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The Effect of Market Structure on Banks' Interest Rate Spreads

An Empirical Analysis of the Norwegian Bank Market

by

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Preface

This thesis was written as a part of the Master of Science in Economics and Business Administration program at The Norwegian School of Economics and Business Administration (NHH). Writing this thesis has been a challenging, yet fun and rewarding experience. Throughout the research process we have gained valuable insight into the Norwegian banking industry and the structural forces driving the local markets within it.

The choice of topic was derived from the authors' strong interest in bank markets and numerical analysis, which contrary to popular belief is quite possible despite being students in the field of Strategy and Management. We have contributed equally to the thesis, but in a complementary manner, which we believe has strengthened the end result.

We would like to thank our advisors, dr.oecon Aksel Mjøs and dr.oecon Gorm Grønnevet, for their support, guidance and invaluable feedback throughout the work with this thesis. We would also like to express our gratitude to the Norwegian Ministry of Finance for granting us access to the data material that has served as the foundation of our work. Our gratitude is also extended to the Institute for Research in Economics and Business Administration (SNF) for being kind enough to let us set up camp at their office facilities during the writing process.

Bergen, 12 July 2010

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1. Introduction

1.1 Background

Currently, there is a growing body of research that discusses market structure and how this affects performance in the banking industry. Market structure refers to the different characteristics of a market, i.e. the number and distribution of banks and the specific attributes of the banks within the market as well as the attributes of the market itself. Performance may be measured in terms of banks' interest rate spreads[1]. Many studies have been conducted on this topic and empirical evidence shows that market concentration has an effect on interest rate spreads. However, competing theories offer contradictory conclusions in regard to this relationship. For instance, proponents of the *Structure Conduct Performance Hypothesis* suggest a direct positive relationship between market concentration and interest rate spreads, while those in favor of the *Efficiency Hypothesis* consider the effect of market concentration on interest rate spreads to be merely spurious. In this study, we thoroughly review the available literature on these topics and investigate how market concentration, along with other possible determinants, affects interest rate spreads in the Norwegian banking sector. We define the Norwegian banking sector as all commercial and savings banks that supply credit. Other types of financial intermediaries are intentionally excluded. On the credit demand side our focus is solely on commercial customers. Private consumers are excluded from our analysis[2].

The data we use consist of comprehensive data sets made available to us by the Norwegian Ministry of Finance. These data sets contain key information about all deposit and loan accounts in Norwegian registered banks belonging to commercial organizations in Norway in the years 1997 – 2008. The data sets include actual year-end balances of the accounts as well as interest that was credited or debited from accounts during the period. Because all data are audited and since all banks are required to report this information to the Norwegian Tax Administration we believe that the data offer a highly accurate snapshot of the Norwegian bank market.

[1] Various measures of performance can be found in the theoretical banking literature. Frequently applied measures include loan rates, deposit rates and interest rate spreads, although other performance measures such as return on assets and net interest margins can also be found in applications.

[2] Commercial customers typically have different banking needs than private consumers. For instance, private consumers' banking needs are usually limited to loans, deposits and payment transaction systems. Consumers are to a lesser extent dependent on close geographical proximity to their banks than commercial customers, due to the advent of internet banking (The Financial Supervisory Authority of Norway, 2008). This impacts how we have defined the relevant bank markets as detailed in the Theory chapter.

1.2 Research Question and Objective

Credit market concentration has increased in most European countries in recent years, the result being fewer and larger credit institutions. In Norway, the number of commercial banks has been relatively stable the last decade. However, this is not to say that the structure of the Norwegian bank market has remained unchanged. Although the number of banks is high compared to other countries when adjusting for the size of the population, the Norwegian bank market has indeed been subject to consolidation with fewer and larger banks making up most local markets, according to a report on competition in the Norwegian bank market from The Financial Supervisory Authority of Norway (Konkurransen i bankmarkedet, 2008). Prior to the financial crisis in 2008 the profitability in the banking sector had been increasing. The good results and high returns on equity can be attributed to low losses on loans, since tighter competition had led to a reduction in the banks' interest margins. It is also evident that the largest banks have had higher returns on their equity than smaller banks. The same report proposes a combination of higher costs and high levels of equity as the cause of the smaller banks' lower returns.

The changes in market size and the differences in equity return among banks of different sizes make it interesting to assess how the spreads between the banks' deposit rates and lending rates are affected by market structure, specifically the number and distribution of banks in a market. Based on an assumption that a correlation between interest rate spreads and market concentration exists, it is tempting to further examine which implications market structure has on the interest rate spread. In order to assess this, it is sensible to look at markets with different market structures, or more precisely; compare markets with various levels of market concentration. This leads us to propose the following research question for our study:

"How does market structure affect the interest rate spread in local Norwegian bank markets?"

The object of the study is to identify how structural changes in local bank markets determine the performance, measured by the interest rate spread, of banks offering commercial lending. The interest rate spread serves as a measure of performance based on the assumption that banks enjoy higher earnings as the difference between loan rates and the cost of funding increases. Since we are interested in the effects of market structure, it is helpful to distinguish between markets with different structural compounds. A typical distinction, commonly used by legislators when determining the anti-trust effects of potential merges, is to set a threshold

that distinguishes between highly concentrated and un-concentrated markets based on their levels of market concentration. We make a similar distinction between markets in the analyses conducted in this study. The academic purpose of this thesis is to provide a thorough analysis on the relationship between market structure and the dynamics of interest rate spreads in the Norwegian banking industry.

1.3 Structure

The rest of this thesis is organized as follows. Chapter 2 discusses the relevant theoretical literature, focusing on studies on the coherence between market structure and measures of performance in the banking industry. This chapter also contains a depiction of our research model derived from the theoretical literature. In Chapter 3 we provide a thorough description of the data that form the basis for our analysis. The methods applied in the analysis are described in Chapter 4. We present our findings in Chapter 5. Chapter 6 contains a detailed discussion of the findings and the conclusions we draw from these.

2. Theory

2.1 Introduction

In this chapter we will first describe the theoretical approach we have used to define the various bank markets in our study. This includes a discussion of different ways to define markets within an industry analysis framework, as well as an assessment of different methods to measure market structure. A discussion of how changes in market structure affect banks' performance, and how market concentration along with other possible determinants affect banks' interest rate spreads will follow[3]. We will proceed with a discussion of competing theories on the subject, with particular emphasis on the *Structure Conduct Performance Hypothesis*, the *Efficiency Hypothesis* and new empirical industrial organization studies on banking.

2.2 Market Definition

When assessing the effect market structure has on competition and performance in the banking sector, a cogent definition of the relevant markets is necessary (Jackson, 1992). As Brooks (1995) points out, it has little meaning to assess conditions of competition, such as market concentration and market share, unless the boundaries of the markets under analysis have been thoroughly defined. The literature on market delineation is rather extensive and several approaches to make correct definitions of markets have been proposed[4]. However, a basic introduction to the topic can be found in Besanko, Dranove, Shanley and Schaefer (2007). When defining a market (in our case we wanted to define the local markets for Norwegian banks that provide credit to commercial entities), it is useful to begin with identifying competitors. By comparing the degree to which the products or services of two firms are substitutes for one another, i.e. the extent to which a price change by one firm leads to a demand change for another firm, it is possible to say something about the level of competition between the firms in question. According to Besanko et al. (2007) products that have the same or similar *product performance characteristics*, have the same or similar *occasions for use* and are *sold in the same market* tend to be close substitutes. A product's performance characteristics describe the product's attributes subjectively from the customer's point of view. For instance, a money market deposit account (MMDA) from bank A may

[3] The interest rate spread can be defined as the difference between the bank's interest revenue from its loans to commercial customers and the interest expenses that the bank has when lending in the money market (i.e. the 3- month NIBOR): (interest paid by borrowers/interest earning loans to borrowers) – NIBOR. We discuss how we define the interest rate spread in our study in Chapter 4.

[4] See for instance Elzinga and Hogarty, 1978 and Stigler and Sherwin, 1985.

share the following characteristics with a MMDA from bank B: larger-than-normal deposits, offers the competitive (real) interest rate and has restrictions on withdrawal. When, where and how a product is used describes the product's occasion for use. Bank A may specialize in syndicating loans to finance large industry projects whereas Bank B could be a consumer bank providing credit to homebuyers requesting a mortgage and to small privately owned businesses. In such a case, the financing services offered by Bank A and Bank B would likely not be substitutes. This illustrates that bank specific competence matters when defining relevant bank markets. Products that share the same performance characteristics and occasions for use may not necessarily be substitutes if they are sold in different geographic markets. Local banks or local branches of nationwide banks that offer the same products and services in their distinct geographic market may be competitors, but they seldom compete for customers with banks in other geographic markets. Besanko et al. (2007) offer a list of three criteria that determine whether two products are in different geographic markets: 1) they are sold in different locations, 2) transportation of the goods is costly and 3) it is costly for consumers to travel to buy the goods. Delineating markets by location alone seems to be insufficient in order to determine the geographic market to which a bank belongs. Therefore a definition of geographic bank markets should take into account both the location of where banking services are offered and the cost of transportation between, and travelling to, these locations. As such, an intuitive approach is to define the geographic markets in our study by the commuter belts[5] to which each bank or branch of bank belongs.

Admittedly, the approach to competitor identification and defining substitutes outlined above can be subjective and is based on intuition rather than empiricism. Attempting to delineate markets by competitor identification may sometimes be challenging due to the occurrence of switching costs. As Degryse, Kim and Ongena (2009) explain, switching between banks may entail both transactional switching costs that are directly observable and informational switching costs associated with the capitalized value of a bank-firm relationship. They argue that banks can increase transactional switching costs by charging account closure fees and can invest in information gathering to increase informational switching costs. Sharpe (1990) argues that information asymmetries between firms and banks arise because banks learn more about their customers than their competitors do through the process of lending. This enables banks to give firms that they have longstanding relationships with better credit ratings than

[5] We refer to commuter belts simply as "regions" throughout this thesis. However, in some contexts we still use the term "commuter belts" for better clarity. Statistics Norway (SSB) defines a commuter belt as a populated region that includes at least one municipality that workers commute within. There are 161 commuter belts in Norway.

these firms would receive elsewhere. As a result of the informational advantage a bank may have over its competitors, the bank can capture some of the rents generated by its best customers by holding up these customers, effectively preventing them from receiving competitive financing elsewhere. Ioannidou and Ongena (2007) show that even under an information-sharing regime, where information is accessible to competing banks, switching costs may still occur. By offering similar credit rating to its current customers, a bank can make it more difficult for competitors to assess the actual quality of the customers in each individual case. Freixas and Rochet (1997: 74) explain how switching costs alter the time profile of competition in bank markets using a two-period model: If switching costs are sufficiently high, banks can "lock in" their customers in the second period and charge higher prices, which again influences the competition in the first period. Hence, a price change in one bank's product will not immediately affect the demand for a competing bank's product. Even though it is possible to take into account the time lags incurred by switching costs when doing the calculations, the scope of such an exercise across the entire Norwegian banking sector almost certainly qualifies for a study of its own.

The type of competition in a market can also be pertinent to identifying relevant competitors. Freixas and Rochet (1999) argue that the assumption of perfect competition is not necessarily appropriate in the banking sector, partly because of high entry barriers, and suggest that models of imperfect competition (oligopoly a la Cournot) better describe competition in bank markets. The same authors also open for the possibility of bank markets being subject to monopolistic competition, which will incur if there is some degree of differentiation between the bank services offered. This suggests that banks do not compete solely on price. Again, it would be possible to incorporate such variables in an assessment of competition in the bank market, but doing such an assessment falls on the side of our primary focus in this study and seems at best superfluous to our purposes.

Simple microeconomic theory on price/quantity elasticities provides a quantitative approach to defining competitors and delineating specific markets. This involves measuring the degree to which two products substitute by calculating the cross-price elasticity of demand. The cross-price elasticity of demand measures the percentage change in demand for one good that results from a one percent change in the price of another good (Pindyck and Rubinfeld, 2005). Simply put, if an increase in the price of one good, A, leads to an increase in demand for another good, B, all else being equal, goods A and B are substitutes. The cross-price elasticity of demand for product B relative to product A can be written as:

$$\eta_{ba} = \frac{\Delta Q_b / Q_b}{\Delta P_a / P_a} \qquad (2.1)$$

where Q_b is the quantity sold of product B and P_a is the price of product A. When η_{ba} is positive, products A and B can be considered substitutes. Although using cross-price elasticities to identify substitutes and thus delineate markets is accurate in its own sense (provided that data on quantity demanded and prices are available), it may not necessarily be feasible when defining markets in the Norwegian banking sector. Brooks (1995) points out that while there appears to be some consensus on identifying market boundaries using cross-price elasticities of demand, the practical problems associated with applying this approach sometimes preclude its use, especially when attempting to define geographic market boundaries.

According to Stigler and Sherwin (1985), a potential source of information that may aid in defining geographic markets is the physical movement of goods or buyers from one place to another. As they explain, markets can be divided by examining the flow of goods and services across geographic regions. This way of defining a market can be considered as a complement to defining markets by a specific metropolitan statistical area. A metropolitan statistical area is a geographical region with a certain population density, for instance a commuter belt, but is not subject to common administrative legislation such as a town or a county would be. While identifying competitors in a specified statistical area may be a good starting point, it merely outlines the ad hoc boundaries between markets and does not necessarily take account of the customers served by the businesses in the specified statistical area. Examining the flow of services for the banks in our data set involves identifying where the customers served by the banks are located and their travel patterns. The contiguous area from which a firm draws its customers is sometimes referred to as a catchment area (Besanko et al., 2007). A natural catchment area for a bank would be the commuter belt that surrounds it. In this context, we should note some important implications that dividing the market into commuter belts have in respect to the differences between bank markets for private consumers and bank markets for commercial entities. The evolution of electronic banking services has effectively eliminated the need for private consumers to be in physical proximity to their banks in order to use the banks' services. Hence, the traditional boundaries between local consumer bank markets no longer exist. Commercial entities, on the other hand, may differ from private consumers in their needs for banking services and may require a closer relationship with their banks. Degryse and Ongena (2005) study the effect geographical distance between firms, their

lending banks and competing banks in the vicinity has on loan conditions. They find that loan rates decrease when the distance between the firm and its lending bank decreases, and increase when the distance between the firm and competing banks increases. The cause of this spatial price discrimination is attributed to transportation costs, rather than to switching costs derived from informational asymmetries. Potential benefits from firm-bank relationships are well documented in the empirical literature on relationship banking (see for instance Boot and Thakor, 2000). The role of firm-bank relationships generally, and geographical distance specifically, makes it more difficult for commercial customers to obtain the services they require from banks that are not in close physical proximity. We therefore argue that even though using commuter belts to delineate private bank markets may not be feasible, commuter belts still represent relevant markets in which banks compete for commercial business customers.

Examining data on customer travel patterns is called flow analysis. Besanko et al. (2007) point out that although flow analysis is a good place to start when attempting to delineate market boundaries, it does have some weaknesses. It may be that customers continue to remain within a certain catchment area over time, but that does not mean that they would not travel outside the catchment area for their required services if prices or any other demand effecting variables were to change. Also, customers may venture outside the predefined catchment area for idiosyncratic reasons, such as seeking a specialized service from a bank that specializes in services not provided in that particular catchment area. This does not automatically imply that banks that offer these specialized services should be included in the catchment area. However, this weakness is less prevalent when dividing markets by predefined commuter belts. Since the boundaries of these commuter belts by definition remain relatively stable over time, it reduces the risk of including banks in a specific local market that in reality belong to another local market.

