1.95   0.051    -.0011825    .4121087
       _cons |   12.60872   3.037228     4.15   0.000     6.655865    18.56158
------------------------------------------------------------------------------
(no endogenous regressors)
```