In his study of market definition in bank merger and acquisition analysis, Jackson (1992) tests whether metropolitan statistical areas are appropriate measures of economic markets for banking services. The study compares the similarity of price movements within given metropolitan statistical areas with average US nationwide price movements to test for the existence of geographically defined local markets. The underlying assumption of the test is that while *similar* adjustment patterns to common influences for banks in different markets would not necessarily prove that they belong in the same geographic region, *dissimilar* adjustment patterns suggest that they *do not* belong in the same geographic area. Jackson's

(1992) findings suggest that for certain bank services, where the interest rate is determined locally; the market delineation appears not to be national.[6] This study was conducted on the US banking sector and it is important to note that the results might not necessarily be transferable to the Norwegian banking sector. However, it seems likely that delineating markets locally by using predetermined metropolitan statistical areas is feasible when factors affecting competition appear to have properties that originate in local areas. The view that bank markets are indeed local in their nature is proponed by Hannan (1991), who argues that if commercial loan markets are substantially broader than metropolitan statistical areas, loan rates should not differ systematically between metropolitan statistical areas. This is not altered by the fact that loan rates obviously may vary across different loans and different banks. His findings suggest that there are significant variations in loan rates between metropolitan statistical areas, providing evidence that idiosyncratic properties of local loan markets affect the interest rate. This further legitimates arguments for using a local market definition. However, it necessitates a framework for which idiosyncratic properties within a market can be measured, which we discuss in the following sections.

2.3 Market Structure

In order to assess how interest rate spreads change across markets it is important to have a sound understanding of the concepts that are used to measure market structure. The structure of the market refers to the number and distribution of firms in a market (Besanko et al., 2007). To capture the structural features within a market, concentration ratios of various kinds are often used. Concentration ratios are useful to explain competitive performance in the banking industry. They also measure the changes in concentration resulting from the entry or exit of a bank into the market and the concentration changes caused by a merger (Bikker and Haaf, 2002). As with delineating markets and defining their boundaries, there are several ways to determine the structure within a given market and calculate the concentration ratios. A highly applicable measure of market structure is the K-bank concentration ratio (Bikker and Haaf, 2002). This is a measure of the combined market share of the K largest firms in a particular market. For example, in a given bank market, the 3-bank concentration ratio is the combined

[6] Specifically, this is the case for Super Negotiable Order of Withdraw (SNOW) accounts and Money Market Deposit Accounts (MMDA). A SNOW account is a type of interest earning checking account that allows the customer to write drafts against money held on deposit. It typically pays higher interest rates than a regular NOW account (but lower than an MMDA), hence the prefix "Super" at the front. MMDAs are high-yielding savings accounts that pay the market rate of interest, the real interest rate, and require a minimum balance of a certain size in exchange for the additional interest paid. A national market specification is appropriate for small (less than $100,000) six-month certificates of deposits (CD6), where the interest rate is determined on a broader national level. Specifically, Jackson (1992) examines the scope of the markets for SNOW, MMDA and CD6 deposit accounts across US markets for bank services. For a more detailed description of the variables included in the study we refer the interested reader to pp. 657-661 in *"Is the Market Well Defined in Bank Merger and Acquisition Analysis"* by Jackson (1992).

market share of the three largest banks in that market. In a market of N equally sized banks, the K-bank concentration ratio (CR) is:

$$CR_K = \sum_{i=1}^{K} s_i = \sum_{i=1}^{K} 1/N = K/N \qquad (2.2)$$

Here S_i is the market share of bank i, K is the number of highest ranked banks included, and N is the number of total banks in the market. While the K-bank concentration ratio is rather easy to use and quick to calculate, it has a large weakness in that it does not change in respect to internal market share changes between the K-number of firms used for reference. For instance, if the largest bank in a market gains market shares at the expense of the second largest firm, the K-bank ratio will remain unaffected. Another way to measure market concentration ratio is the Herfindahl-Hirschman Index (sometimes referred to as the Herfindahl Index or simply HHI). The HHI is calculated by summing the squared market shares of all firms in the market, producing a number that theoretically can be between 1/N and 1(in practice the number will range between close to 0 and close to 1). This index can be written as:

$$HHI = \sum_{i=1}^{N} (S_i)^2 \qquad (2.3)$$

where S_i is the market share of firm i and N is the number of firms in the market. For example, if a market has two firms with a market share of 50 percent each, the HHI is calculated as $.5^2 + .5^2 = .5$. Given the pre-specified number of firms in a market, the index is closer to zero when all the firms are of equal size and tends toward one in the case of monopoly. In contrast to the K-bank concentration ratio, the HHI avoids the problem of arbitrarily cutting off smaller firms and is not insensitive to the share distribution within the market (Bikker and Haaf, 2002). There is therefore little doubt that the HHI conveys more information than the K-bank ratio. If one assumes that the size of the largest firms relative to each other is an important determinant of conduct and performance, calculating the HHI is more appropriate than relying on the K-bank ratio (Besanko et al., 2007). A study by Davies (1979) revealed that the HHI is less sensitive to changes in the number of firms within a market if the number of firms initially in the market is large. In the banking literature, the HHI is the most common concentration measure, and the index is in many cases considered a benchmark for other concentration ratio indices (Bikker and Haaf, 2002). Other concentration

indices, such as the Comprehensive Industrial Concentration Index, have also been promoted but have not been applied to similar extents as the K-bank concentration ratio and the HHI in the empirical banking literature[7]. Hall and Tideman (1967) offer an index that is closely related to the HHI. They argue that the number of banks in a market has important implications for entry conditions and should therefore be included when calculating market concentration. The index differs from the HHI in that the market share of each bank is weighted by its ranking order, giving the largest bank the weight i=1. The index is written as:

$$HTI = \frac{1}{(2\sum_{i=1}^{N} is_i - 1)} \qquad (2.4)$$

The Rosenbluth index resembles the HTI, but takes a different approach to the ranking of banks used as weights (Bikker and Haaf, 2002). The ranking of banks starts with the smallest firms, thus making the Rosenbluth index sensitive to market share changes between smaller banks. The index is calculated as follows:

$$RI = 1/(2C) \qquad (2.5)$$

where C refers to the area above the concentration curve. That is, C is the difference between the level of concentration in the market (which ranges between 0 and 1) and the entire market (which is always equal to 1) for a given concentration curve. RI is identical to HTI for

$$C = \sum_{i=1}^{N} is_i - 1/2 \qquad (2.6)$$

Although various concentration ratios have been shown to yield diverging values when applied on markets in the banking sector, Bikker and Haaf (2002) found that that the rankings of markets across 20 countries remained the same based on both the K-bank concentration ratio and the HHI. In addition to this, these two indices appear to be a good indicator for the relationship between market structure and market performance. Finally, Bikker and Haaf (2002: 20) argue that the choice of concentration index should be made on account of

> *'…the relevant impact larger and smaller firms have on competition and the relative impact of size distribution and number of banks.'*

[7] For a thorough review of the applicability of various concentration indices in the banking industry, see Bikker and Haaf: *Measures of Competition and Concentration in the Banking Industry: A review of the Literature* (2002).

The following table offers a comparison of a selection of the concentration ratios discussed in their study:

Table 2.1: Application of Concentration Measures to the Dutch Mortgage Market[8]

Index type	Range	Typical features	Values
3-bank ratio	1/n < HHI < 1	Takes only large banks into account, arbitrary cut off.	0.82
4-bank ratio			0.90
5-bank ratio			0.96
HHI	1/n < HHI < 1	Considers all banks; sensitive to entrance of new banks.	0.24
HTI	0 < HTI < 1	Emphasis on absolute number of banks.	0.25
Rosenbluth	0 < RI < 1	Sensitive to changes in the size distribution of small banks.	0.04
CCI	0 < CCI < 1	Addresses relative dispersion and absolute magnitude; suitable for cartel markets.	0.56

Source: Bikker and Haaf (2002: 19)

Given the relatively small number of banks in each of the predefined commuter belts in our data set, and the applicability of the index' use, we highlight that the HHI provides us with a reasonable measure of market concentration for the commuter belts in our data set. Similarly, the HHI can be used to determine the market concentration in the banks' output markets since it is feasible to assume that the market concentration in these markets may also determine the aggregated interest rate spreads on the bank level.

2.4 Determinants of the Interest Rate Spread

The structure of a market and the intensity of competition can affect the profitability and conduct of its firms profoundly. At various levels of market concentration, the type of competition and thus the performance of the banks in a given market may alter. The empirical literature on the impact of market concentration on bank conduct, especially the effect on loan rates, is comprehensive. As Degryse et al. (2009) point out; the magnitude of the impact market concentration has on interest rates varies widely in the empirical literature. They consider markets with a HHI below .10 to be competitive and markets with a HHI above .18 to be concentrated, and accept a change in HHI of .10 as a benchmark for marking the transition from a competitive to a concentrated market. A similar interpretation from the US Department of Justice and Federal Trade Commission, often used in merger transactions, considers markets with a HHI below .10 to be competitive, and those with a HHI between .10 and .18 to be moderately concentrated. Markets in which HHI is in excess of .18 are labeled

[8] We have calculated the corresponding values for the Norwegian bank market. A table with these calculations can be found in Appendix B.

as concentrated[9]. The executive body of the EU, the European Commission, has similar guidelines but applies a wider range to markets considered moderately concentrated. Here, markets with HHI levels below .10 are also labeled as competitive, markets between .10 and .20 are considered moderately concentrated and markets exceeding .20 are generally regarded as too concentrated to allow for mergers.[10] Regardless of the distinction method one chooses to use, it is evident that the level of market concentration is correlated with performance, and in the case of banks, the interest rate spread. An important note, however, is that the distinctions outlined above are intended to be guidelines for markets in general, not just bank markets specifically.

Kim, Kristiansen and Vale (2005) use a panel data set of Norwegian banks in the period 1993 – 1998 and find that an .10 increase in HHI results in an increase of 3 basis points[11] (bp) in the loan rate in the relevant period. Sapienza (2002) analyzes the effects of bank mergers on loan contracts. Her findings indicate that an increase in HHI by .10 increases loan rates by 59 bp in the Italian bank market. Further, she reports some interesting findings as to how bank consolidation affects loan rates. Mergers involving the acquisition of banks with small market shares tend to benefit borrowers through efficiency gains. In-market mergers (mergers between banks in the same local market) are found to decrease the interest rate the banks charge to borrowers. However, her findings suggest that when in-market mergers involve the acquisition of a local bank with a market share larger than 6.15 percent the gains in efficiency are offset by monopoly power, resulting in an increase of the loan rates charged to borrowers. This is also true for rival banks in the markets where the mergers take place, indicating that the entire market of banks benefits from higher degrees of consolidation. Finally, Sapienza's (2002) findings suggest that the number of bank relationships borrowers have and the size of both borrowers and banks affect the loan rates. Ho and Saunders (1981) argue that the interest rate spread depends not only on market concentration, but also on the degree of managerial risk aversion, the average size of bank transactions and the variance of the interest rate on bonds. However, they claim that the market structure influences differences in interest rate spreads between large and small banks heavily. By comparing two subgroups based on their asset size, they find that the smaller banks in their study had an average transaction spread of

[9] Horizontal Merger Guidelines issued by the United States Department of Justice and the Federal Trade Commission: The Herfindahl-Hirschman Index (internet). Available from: http://www.justice.gov/atr/public/testimony/hhi.htm (Accessed 25 May 2010).

[10] Guidelines on the assessment of horizontal mergers under the Council Regulation on the control of concentrations between undertakings issued by the European Commission: Official Journal C 31 of 05.02.2004 (internet). Available from: http://europa.eu/legislation_summaries/competition/firms/l26107_en.htm (Accessed 25 May 2010).

[11] One basis point is the equivalent of 1/100th of one percentage point.

approximately 1/3 of a percent more than the larger banks. The differences in spreads are largely attributed to market structure factors that enabled the smaller banks to earn additional producer's rent[12]. Ho and Saunders (1981) also highlight that even in highly competitive markets, an interest rate spread will always exist due to the underlying uncertainties surrounding bank transactions. This further suggests that the intensity of competition within the market has implications for banks' interest rate spread.

Other studies report similar findings. Berger and Hannan (1989), argue that banks in local markets that are concentrated pay MMDA, SNOW and short-term CD rates that are lower than those paid in less concentrated markets. Moreover, their findings suggest that the difference in deposit rates paid varies over time in concentrated and un-concentrated markets, and that this difference is strongly related to the aggregate level of interest rates. Hannan (1991) finds that banks in more concentrated markets charge higher loan rates. A possible explanation that he offers for the differences in the relationship between market concentration and loan rates over time is the greater price rigidity observed in concentrated markets. Arguments supporting the notion that the degree of competition in the banking industry affects credit availability (and hence the interest rate spread) are indeed not uncommon in conventional theories of industrial organization (Di Patti and Dell'Ariccia, 2004). While there appears to be strong evidence from the empirical literature that banks in highly concentrated local markets enjoy higher interest rate spreads compared with banks in less concentrated markets, another common finding in both the banking literature and in the literature on industrial organization is that concentration measures have fairly weak relationships with performance measures when market shares are also included in the regression equation (Berger, Demirgüc-Kunt, Levine and Haubrich, 2004).

This has ensued a debate among researchers as to what causes the differences in margins between markets with high and low concentrations[13]. No matter which arguments one chooses to favor, it is evident that several factors contribute to the variations in interest rate spreads between different bank markets. According to Demirgüc-Kunt and Huizinga (1999) bank characteristics, macroeconomic conditions, bank taxation, deposit insurance regulation, overall financial structure, as well as underlying legal and institutional indicators are

[12] The producer's rent is the additional profit above normal interest rates accruing to the producer due to a temporary or permanent monopoly of the means of production.

[13] Proponents of the *efficiency structure hypothesis* argue that high concentration endogenously reflects the market share gains of efficient firms, whereas the *structure conduct performance hypothesis* seeks to explain the performance differences between firms in high and low concentration markets as a result of market power, i.e. that the degree of market concentration is inversely related to the intensity of competition. We will elaborate more on the differences between these two approaches in the later sections of this chapter.

determinants reflected by differences in interest margins and bank profitability. First, differences in the mix of bank activity (bank characteristics) are found to impact the profitability and the interest rate spread. Banks that rely on deposits as their primary source of funding and banks that have a relatively high amount of non-interest earning assets tend to be less profitable. Similarly, because banks pass on operating costs to their depositors and lenders, variations in the banks' operating costs can also explain differences between banks' interest margins. Second, Demirguc-Kunt and Huizinga (1999) suggest that macroeconomic factors such as inflation and real interest rates, contribute to variations in interest margins[14]. Inflation is associated with both higher costs and higher income, although the study finds clear implications that income increases more than costs, hence increasing the banks' profitability. Third, financial structure within markets as measured by bank size and market concentration ratios is found to affect banks' interest margins positively. Also worth noting is that tax levels, deposit insurance regime and institutional factors, such as law and order, corruption and indices of credit rights were found to have some effects on banks' interest margins (Demirguc-Kunt and Huizinga, 1999), although these effects mostly help to explain variations between markets in different countries. These factors seem to be less relevant for our study since we are examining variations between markets within one country, implying that all markets are subject to the same tax regimes, insurance regulations and legal jurisdictions. There is evidence that suggests that firm specific factors on the customer side that are related to competitive forces within a market, specifically the relationships that customers have with their banks, contribute to determine the interest rate spread. In a study conducted with the same data set on Norwegian banks as our own, Hetland and Mjøs (2010) find that domestic mergers reduce loan availability and increase interest rate margins for nontransparent small and medium sized borrowers. More transparent firms, which have access to alternative sources of financing, do not appear to suffer from the same effects. They argue that a likely reason for this is that mergers terminate valuable banking relationships. These findings indicate that the way structural changes in bank markets affect the banks' interest rate spreads also depends on what kind of relationship the banks affected by changes have to their customers. In a study by Petersen and Rajan (1995) on the effect of competition in credit markets on lending relationships, results indicate that credit constrained firms are more likely to be granted credit in concentrated credit markets than in competitive credit

[14] It should be noted that the study by Demirguc-Kunt and Huizinga (1999) was conducted on banks from several countries and that these factors may not be as prevalent in local markets within a country. For instance, high real interest rates are for the most part associated with high interest margins in developing countries.

markets because lending institutions in more concentrated markets can internalize the benefits of assisting these firms more easily. In essence, the findings of both Hetland and Mjøs (2010) and Peterson and Rajan (1995) confirm that firm specific variables on the customer side will also affect the performance of banks. Other firm specific variables that affect performance may include credit risk (default risk, debt to equity ratio, profit to asset ratios) and industry structure on the customer side.

A finding that is common for most of the studies reviewed thus far in this section is that market concentration and factors reflecting market power affect the interest rate spread of banks. What causes the interest rate spreads to be affected by the competitive structure within a market has been subject to a great deal of debate among researchers, which we discuss below.

2.5 Competition between Banks and Market Power

Currently, there is a large body of research papers that describe bank competition and the resulting impact on deposit rates, interest margins, and the banks' market power. The majority of these studies have tested the validity of two different hypotheses that have emerged as the most common underlying explanations for the link between performance and market concentration in the banking industry. The first hypothesis is the "structure conduct performance hypothesis" (SCP), which argues that higher market concentration causes less competition between banks and leads to higher bank profitability due to increased market power (Degryse et al., 2009). The second hypothesis is the "efficiency hypothesis", which states that the merged banks in more concentrated markets are able to realize efficiency gains, and can pass these gains on to customers in the form of better deposit rates (Craig & Dinger, 2008). In recent years however, several papers on new empirical industrial organization criticize these approaches and attempt to explain firm conduct directly instead of relying on "indirect proxies" such as market structure or market shares (Degryse et al., 2009). In this section we will elaborate more closely on both the efficiency and SCP hypotheses as well as on some of the criticism against these approaches.

2.5.1 The Structure Conduct Performance Hypothesis

Proponents of the structure conduct performance hypothesis argue that the banks in more concentrated markets are able to set prices on loan and deposit rates to their own advantage due to collusion or other forms of non-competitive market practices (Berger & Hannan, 1989). A typical way to test the SCP hypothesis is to regress a measure of bank performance,

such as bank profitability, on a measure of market concentration, such as the K-bank concentration ratio or HHI (Degryse et al., 2009). Berger and Hannan (1989) conducted a study on the US deposit market within the SCP framework. In order to exclude the efficiency structure hypothesis explanation of the results their study examined the price-concentration relationship. The study analyzed bank deposits rates from 470 banks using quarterly data over a period of two and a half years from 1983 - 1985, focusing on the link between deposit rates and concentration. The authors use both a 3-bank ratio (CR3) and the HHI as measures of market concentration and estimate the following regression equation:

$$r_{ijt} = \alpha_0 + \alpha_1 CR_{jt} + \sum_k \gamma_k X_{k,ijt} + \varepsilon_{ijt} \qquad (2.7)$$

where r_{ijt} is the deposit rate paid by bank i in period t, CR_{jt} is the measure of market concentration in market i at time t and $X_{k,ijt}$ represent k-vector control variables that may affect the deposit rate. The results of their estimation indicate that market concentration has a negative impact on deposit rates. They conclude that their findings confirm the SCP-hypothesis. Berger and Hannan (1998) follow up this work in an analysis on bank mergers and the impact on prices. The authors examine mergers in the period of 1991-1994 and the deposit rates offered by the participating banks. The deposit rates are compared in order to find changes in geographical markets that experience substantial horizontal bank mergers versus markets that do not experience this. The authors find that the deposit interest rates decrease significantly in the markets that have experienced mergers (and thus become more concentrated), and conclude that this is the result of increased market power of the merged banks. An important note about the two studies discussed above is that the performance measure they use, deposit rate, is distinctively different in its implications from loan rate as a performance measure. A bank is unlikely to have the same degree of market power on deposits as it may have on loans because opening a deposit account is based on the customer's assessment of banks, whereas the decision to grant credit is based on the bank's assessment of the customer.

2.5.2 The Efficiency Hypothesis

The efficiency hypothesis is derived from the assumption that the most efficient banks are the ones that will gain market share (Demsetz, 1973; Peltzman, 1977). In this framework, market concentration is driven endogenously by bank efficiency. As Berger (1995) explains, there are two types of bank efficiency; *X-efficiency* measures efficiency of managerial prowess,

whereas *scale efficiency* measures the extent to which some banks produce at more efficient scales than others. Degryse et al. (2009) offer the following generalization of a regression equation that pertains to the efficiency hypothesis:

$$\pi_{ijt} = \alpha_0 + \alpha_1 CR_{jt} + \alpha_2 MS_{ijt} \sum_k \gamma_k X_{k,ijt} + \varepsilon_{ijt} \qquad (2.8)$$

where π_{ijt} is an arbitrary measure of bank i's profitability and MS_{ijt} is the market share of bank i at time t. The remaining variables remain the same as in (2.7). This regression is an attempt to disentangle the SCP and efficiency hypotheses. Where the SCP implies that $\alpha_1 > 0$, the efficiency hypothesis implies that $\alpha_2 > 0$ (Degryse et al., 2009). In other words, both X-efficiency and scale efficiency hypotheses imply that market share has a positive impact on profitability. In a study by Berger (1995), that includes measures of both X-efficiency and scale efficiency, results show that X-efficiency has a positive effect on banks' profits, whereas scale efficiency does not appear to be equally important. His findings suggest that market share, as a representative measure of larger banks 'market power, has a very small, yet still significant, impact on return on assets. Peristani (1997) attempts to assess whether consolidation, in the form of bank mergers, results in better efficiency, and analyzes bank mergers in the US from 1980 to 1990 by examining the effect of mergers on managerial efficiency (X-efficiency) and scale efficiency. He argues that the merger participants

'…realized a small, but significant decline in pro forma X-efficiency two to four years after the merger.' Peristani (1997:336),

while the banks achieved moderate gains in terms of scale economies. The study concludes that mergers yield no significant improvements in terms of X-efficiency. Another study, conducted by Huizinga, Nelissen and Vennet (2001) attempts to confirm the efficiency hypothesis by examining the links between mergers, efficiency and profitability. They analyze 52 horizontal bank mergers in Europe, in the period 1994-1998. The authors argue that both substantial unexploited scale economies and large X-inefficiencies are evident in European banking. They conclude that mergers have a positive impact on cost efficiencies, while profit efficiency improves marginally, hence stating that consolidation appears to be socially beneficial.

2.6 Fundamental Criticism against the SCP and Efficiency Hypotheses

Both the SCP hypothesis and the efficiency hypothesis have been subject to criticism and debate. Critics argue that these approaches assume an unreasonable precondition because they assume a one-way causality from market structure to performance (Degryse et al. 2009). In a study on the relative competitive position of European bank markets Carbo, Humphrey, Maudos and Molyneux (2009) find that the use of various existing competition measures yields diverging results across countries, within markets and over time. They argue that traditional indicators of competition, such as the HHI, may not predict bank market competition accurately and that they fail to explain a significant proportion of variations in performance measures such as the interest rate spread. Attempts to avoid the ambiguity of these results have been made by applying new empirical industrial organization (NEIO) models to assess competition levels in bank markets. Pannzar and Rosse (1987) propose a model that investigates the relationship between changes in input prices and equilibrium industry revenues. To measure the aggregated elasticities of total interest revenue with respect to input prices they calculate a H-statistic that can be computed as:

$$H = \sum_{f} \beta_f \qquad (2.9)$$

where f denotes the factor input. A H-statistic = 1 indicates perfect competition and H-statistics between 0 and 1 indicate monopolistic competition. A H-statistic $\leq$ 0 indicates a monopoly situation. Claessens and Laeven (2004) study the extent to which input prices are reflected in bank revenues under the Panzar and Rosse (1987) methodology. Their findings suggest that most bank markets are characterized by monopolistic competition. They also argue that fewer entry and activity restrictions lead to higher H-statistics and more competitive banking systems. Finally, they argue that the lack of importance of market structure in their findings may indicate that competition policy in the banking sector is more complicated than previously thought.

2.7 Implications from Theory

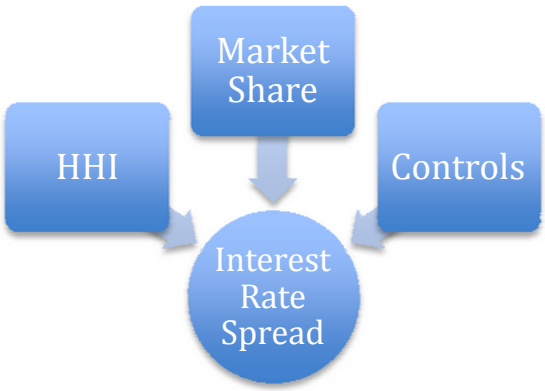
Our literature review suggests that banks operate in local markets and that clear definitions of the markets under analyses are imperative. Delineating bank markets can be achieved by dividing the national Norwegian bank market into locally defined regions, such as commuter belts. Concentration indices are commonly used to measure the structure within bank markets and help determine the level of competition in each market. While several concentration

indices have been proposed to measure the structure of bank markets, the most commonly applied indices are various versions of k-bank concentration ratios and the HHI. The empirical literature on banking discusses several determinants of loan and deposit interest rates. The review of a selection of studies on this topic reveals that in addition to market concentration and other market specific variables, both bank specific variables, firm specific variables and factors describing the bank-firm relationship also have an impact on interest rates. However, there seem to be ambiguous assessments concerning the cause of these effects. While some researchers argue that higher bank market consolidation causes banks to become more efficient, enabling them to reduce costs and hence increase their margins, others explain increased margins with changes in the market structure. The latter theory suggests that banks in more consolidated markets are able to use their market power to their benefit. It is worth noting that both these hypotheses have been subject to criticism from newer empirical industrial organization models. This criticism is largely aimed at the one-way causality implicit in these frameworks.

As a final note, we would like to point out that most of the studies on the relationship between bank profitability and its determinants reviewed in this chapter, use loan rate as a profitability measure, meaning that they look only at the price charged by the banks for their loans. This measure does not reflect the funding costs the banks have themselves, e.g. the interbank rate (Norwegian Interbank Offered Rate, NIBOR, in Norway) or, if the banks rely heavily on deposits for funding, the deposit rate. Hence, the loan rate alone serves as a good comparative measure of banks' profitability (how well the banks perform compared to each other), but does not necessarily tell anything about the absolute profitability since the costs are not included in the measure. We therefore believe that it may be reasonable to extract the banks' funding costs to arrive at an accurate performance measure, even though the determinants of the loan rate the banks charge and the determinants of the NIBOR or the deposit rate may not be the same. In our opinion the NIBOR, which is the same for all banks in Norway, is a better assessment of the banks' funding costs than the deposit rate because deposits made by firms make up a fairly small proportion of the banks' funding sources in the markets for commercial customers.

2.8 Research Model

Our research model is based on the assumption that increased market concentration and other structural factors play an important role in determining the interest rate spreads of banks in local markets. Market structure may impact the interest rate spread level in three ways. As our literature review suggests, in the case where the interest rate changes to the advantage of the banks, the SCP-hypothesis argues that this is due to the fact that banks in more concentrated markets may enjoy higher market power. On the other hand, the efficiency-hypothesis suggests that the level of bank efficiency drives market concentration endogenously. This implies that increases in both structure and performance are results of efficiency gains. The third scenario is that the level of concentration does not affect banks' interest rate spreads at all. Based on our review of the literature above, we propose the following graphic research model for our study[15]:



Since we are investigating whether there are any differences in the interest rate spread when market concentration varies in low concentration markets and high concentration markets, the independent variables of the model are market concentration, measured by HHI, and market shares, measured by the proportion of loans the individual banks have in the local loan markets. We make a distinction between markets with low and high concentration because it appears reasonable that the fundamental assumptions about the relationship between competition, market power and market structure have different implications for markets that differ from one another in respect to their levels of market concentration. We define low concentration markets as regions with HHI below 0.2. High concentration markets are defined as regions with HHI above 0.2. From this model we arrive at the following main hypothesis:

[15] We introduce an econometric expression of the model that more fully details the coherence between the variables in chapter 4.

H_0 : *Market structure affects banks' interest rate spreads similarly in high and low concentration bank markets*

H_A : *Market structure affects banks' interest rate spreads differently in high and low concentration bank markets*

Because the initial assumption is based on a positive correlation between market concentration and the banks' interest rate spreads, the hypotheses reflect a belief that in high concentration markets, as market concentration increases, the higher the interest rate spread will be. However, in low concentration markets, the interest rate spread may not be affected in the same way, since the markets may be subject to competitive forces that inhibit market power benefits to increase interest rate spreads. Hence, other factors may describe variations in the interest rate spreads in low concentration markets better. Firm specific variables on the customer side are not included directly in the model, however we do acknowledge that they can affect the interest rate spread. The implications this has for our model will be discussed in Chapter 4.

3. Data

3.1 Introduction

All Norwegian registered commercial entities involved in lending, such as banks, credit institutions, and loan brokers among others, are required by law to provide key financial information to the Norwegian Tax Administration on a yearly basis for taxation purposes. Entities that provide lending report information about their customers such as registered bank accounts, year end balances of these accounts, the total interest charged on loans, and total interest paid for deposits as well as several other types of client data that we will touch upon later in this thesis. The Norwegian Tax Administration gathers accurate information on all business entities that have loan and deposit accounts in Norwegian registered financial institutions through this mechanism[16].

Through a special permission granted by the Norwegian Ministry of Finance, data sets with this information from 1997 - 2008 have been provided to Dr. Aksel Mjøs at the Institute for Research in Economics and Business Administration (SNF) for research purposes. The Norwegian Ministry of Finance has in turn also granted us as the authors of this thesis access to the data sets. Details of the data that can be used to identify individual entities are confidential and therefore strictly forbidden to publish. Due to these confidentiality requirements, we have not included names of business entities in any charts, tables or figures. However, detailed discussions of our research findings are still viable, since the findings are nevertheless interesting without identifying the individual banks or their customers.

3.2 Description of Data

The data sets provide key information about the banks' client accounts such as account balances and interest amounts that have been credited or debited the accounts. The data comprise the entire population of organizations in the Norwegian financial sector as well as all registered organizations that have one or more accounts in a Norwegian registered financial institution. On the credit supply side[17] the data include all registered banks in Norway, including foreign banks that are registered in Norway as well as mutual organizations such as cooperatives (handelslag), pension funds, public financial institutions (such as Innovation Norway), insurance companies, municipalities, and law firms. On the

[16] Note that all accounts have been audited as regulated by Norwegian law (Regnskapsloven).

[17] Organizations that provide lending, i.e. banks.

credit demand side [18], all companies such as privately held organizations, non-profit organizations, financial institutions and even banks that have registered accounts in other banks, are included in the data sets. Overall, the data set represents the entire population for our research, with a few exceptions, which we will outline in the Limitations section in this chapter.

The data are reported with a unique organization number (organisasjonsnummer)[19] belonging to and identifying the entities that own the accounts. By using the organization number, the data can be coupled with other data sets, which widely broadens the scope of the research. For instance, we have combined the data sets with company information data obtained from SNF, which lets us create additional variables that allow geographical categorization of the accounts, and accounting data for the business entities provided by Dun and Bradstreet[20]. The table below is a summarization of the data sets.

Table 3.1 Summarization of Data Sets*

Year	Number of observations (accounts) before	Number of observations (accounts) after	Total loans before (Billion NOK)	Total loans after (Billion NOK)
1997	726,793	354,993	491	202
1998	767,113	382,952	558	246
1999	839,345	394,975	611	244
2000	841,961	478,751	727	358
2001	919,761	502,913	789	387
2002	805,888	518,414	821	388
2003	812,203	559,995	860	452
2004	807,723	537,741	1,144	435
2005	858,945	559,741	1,094	514
2006	944,988	596,886	1,292	592
2007	1,009,289	653,773	1,549	741
2008	1,074,176	691,576	1,891	905

* In the table, "before" and "after" denote data before and after we performed cleansing and sampling of the data. See section 3.5 for details about cleaning and sampling.

We will present the data in summarized and graphical formats that are relevant to our study in the National Overview section.

18 The credit demand side refers to organizations that borrow funds.

19 "Organisasjonsnummer" is a 9-digit business enterprise organization number that is provided by the Register of Business Enterprises. (All business entities that operate in Norway are required to be registered at the Register of Business Enterprises, including foreign owned entities.) For further details we refer to the website of the Register of Business Enterprises http://www.brreg.no/english/registers/business/.

20 Dun and Bradstreet provide databases with information about organizations, gathered from various sources such as "Enhetsregisteret – Central Coordinating Register for Legal Entities", the Norwegian Tax Administration and so forth. For a complete description please refer to the company's website at http://www.db24.no.

3.3 Limitations in the Data sets

Perhaps the biggest limitation in the data sets is that they do not contain any contractual information between the banks and their customers, such as loan rates (fixed or variable), loan repayment terms, collateral requirements and the types of loans in general. Nor do the data sets contain information about the banks' credit risk assessments of their customers. Moreover, the data sets only provide information on annual opening and closing balances. This can lead to inconsistent interest rate calculations on loans and deposits. For instance, if a loan is issued at the beginning of December 2007, the opening balance in 2008 will show a relatively low interest paid for that particular loan because the interest paid for the loan has only accrued for one month. If the loan amount is very large, it will create an extreme outlier (see section 4.5.2 for details on how we reduce this problem). Another possible limitation in the data sets is that they lack data on organizations on the credit demand side. Since the data sets include only Norwegian registered lenders, Norwegian registered borrowers that only have loans or deposits in foreign financial institutions that are not registered in Norway are excluded from the data sets. However, the number of firms that have these types of loans is limited. Most firms that fall into this category are large corporations that operate in foreign markets. Although we recognize this limitation in the data set, we do not perceive this as a potential problem, since we are concerned only with the behavior of domestic interest rate spreads in this study.

3.4 Challenges with the Data

One of the first challenges we encountered was how we should define the individual competing banks in order to gather an accurate count on the number of banks in the markets. The data sets record all banks that are separate legal entities, each with its own name and organization number, even though the entity may be a local branch of a bank. Failure to recognize the branches as subdivisions of a mother bank would have repercussions for the calculations of not only the number of banks in a market, but also the banks' market shares, market concentration indices as well as other variables. Thus, it is reasonable to assume that a branch does not compete with other branches that belong to the same bank. All of the branches and the mother entity should then be counted as one competing entity if the branches appear within the same region. Note however, that if the bank has branches in different regions, these branches will count as separate entities.

To continue this discussion, most banks in Norway belong to one of three major savings bank groups or are branches of major commercial banks, such as Nordea[21]. However, as opposed to branches, it is reasonable to assume that banks that belong to the same savings bank group will compete with each other if they are located in the same region. This may be observed in practice. For instance, in Trondheim, the banks Surnadal Sparebank, Selbu Sparebank and Klæbu Sparebank among others all belong to the Terra Gruppen group of banks, but nevertheless compete against each other in the local market and should be counted as separate competing entities. Adding complexity to this challenge is that mergers and acquisitions that were undertaken within the period 1997 - 2008 would imply that a merged/acquired bank should be recognized as a branch of the acquiring bank. In his work with other studies, Dr. Aksel Mjøs has undertaken a tedious grouping of banks that operate in Norway, using data from Dun and Bradstreet and other sources to find the organization structure of the banks. We have been granted permission from Dr. Aksel Mjøs to use these groupings in our study. It is important to note that all reporting and all analyses in this study are based on the bank groups being labeled as a single competing entity, even though the group may consist of several banks. We normally denote the individual bank group in the singular form, as in 'bank'.

3.5 Data Sample and Cleansing

We took careful measures to keep all instances in the data sets before we sampled the data into a panel for our analysis. However, we had to perform a revision of the data sets and exclude several instances in order to narrow down the data sets to the instances that were relevant to our analysis. Since the main focus of our study is the interest rate spreads and their determinants in the banking sector, we excluded all instances where a lending institution is not defined as a bank. More specifically, all loan providers that did not fall into the categories savings bank or commercial bank were omitted. The reason for this is that a loan provider that does not fall into one of these categories, such as a public institution like Innovation Norway, does not operate and compete on the same commercial conditions as a regular bank. A reasonable assumption may be that these public lenders may charge interest rates that may not be sustainable and profitable for the institution, since part of their mission is either non-profit

[21] There are three savings bank groups in Norway. Terra-Gruppen has 78 member banks. Sparebank1 Alliansen has 20 member banks. The third group, DnB NOR, has nine savings banks that have partnering agreements. DnB NOR is Norway' largest bank. There are only nine additional savings banks in Norway that are independent as of June 6 2009. See http://www.sparebankforeningen.no/id/1493.

operations, or to provide favorable lending to high-risk newly founded companies with promising concepts.

Nor did we want to include the interbank market in our analysis. As stated above, the original data sets include accounts that are owned by banks, for instance when bank Y has deposits in bank X. Banks frequently borrow from each other, and we observed large amounts that were related to these transactions in the data sets. Hence, these accounts were omitted from the sample. On the demand side, we limited the sample to include only organizations that have limited liability and partnerships as organization form. All other types of organizations were excluded from the data set. As such, entities such as municipalities and government owned organizations were excluded. One reason for excluding these entities is that they may borrow money for non-commercial purposes, and can sometimes be granted funds on different terms and conditions than corporations and partnerships. Thus, if we had included government owned organizations in our study, it could have resulted in an unintended and undesirable effect on the calculated interest rates which are pertinent to our study.

Lastly, in preparation for selecting the appropriate sample for our analysis, we performed a cleansing procedure of the data sets. We deleted undesired instances (accounts) such as obvious duplicated instances erroneously recorded by the Norwegian Tax Administration, instances with no loan or deposit data[22], and instances with erroneously reported bank organization numbers. Additionally, after calculating the interest rate margins for both loans and deposits, we found that some banks in certain regions had margins above 100 percent. The likely causes of this error were either erroneous reporting of interest rates charged on loans or deposits, or incorrect reporting of deposit and loan amounts. This error affected only a few instances, and the banks in those regions were excluded. We found it important to exclude these instances since they would have had an impact on the other key figures such as the number of active banks in a region, which in turn would have lead to incorrect measures of market concentration, market shares, and so forth.

22 We have only included banks that have customer accounts with outstanding loans or deposits at the closing balance. This is important in order to count the correct number of active banks in the market. Correct counting of the number of banks and their registered accounts has important implications for the calculation of regional HHI and market shares of banks, as well as other key figures in the study.

3.6 Key Figures

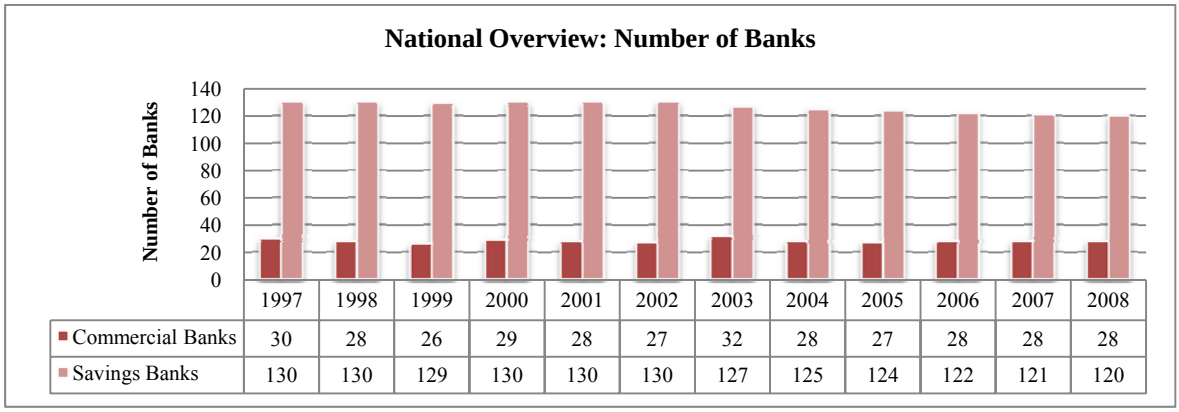
As a preliminary exercise to the analysis, we calculated key figures and produced charts in order to gain an overview of the data sets and understand the market structure. This section provides an overview of these figures and charts.

3.6.1 National Overview

Number of Banks

Figure 3.1 shows a graphic display of active banks in the Norwegian market in the time period 1997 – 2008. Note that we have categorized the banks into commercial banks and savings banks. Although we made such a distinction between the banks in the overview, it is assumed that commercial banks and savings banks that are active in the loan and deposit markets of commercial customers compete on the same terms, and we do not further differentiate these banks in our analysis.

Figure 3.1 Number of Banks



	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Commercial Banks	30	28	26	29	28	27	32	28	27	28	28	28
Savings Banks	130	130	129	130	130	130	127	125	124	122	121	120

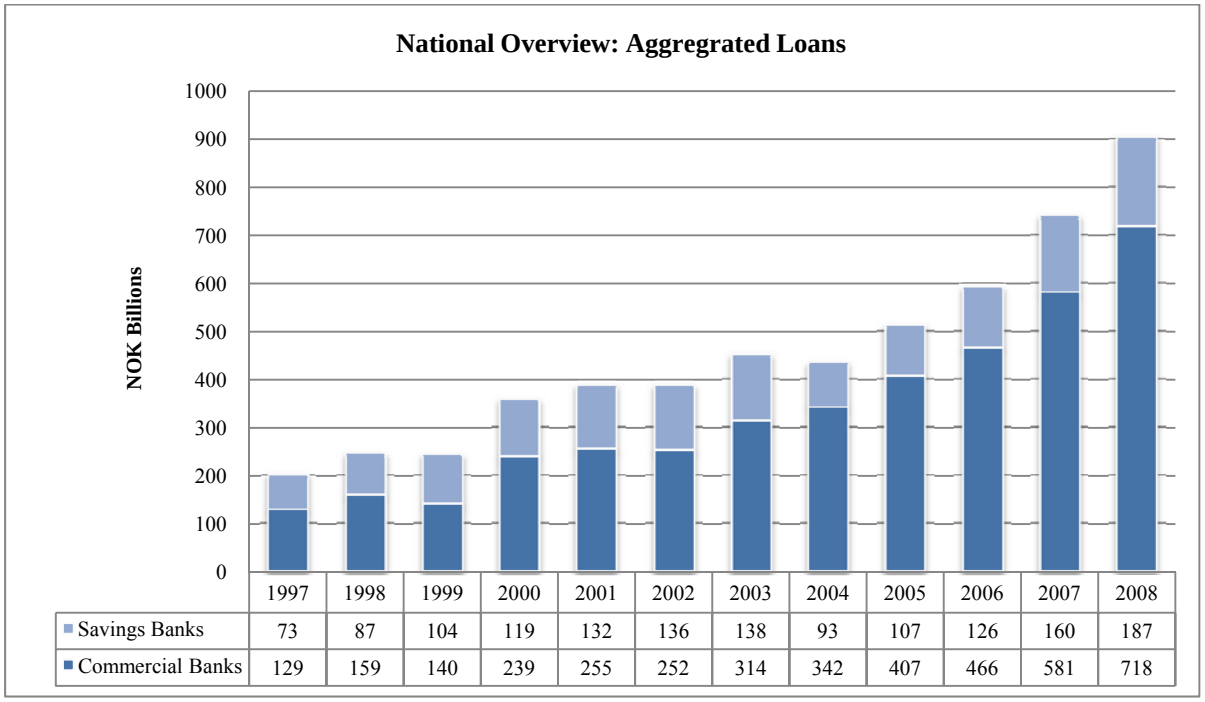
Here we can observe that the number of banks has decreased slightly from the peak in 1997 with 160 banks to 148 banks in 2008, most notably there is a fall in the number of savings banks. This is attributed to the increased number of mergers and acquisitions in the Norwegian banking sector as well as a few banks exiting the market[23].

[23] For further details about mergers and acquisitions, see Finance Norway – FNO. Available from (online): http://www.fnh.no.

Loans

In order to assess the size of the entire Norwegian market, we calculated the aggregated loans. For each year in the time period, we aggregated the loan accounts of all customers as recorded from all banks. Note that the amounts are end of the year closing balances.

Figure 3.2 Aggregated Loans



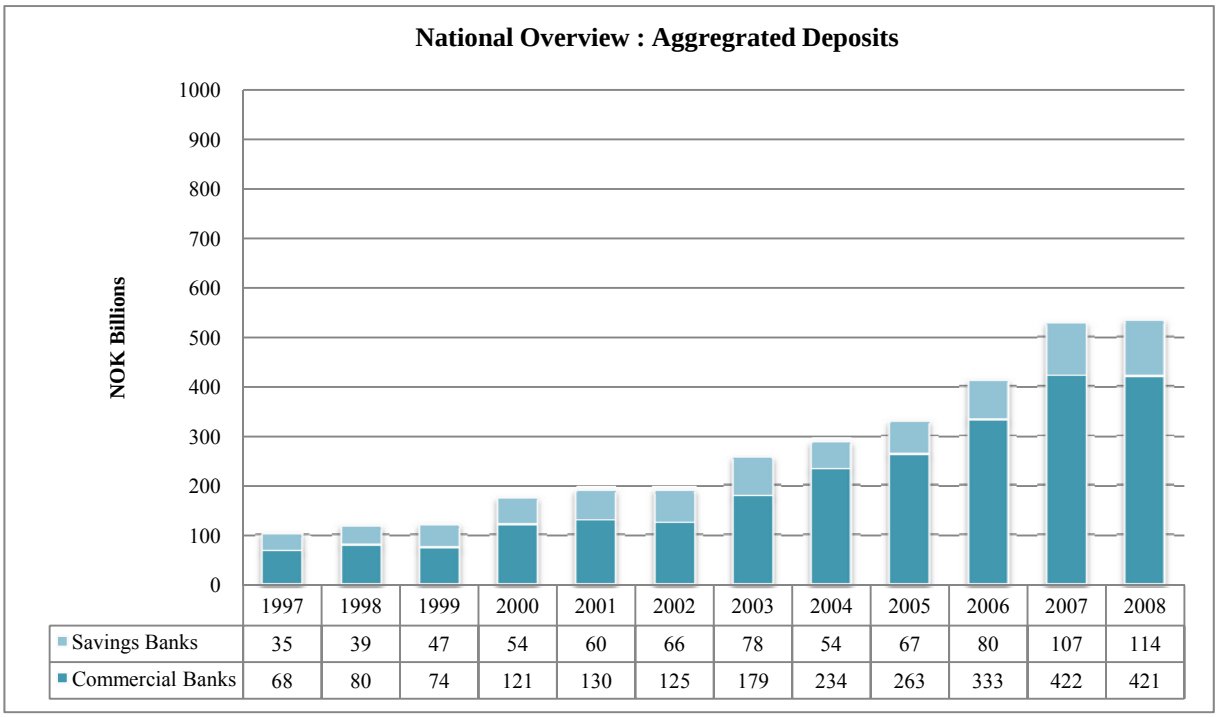
	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Savings Banks	73	87	104	119	132	136	138	93	107	126	160	187
Commercial Banks	129	159	140	239	255	252	314	342	407	466	581	718

While the number of banks has decreased slightly over the time period, we observe a significant increase in the market size in terms of total loans, from about NOK 200 billion in 1997 to about NOK 900 billion in 2008. The commercial banks have increased their loan amounts compared to the savings banks, which may indicate that commercial banks have become an increasingly more important funding source for companies.

Deposits

Similarly to the rise in the number of loans during the time period, the total loan amount has also increased dramatically. Roughly, the market grew more than 500 percent from 1997 to 2008, indicating that the banks have grown in size, rather than in numbers. This observation entices to further analysis to see if the bank market has become more concentrated, or if this increase can be attributed to other underlying causes. We calculated the HHI, and observe that the market indeed became more concentrated. As with the aggregated loans data, the commercial banks have also grown at a noticeably faster rate than the savings banks.

Figure 3.3 Aggregated Deposits

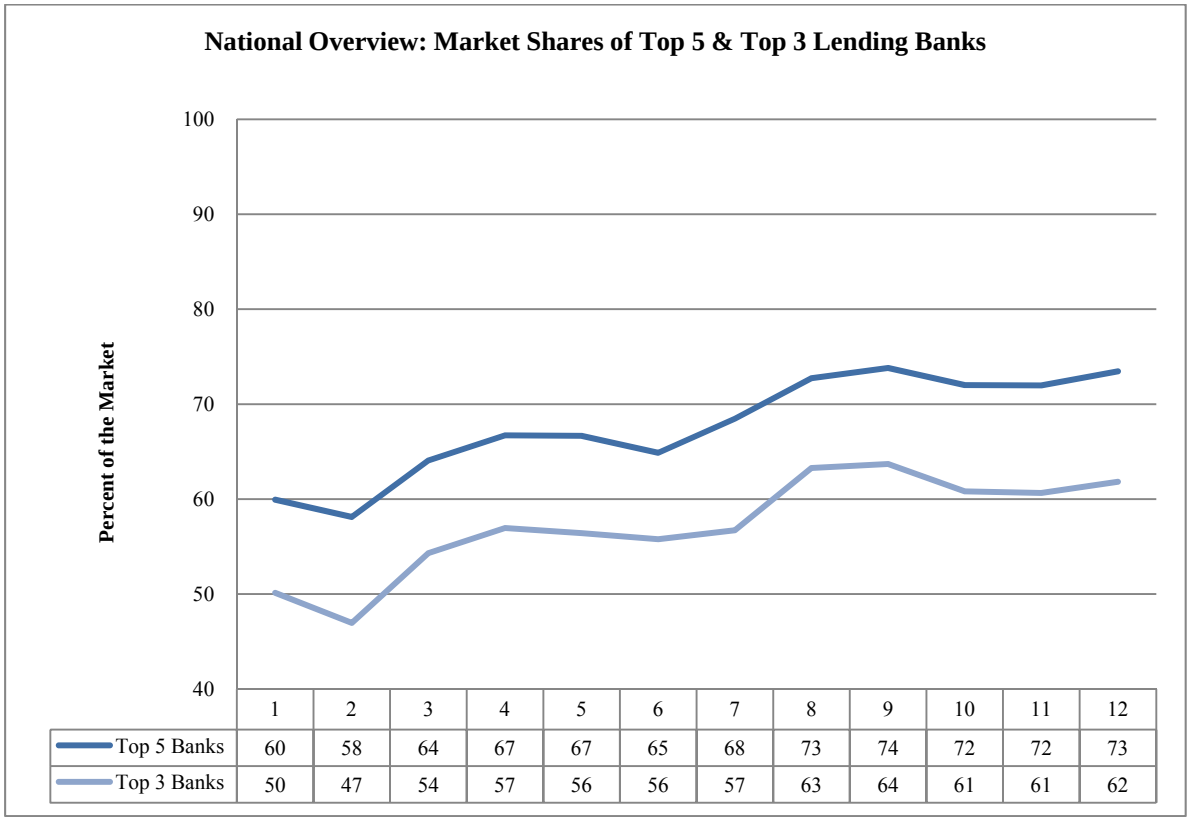


	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Savings Banks	35	39	47	54	60	66	78	54	67	80	107	114
Commercial Banks	68	80	74	121	130	125	179	234	263	333	422	421

Market Shares by Loans

To further understand the market structure, we calculated the market share of the top five and top three banks in terms of markets shares. The top lending banks increased their market share from 1997 to 2008, and it is likely that this increase came at the expense of smaller banks' market shares and/or was due to the simple fact that the number of banks had decreased. We have already assessed that the number of banks did decrease slightly, however it is difficult to tell without further analysis whether the decrease in the number of banks or the changes in the market shares of the top banks versus the rest of the banks, had the greatest impact.

Figure 3.4 National Market Shares by Loans

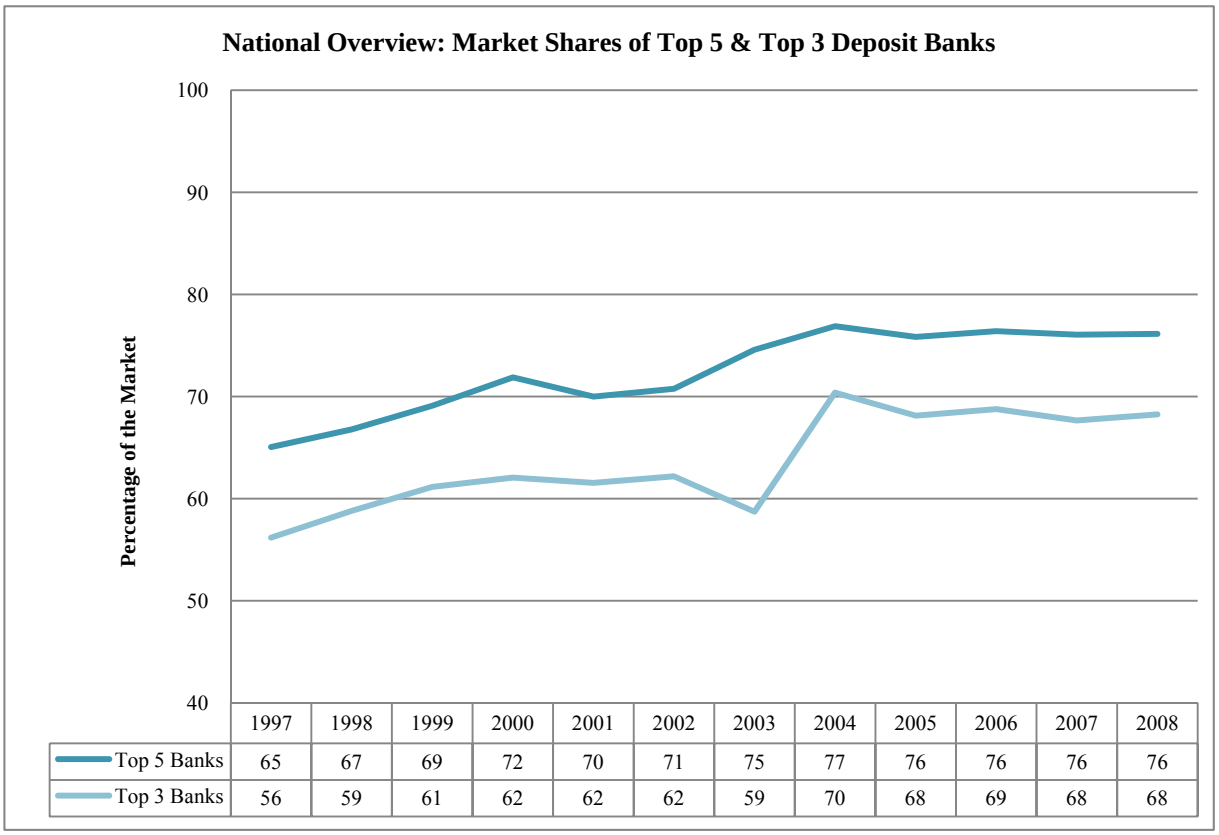


	1	2	3	4	5	6	7	8	9	10	11	12
Top 5 Banks	60	58	64	67	67	65	68	73	74	72	72	73
Top 3 Banks	50	47	54	57	56	56	57	63	64	61	61	62

Market Shares by Deposits

Figure 3.5 shows that the top five and top three banks that had recorded deposits, had also gained market shares through the period.

Figure 3.5 National Market Shares by Deposits

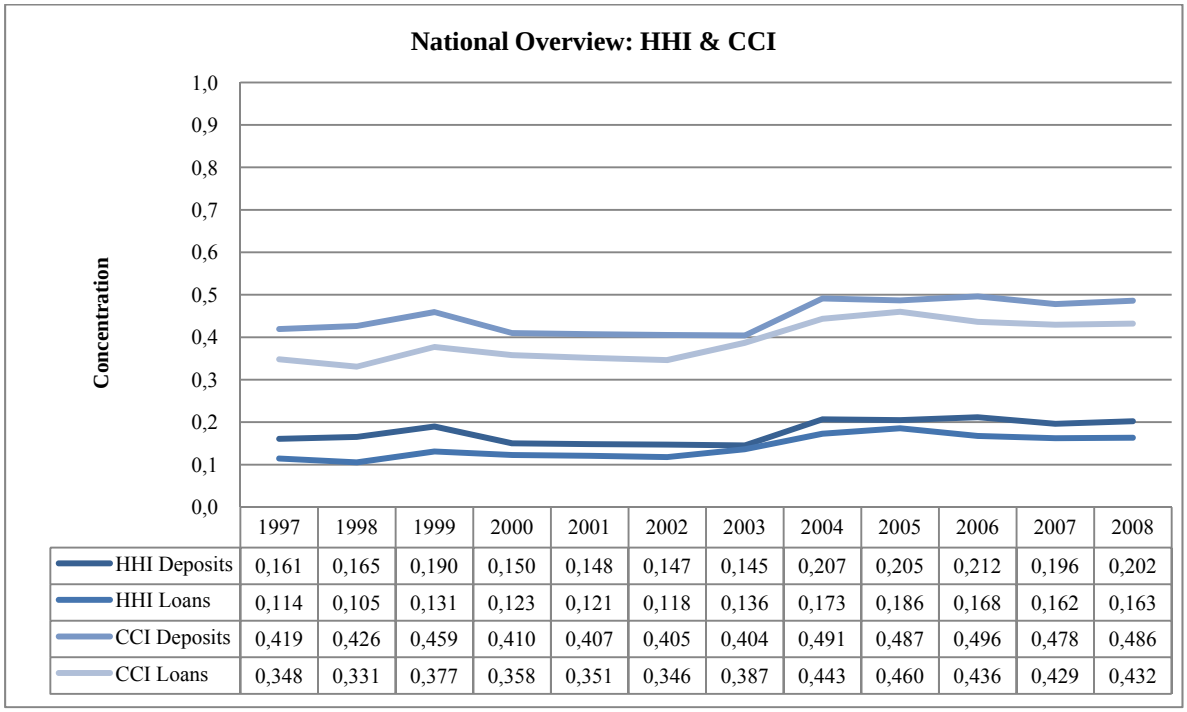


	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Top 5 Banks	65	67	69	72	70	71	75	77	76	76	76	76
Top 3 Banks	56	59	61	62	62	62	59	70	68	69	68	68

Concentration Indices

We calculated the HHI for the regions (commuter belts) that had active lending banks, as well as the HHI on the national level. We also calculated the CCI for each region to see if it would reveal other types of changes in the market structure than the HHI shows us. Generally, the loan market became more concentrated during the period. This may be attributed to consolidation between banks.

Figure 3.6 Market Concentration



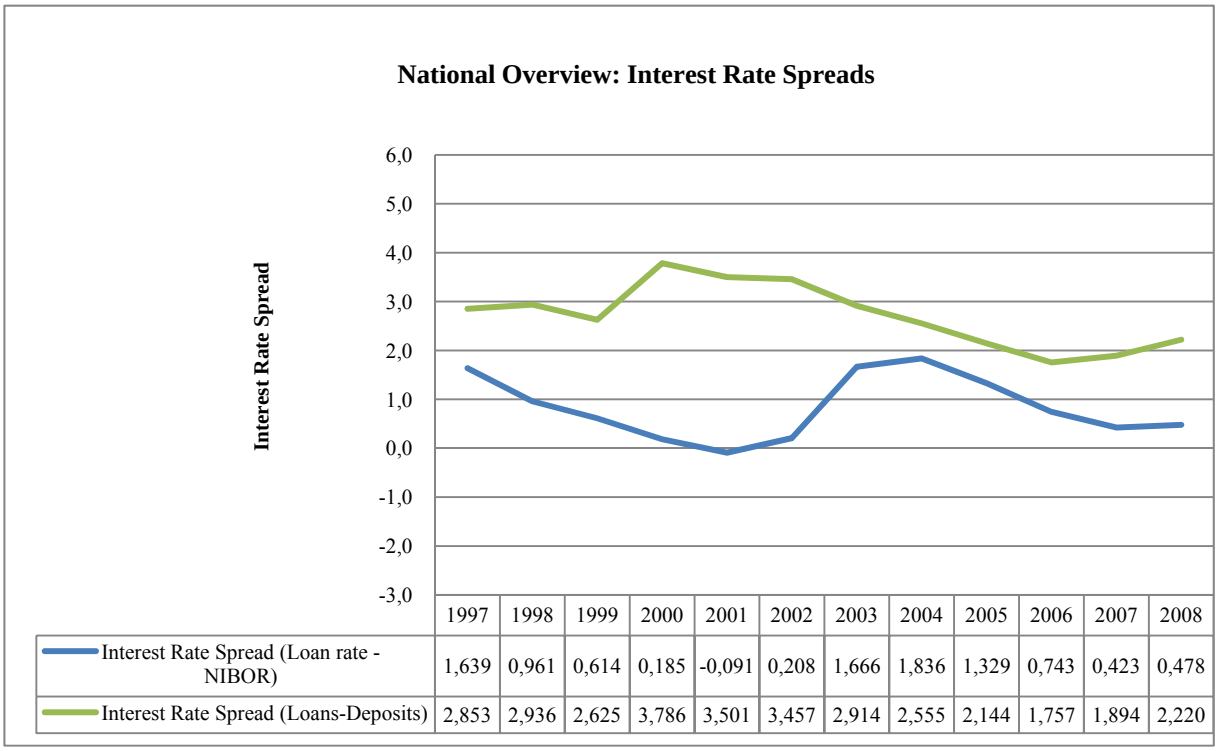
	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
HHI Deposits	0,161	0,165	0,190	0,150	0,148	0,147	0,145	0,207	0,205	0,212	0,196	0,202
HHI Loans	0,114	0,105	0,131	0,123	0,121	0,118	0,136	0,173	0,186	0,168	0,162	0,163
CCI Deposits	0,419	0,426	0,459	0,410	0,407	0,405	0,404	0,491	0,487	0,496	0,478	0,486
CCI Loans	0,348	0,331	0,377	0,358	0,351	0,346	0,387	0,443	0,460	0,436	0,429	0,432

The figure above shows that the Norwegian bank market as a whole became more concentrated during the time period, especially for banks that provide deposits. In 2008, the HHI for deposits was 0.202, which implies that the market was concentrated. The HHI for loans has also notably increased, from 0.114 in 1997 to 0.163 in 2008. It is interesting to observe the jump in HHI from 2003 to 2004. Part of this increase may be the result of the merger between Gjensidige NOR and DNB in 2004, which is the largest merger recorded in the Norwegian banking sector. The CCI has a similar trend as the HHI for the period.

Interest Rate Spreads

We calculated two types of interest rate spreads. First, we calculated the spread between the interest rate charged on loans and the 3-month average Norwegian Interbank Offered Rate (NIBOR)[24] for the given year (loan rate – NIBOR). The second spread we calculated was the difference between the interest rates charged on loans and the interest rate given on deposits (loan rate – deposit rate). For further details on the calculations please refer to the Methods chapter, section 4.5.2. The graphs below show the development of the two interest rate spreads over the given time period. Naturally, we were most interested in observing the trend of the interest rate margin on loans adjusted for NIBOR and comparing this with the corresponding HHI trend. A quick comparison of the HHI graph in Figure 3.6 and the interest Rate Spread (loan rate – NIBOR) graph in Figure 3.7 indicates that these two variables seem to correspond somewhat. This strengthened our belief that further analysis would yield telling results. The spread between loan and deposit rates did not seem to correspond with the HHI trend prior to the year 2002, but it seems to follow a similar pattern in the years after that.

Figure 3.7 Interest Rate Spread



	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Interest Rate Spread (Loan rate - NIBOR)	1,639	0,961	0,614	0,185	-0,091	0,208	1,666	1,836	1,329	0,743	0,423	0,478
Interest Rate Spread (Loans-Deposits)	2,853	2,936	2,625	3,786	3,501	3,457	2,914	2,555	2,144	1,757	1,894	2,220

[24] The relevant NIBOR rates can be found at Norges Bank's home page. Available from (online): http://www.norges-bank.no/templates/article____57364.aspx (Accessed 5 May, 2010).

3.6.2 Regional Overview

So far, we have presented the data on the national level. As stated, the focus of our analysis is on the differences between regions. In this section we present the data on the regional level. However, since there are 161 commuter belts in Norway, it is difficult to visually present information that encompasses all the regions. We have therefore compiled tables and figures with a subset of the regions that may play an important role in our study.

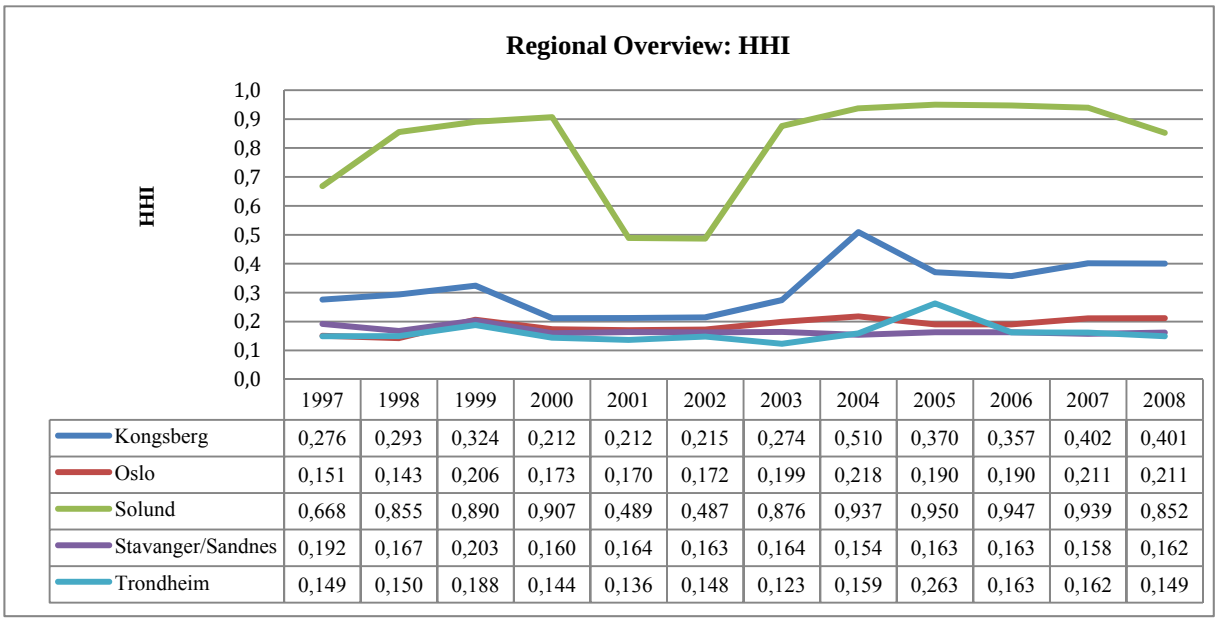
Choosing Representative Regions

For simplicity reasons, we will present data for two regions with low HHI ratios, Trondheim and Stavanger/Sandnes, and two regions with high HHI ratios, Solund and Kongsberg. We also include a fifth region, Oslo, which represents a moderately concentrated market. Please refer to Appendix C for charts that rank the regions by HHI. In order to determine which regions gave reasonable representations of the regional data, we chose the regions presented in this section on the basis of a detailed regional chart on HHI and a cross comparison of the regions' loan size. First, Trondheim is a large region and is among the least concentrated regions in Norway with HHI ratios of 0.1491 and 0.1489 in 1998 and 2008 respectively. The region is ranked as the fourth largest region in terms of issued loans in 2008 with NOK 39.3 billion. Second, Stavanger/Sandnes is Norway's second largest region in terms of issued loans with NOK 74.5 billion in 2008. Stavanger/Sandnes had a HHI of 0.1619 in the same year. The low HHI ratio for this region makes it a suitable representative for the low concentration regions. Third, Solund had a HHI of 0.8524 in 2008. There are regions that have higher HHI-ratios; however, an important argument for choosing Solund as a representative for high-concentration regions is that this region had issued the largest loans (NOK 310 million in 2008) among those regions with high HHI-ratios. Fourth, Kongsberg has HHI-ratios ranging from 0.2762 to 0.4006 from the year 1997 to 2008. This, combined with loans of NOK 7.9 billion in 2008, makes this region a good representative for regions with fairly high concentrations. Fifth, Oslo is the largest region, with loans of NOK 361 billion in 2008. Interestingly, Oslo was a low concentration region in 1998 with a HHI-ratio of 0.1509, but would be ranked as a highly concentrated market in 2008 with a HHI-ratio of 0.2115. Thus, the extensive change in the HHI-ratio for the Oslo region suggests that the market structure may have changed significantly during the observed time period.

HHI Loans

We calculated the HHI-ratios for each region that had banks with recorded loans. Overall, Figure 3.8 shows that the regions became more concentrated in the period, with Kongsberg peaking in the year of 2004 and Trondheim showing the same behavior with a lag of one year, most probably due to the DnB NOR merger. Stavanger/Sandnes contradicted with the trend, and became less concentrated, going from a HHI-ratio of 0.1916 in 1997 to 0.1625 in 2008. An interesting observation is that loans grew at a rapid pace in the Stavanger/Sandnes region through the same time period, which would imply that the loans were somewhat evenly spread among the banks that operated in that region. Observe that in 2000 and 2001, the HHI for Solund dropped from 0.907 to 0.489, and then rose back to a HHI of 0.876 in 2003. Upon further investigation, we found that a company recorded a loan of NOK 50 million in the years 2001 and 2002, which led to an increase of total loans in the region of more than 100 percent. A bank that in previous years had a market share of less than one percent in the Solund region issued the loan. Subsequently, this bank's market share rose to over 50 percent, causing the HHI to drop substantially. As a side note, according to the Brønnøysund Register, the company in question went out of business in the year of 2006.

Figure 3.8 Market Concentration

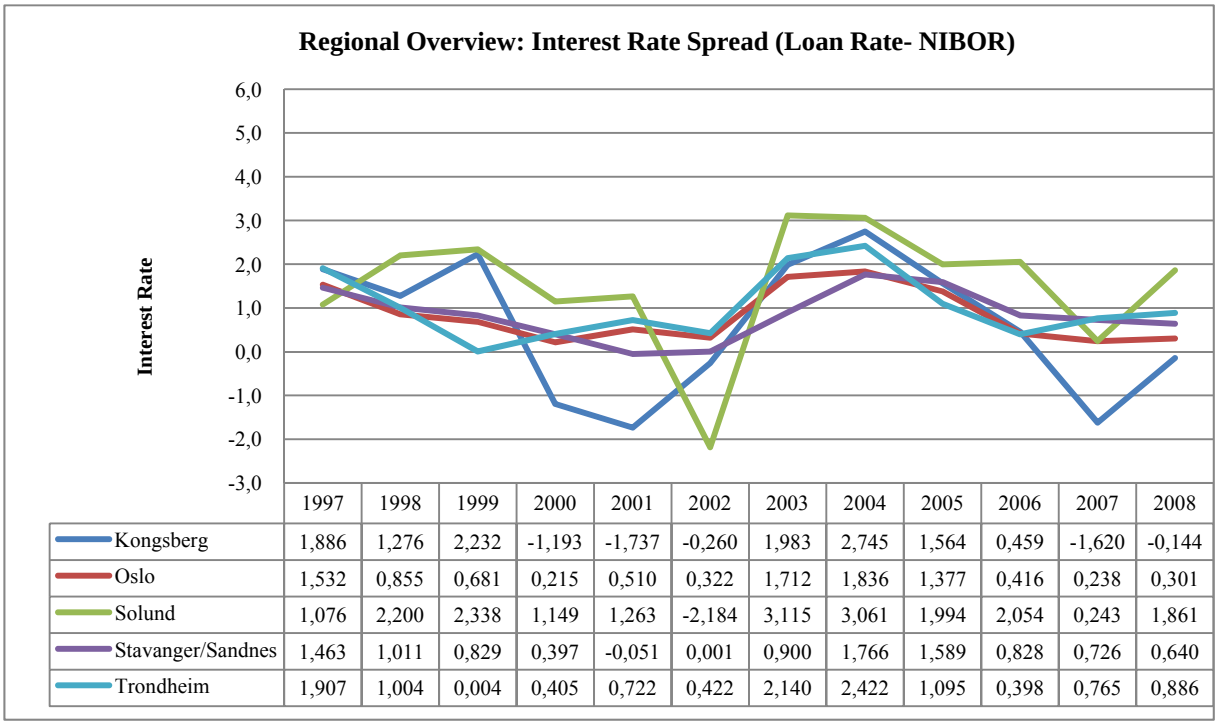


	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Kongsberg	0,276	0,293	0,324	0,212	0,212	0,215	0,274	0,510	0,370	0,357	0,402	0,401
Oslo	0,151	0,143	0,206	0,173	0,170	0,172	0,199	0,218	0,190	0,190	0,211	0,211
Solund	0,668	0,855	0,890	0,907	0,489	0,487	0,876	0,937	0,950	0,947	0,939	0,852
Stavanger/Sandnes	0,192	0,167	0,203	0,160	0,164	0,163	0,164	0,154	0,163	0,163	0,158	0,162
Trondheim	0,149	0,150	0,188	0,144	0,136	0,148	0,123	0,159	0,263	0,163	0,162	0,149

Interest Rate Spread (Loan Rate – NIBOR and Deposit Rate – NIBOR)

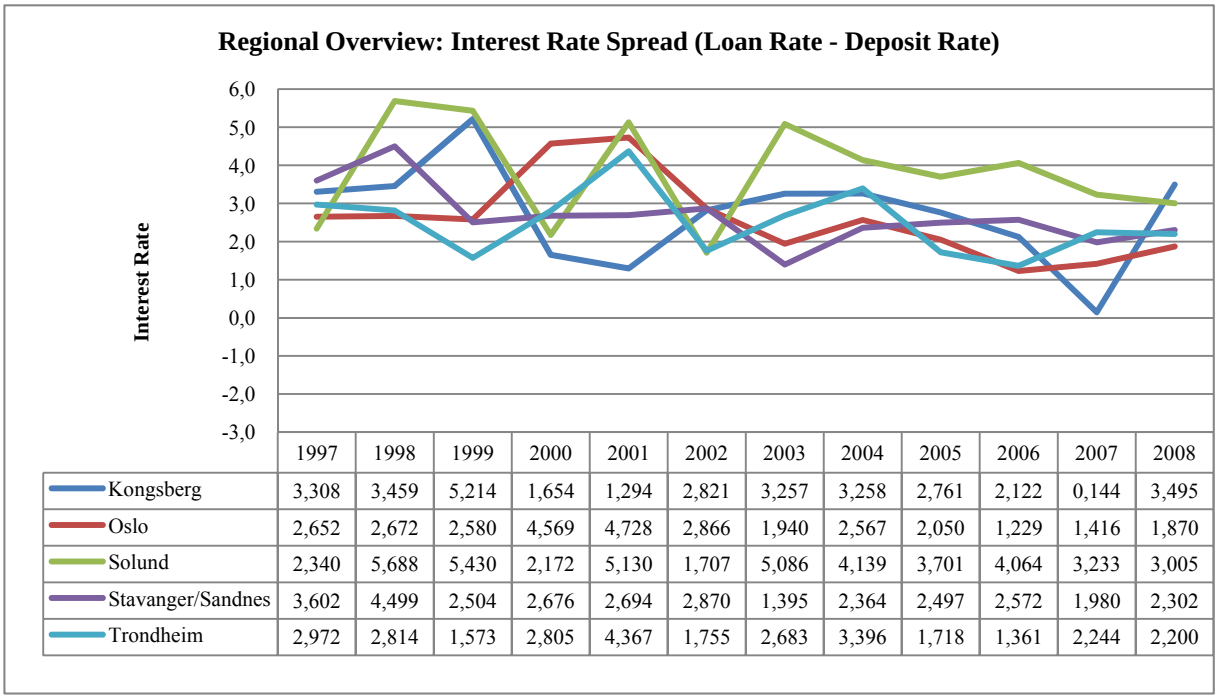
An overview of the regional interest rate spreads indicates that the regional spreads follow a similar trend as the spread on the national level. However, two interesting observations from Figures 3.9 and 3.10 are worth commenting. Recall that Kongsberg and Solund were labeled as high concentration markets. We can see that for both regions, the volatility of the interest rate spreads was higher than for the other regions in the overview. A possible explanation may be that the market-leading banks were able to affect the interest rate to a larger degree than in less concentrated markets. Another explanation may be that the number of banks in the regions was small, and that the change in the interest rate of each bank had a high impact on the interest rate spread. The less concentrated regions experienced smoother interest rate spreads throughout the periods. This observation may pay merit to our hypothesis that there are indeed differences in markets with high and low HHI levels. Because deposits are much smaller than loans, Figure 3.10 shows somewhat more erratic movements.

Figure 3.9 Interest Rate Spread (Loan Rate – NIBOR)



	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Kongsberg	1,886	1,276	2,232	-1,193	-1,737	-0,260	1,983	2,745	1,564	0,459	-1,620	-0,144
Oslo	1,532	0,855	0,681	0,215	0,510	0,322	1,712	1,836	1,377	0,416	0,238	0,301
Solund	1,076	2,200	2,338	1,149	1,263	-2,184	3,115	3,061	1,994	2,054	0,243	1,861
Stavanger/Sandnes	1,463	1,011	0,829	0,397	-0,051	0,001	0,900	1,766	1,589	0,828	0,726	0,640
Trondheim	1,907	1,004	0,004	0,405	0,722	0,422	2,140	2,422	1,095	0,398	0,765	0,886

Figure 3.10 Interest Rate Spread (Loan Rate – Deposit Rate)

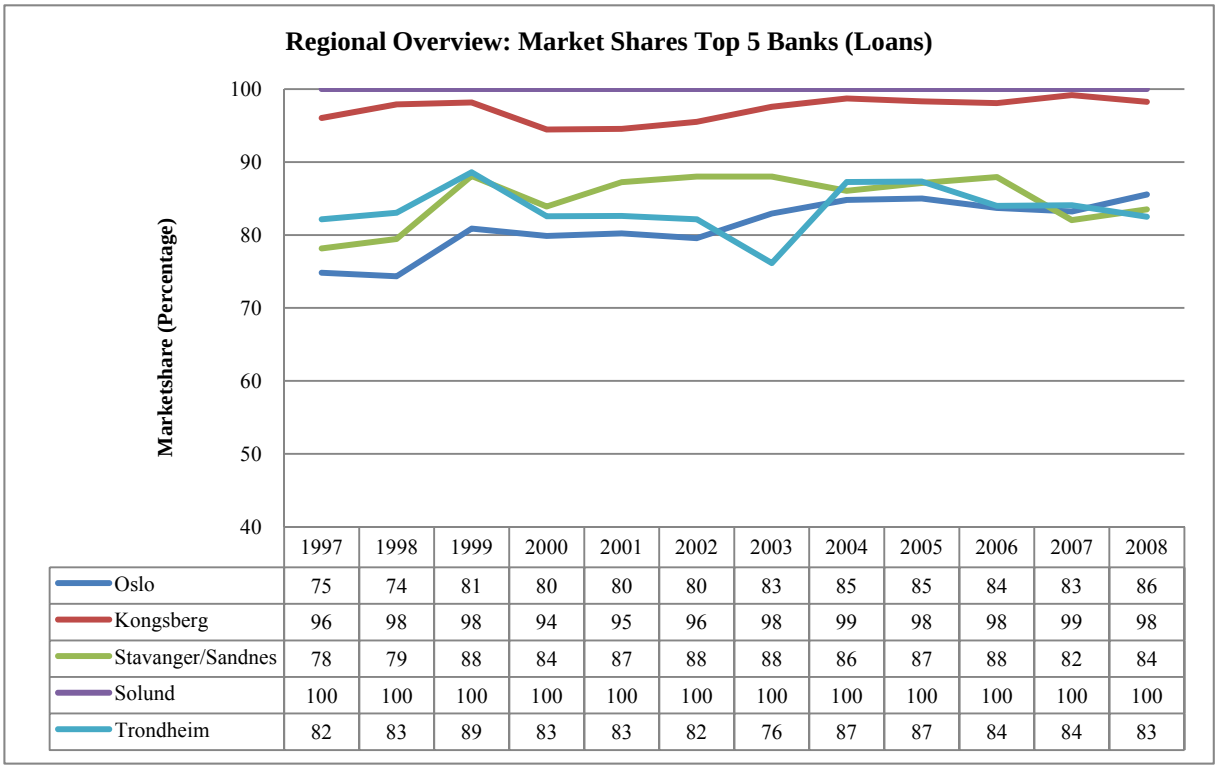


	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Kongsberg	3,308	3,459	5,214	1,654	1,294	2,821	3,257	3,258	2,761	2,122	0,144	3,495
Oslo	2,652	2,672	2,580	4,569	4,728	2,866	1,940	2,567	2,050	1,229	1,416	1,870
Solund	2,340	5,688	5,430	2,172	5,130	1,707	5,086	4,139	3,701	4,064	3,233	3,005
Stavanger/Sandnes	3,602	4,499	2,504	2,676	2,694	2,870	1,395	2,364	2,497	2,572	1,980	2,302
Trondheim	2,972	2,814	1,573	2,805	4,367	1,755	2,683	3,396	1,718	1,361	2,244	2,200

Market Shares of Top Five Banks

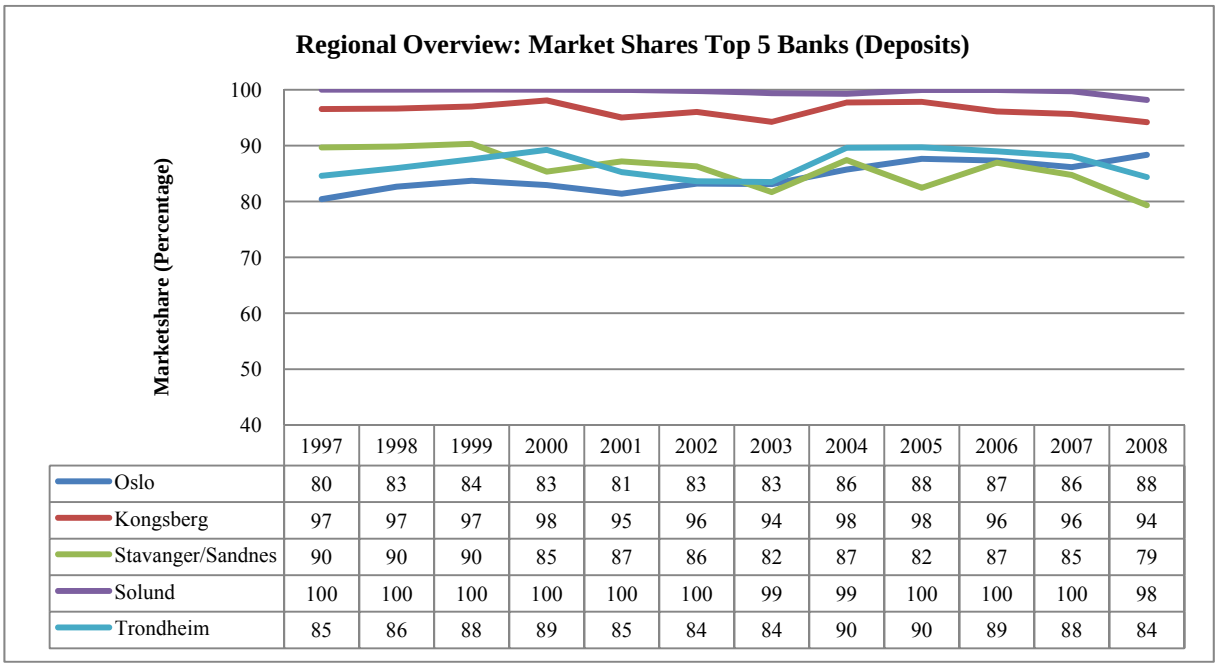
To display a graphical illustration of the market shares of all the individual banks in each of the regions in an efficient way would be nearly impossible. Instead, we have calculated the market share of the top five banks in terms of market shares in each region both for loans (Figure 3.11) and deposits (Figure 3.12), and then aggregated the market shares. Combined with the charts displaying the number of banks in the particular regions, this will give some indications of the market structure in these regions. Not surprisingly, in the smaller regions Solund and Kongsberg the top five banks share nearly 100 percent of the entire market between them, mainly due to the small number of active banks in those regions. In the larger regions, the top five banks make up roughly 75 - 85 percent of the market, and the top banks' combined market shares have increased throughout the time period.

Figure 3.11 Market Shares by Loans



	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Oslo	75	74	81	80	80	80	83	85	85	84	83	86
Kongsberg	96	98	98	94	95	96	98	99	98	98	99	98
Stavanger/Sandnes	78	79	88	84	87	88	88	86	87	88	82	84
Solund	100	100	100	100	100	100	100	100	100	100	100	100
Trondheim	82	83	89	83	83	82	76	87	87	84	84	83

Figure 3.12 Market Shares by Deposits

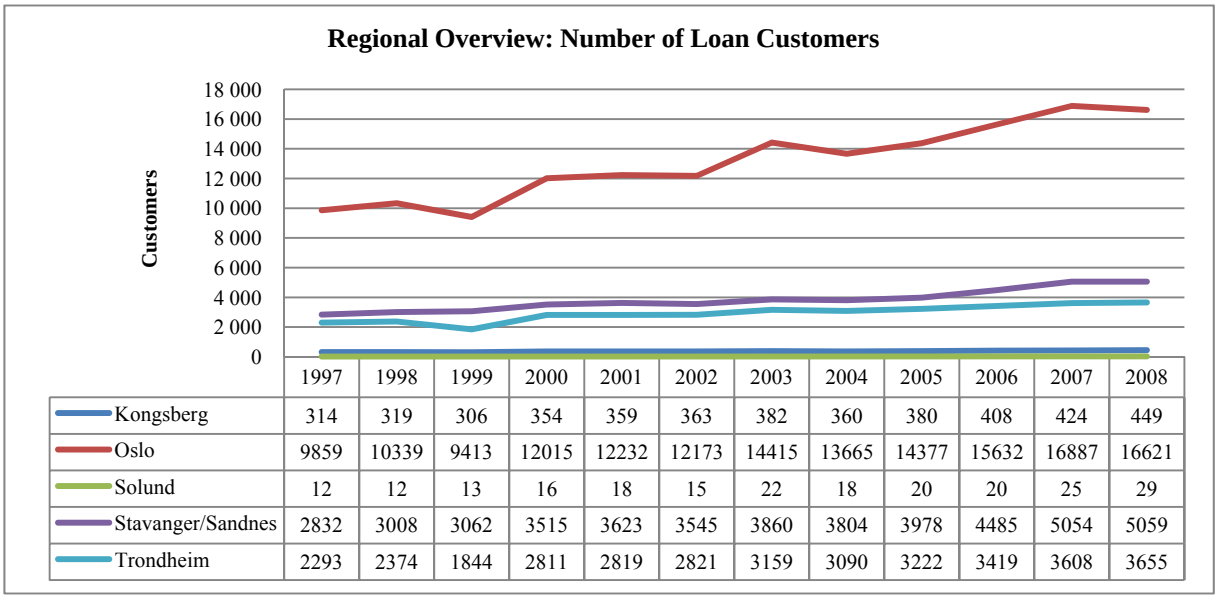


	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Oslo	80	83	84	83	81	83	83	86	88	87	86	88
Kongsberg	97	97	97	98	95	96	94	98	98	96	96	94
Stavanger/Sandnes	90	90	90	85	87	86	82	87	82	87	85	79
Solund	100	100	100	100	100	100	99	99	100	100	100	98
Trondheim	85	86	88	89	85	84	84	90	90	89	88	84

Number of Customers

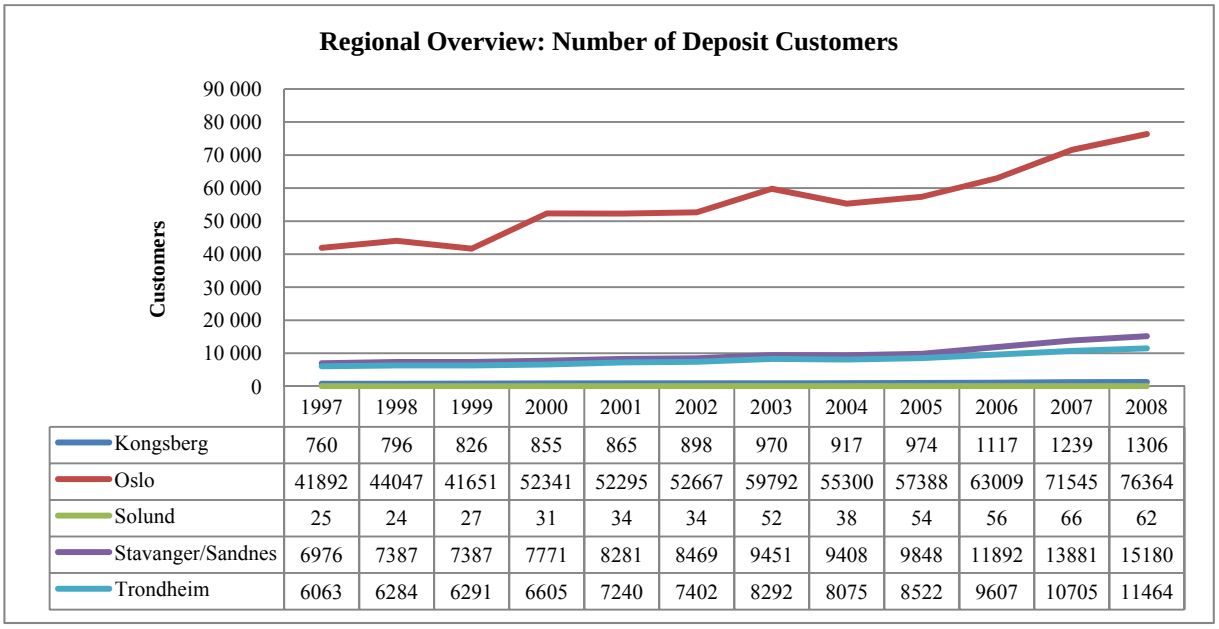
The count of customers was done by counting the organization number of the customers for each bank in all the regions. By doing this, we could record the fact that a customer may have multiple customer relationships with different banks, and across regions as well. Further, in order to count as an active customer, the associated account(s) of the customer must either have a registered loan or deposit. The charts below show an increase in both loan and deposit customers in the period.

Figure 3.13 Number of Loan Customers



	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Kongsberg	314	319	306	354	359	363	382	360	380	408	424	449
Oslo	9859	10339	9413	12015	12232	12173	14415	13665	14377	15632	16887	16621
Solund	12	12	13	16	18	15	22	18	20	20	25	29
Stavanger/Sandnes	2832	3008	3062	3515	3623	3545	3860	3804	3978	4485	5054	5059
Trondheim	2293	2374	1844	2811	2819	2821	3159	3090	3222	3419	3608	3655

Figure 3.14 Number of Deposit Customers

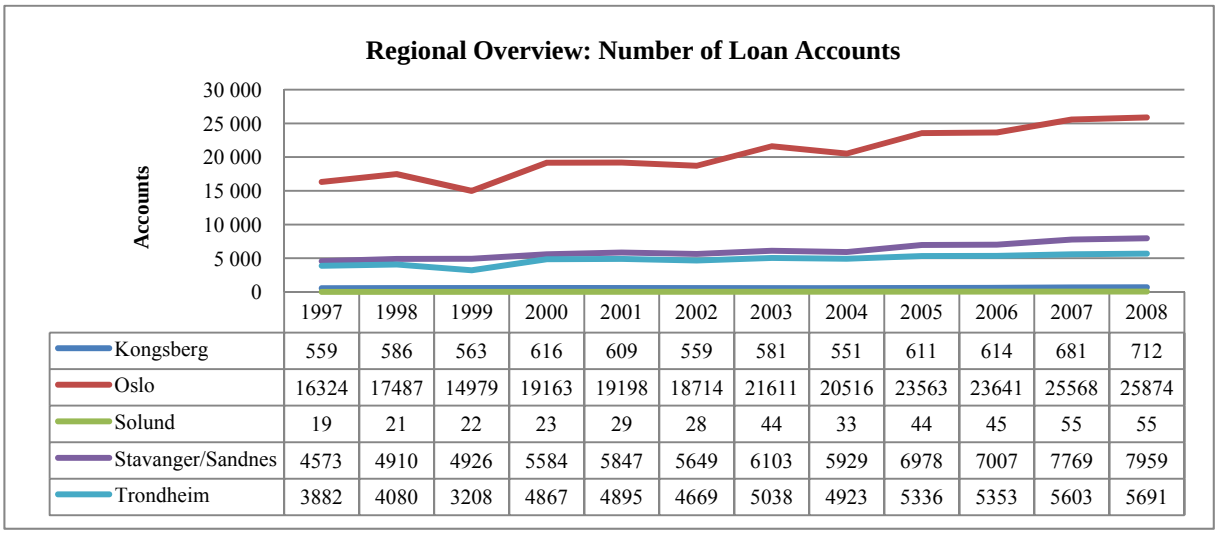


	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Kongsberg	760	796	826	855	865	898	970	917	974	1117	1239	1306
Oslo	41892	44047	41651	52341	52295	52667	59792	55300	57388	63009	71545	76364
Solund	25	24	27	31	34	34	52	38	54	56	66	62
Stavanger/Sandnes	6976	7387	7387	7771	8281	8469	9451	9408	9848	11892	13881	15180
Trondheim	6063	6284	6291	6605	7240	7402	8292	8075	8522	9607	10705	11464

Number of Accounts

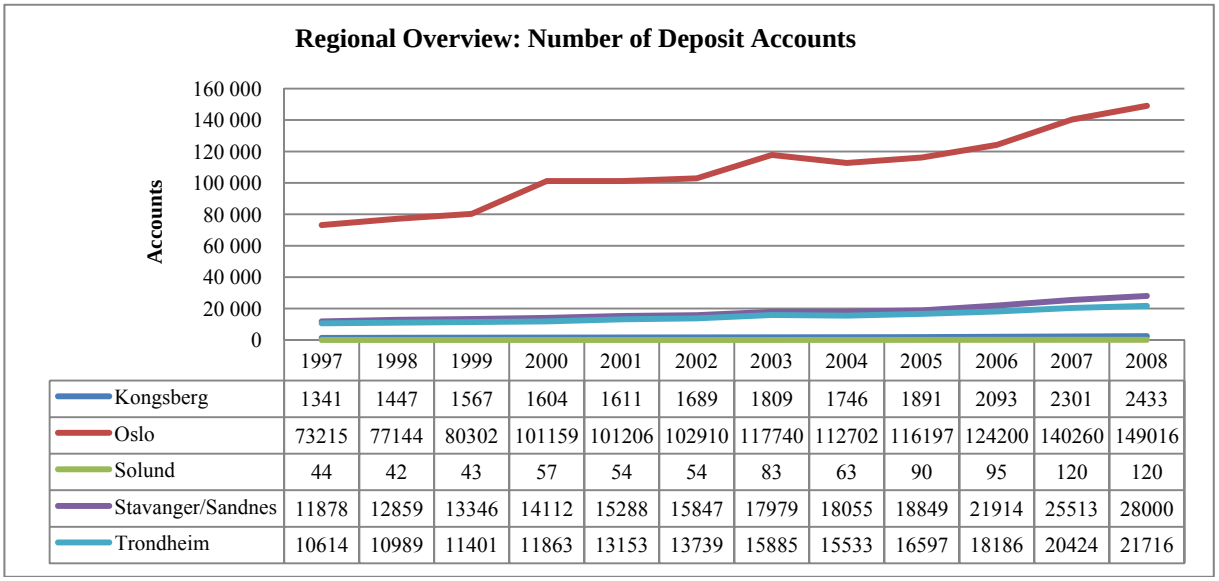
The figures for loans and deposits simply count the number of active accounts in each region. The accounts must have registered loans or deposits for each respective year in order to be counted. By doing this, we have taken into account that a customer may have multiple accounts in several banks across regions. The graphs show that there is a substantially higher number of deposit accounts than loan accounts. When cross-referenced with the number of customers, we can see that the number of customers has also increased throughout the period. This suggests that the increased number of accounts may be a manifestation of the increased number of customers.

Figure 3.15 Number of Loan Accounts



	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Kongsberg	559	586	563	616	609	559	581	551	611	614	681	712
Oslo	16324	17487	14979	19163	19198	18714	21611	20516	23563	23641	25568	25874
Solund	19	21	22	23	29	28	44	33	44	45	55	55
Stavanger/Sandnes	4573	4910	4926	5584	5847	5649	6103	5929	6978	7007	7769	7959
Trondheim	3882	4080	3208	4867	4895	4669	5038	4923	5336	5353	5603	5691

Figure 3.16 Number of Deposit Accounts

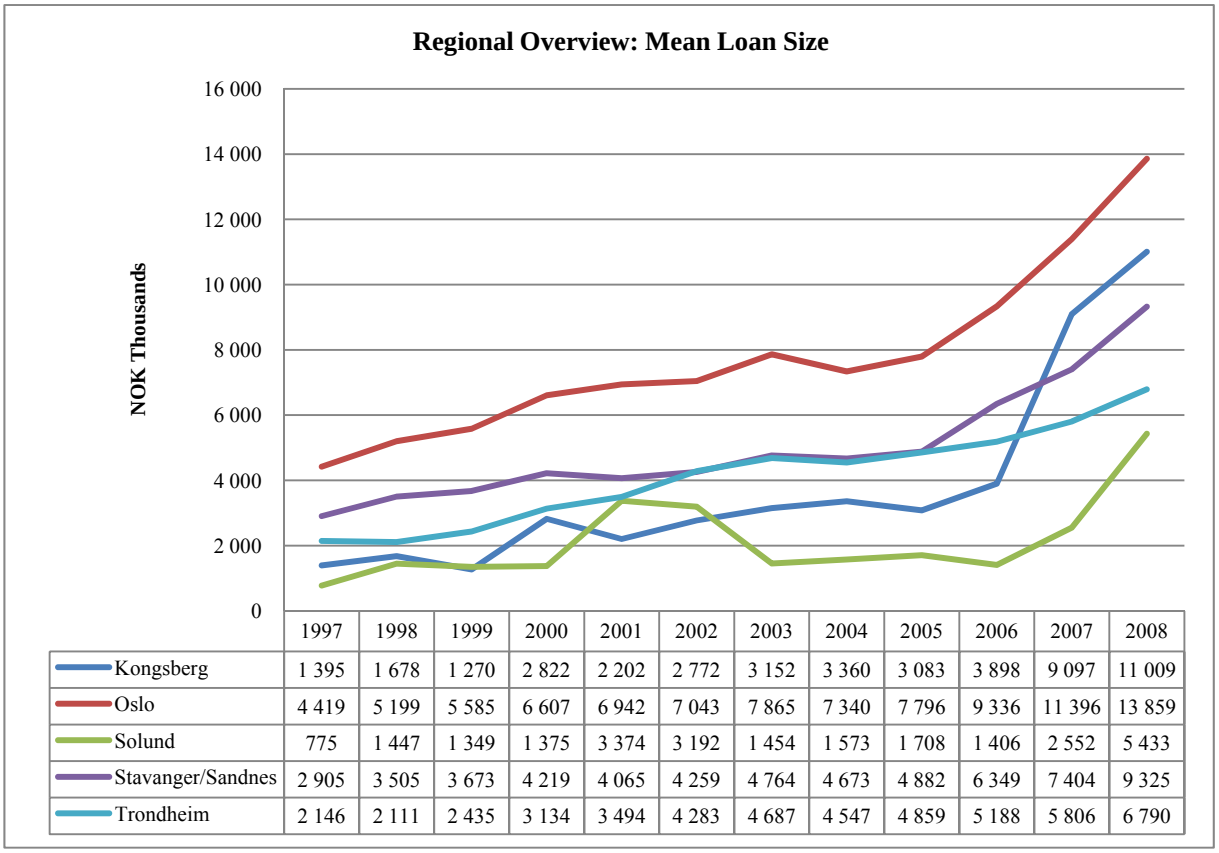


	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Kongsberg	1341	1447	1567	1604	1611	1689	1809	1746	1891	2093	2301	2433
Oslo	73215	77144	80302	101159	101206	102910	117740	112702	116197	124200	140260	149016
Solund	44	42	43	57	54	54	83	63	90	95	120	120
Stavanger/Sandnes	11878	12859	13346	14112	15288	15847	17979	18055	18849	21914	25513	28000
Trondheim	10614	10989	11401	11863	13153	13739	15885	15533	16597	18186	20424	21716

Mean Loan Size

Mean loan size was calculated by summarizing all loans registered in the region, and then dividing this by the number of customers that had loans. The figures show that the mean loan size trended upwards, which may suggest that the individual customers have grown in size and managed to borrow more through the period. Notably, the mean loan size in 2008 for Oslo was above NOK 13 million, which initially seems like a large amount. The main reason for this is that the sample consists of firms whose loan sizes vary greatly. For instance, in the Oslo region there were 22 borrowers that had loans in excess of NOK one billion in the year of 2008, and five percent of the borrowers had loans in excess of NOK 64 million. Although the mean was around NOK 14 million, the median was NOK 777,000.

Figure 3.17 Mean Loan Size



	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Kongsberg	1 395	1 678	1 270	2 822	2 202	2 772	3 152	3 360	3 083	3 898	9 097	11 009
Oslo	4 419	5 199	5 585	6 607	6 942	7 043	7 865	7 340	7 796	9 336	11 396	13 859
Solund	775	1 447	1 349	1 375	3 374	3 192	1 454	1 573	1 708	1 406	2 552	5 433
Stavanger/Sandnes	2 905	3 505	3 673	4 219	4 065	4 259	4 764	4 673	4 882	6 349	7 404	9 325
Trondheim	2 146	2 111	2 435	3 134	3 494	4 283	4 687	4 547	4 859	5 188	5 806	6 790

4. Methods

4.1 Introduction

The aim of this chapter is to give a detailed assessment of the various methods that we have used in our study and the methodology on which our research is based. This will include careful descriptions of the setting that forms the basis for our thesis, the approach used to conduct the research, our choice of research design, methods for data collection and data analysis as well as a thorough discussion of the reliability and validity of the data. The term *methods* refers to the techniques and procedures used to obtain and analyze data, whereas *methodology* is the theory of how research should be undertaken (Saunders, Lewis and Thornhill, 2007). To make this chapter as comprehensible and lucid to the reader as possible, both a general discussion of the methods we have used as well as an assessment of the specific implications these methods have for our research are covered in this chapter. We will not describe any of our results in this part of the thesis as they will be examined and explained thoroughly in the Results chapter.

4.2 Research Setting

Because we are concerned with determinants of banks' interest rate spreads in the Norwegian banking sector, the setting under which our research was conducted is the market for Norwegian bank loan and bank deposit services. We define this market as all Norwegian banks that offer these services to domestic firms (for a more thorough definition we refer to Chapter 3). Data from the Norwegian banking sector spanning from the fiscal years 1997 – 2008 were used as basis for our research. We have chosen this particular setting because we believe that it serves as an expedient platform to answer our research question. Although studies of the impact of market structure on bank performance have been conducted in the past[25], the relationship between market structure and interest rate spreads in local Norwegian bank markets has not been examined with data sets similar to ours. As such, our choice of setting may contribute to a broader understanding of the topics we cover in this study.

[25] Many of these studies are reviewed thoroughly in Chapter 2.

4.3 Approach

In order to test our hypothesis we identified a set of variables from a theoretical framework. The extent to which the theory is clear and precise at the beginning of a research project raises important implications for the choice of design (Saunders et al., 2007). The design of the study has to be consistent with the approach under which it is appropriate to conduct the research in question. There are essentially two different approaches that can be used. A *deductive approach* is appropriate when a theory or hypothesis is already developed and a strategy is designed to test this hypothesis, whereas an *inductive approach* involves collecting data first and then developing a theory as a result of the data analysis (Saunders et al., 2007). Our research builds upon an already well-established theoretical framework and we developed a hypothesis which we tested with the use of quantitative data. As such, we have used a deductive approach. There are several distinguishing features associated with this approach (Saunders et al., 2007); first, a deductive approach is well suited when attempting to explain causal relationships between variables. This is what we have attempted to do when examining the relationship between interest rate spreads and various sources of changes in market structure. Second, the deductive approach involves controls to allow for hypothesis testing. By including additional explanatory variables in our model other than market concentration and market share we were able to ensure that changes observed in the interest rate spreads were a function of the variables that we tested rather than unobserved variables. Another characteristic of the deductive approach is that the variables are operationalized in ways that allow them to be measured quantitatively. Since we were using historical registry data to construct all our variables (as opposed to variables constructed on the basis of a survey, for instance), the variables in our model were already given in operational terms. Finally, the last characteristic of the deductive approach is generalization. The extent to which the results of a study can be generalized to the entire population depends on how the sample in the study is selected. In our case, we define the population as the entire Norwegian bank market. Deductive research progresses through five sequential stages (Robson, 2002):

1. Deducing a hypothesis from theory
2. Expressing the hypothesis in operational terms
3. Testing the operational variables in the hypothesis
4. Examining the outcome of the test
5. If necessary, modifying the theory in light of the test results

The above stages represent the step-by-step progress under which our research was conducted.

4.4 Research Design

A study's research design contains a general description of how the entire research process will be carried out in order to answer the research question (Gripsrud, Olsson and Silkoset, 2004). It is a plan that outlines the objectives of the research, what type of data that is needed, the sources of these data and how they are to be analyzed. The research design should also include considerations on potential constraints (Saunders et al., 2007). There are three main types of research design. An *exploratory design* is particularly useful if the purpose of the research is to gain insight into an area that is not well known to the researcher at the beginning of the project, and if the goal is to clarify the understanding of the problem in question (Saunders et al., 2007). When a *descriptive design* is used, the object of the study is to describe the current situation in a certain field of study (Gripsrud et al., 2004; Saunders et al., 2007). Finally, when attempting to establish causal relationships between different variables, an *explanatory design* is used. In this type of design the emphasis is on explaining relationships between variables within a particular situation (Saunders et al., 2007). The reasoning behind explanatory research is that if, under a predetermined set of conditions, a certain situation X, correlates with another situation Y, and X comes before Y in time, there is a good possibility that there is a causal relationship between the two variables X and Y given that no other possible explanation for the correlation between X and Y exists (Gripsrud et al., 2004).

The purpose of our study was to test causal relationships between the interest rate spreads and bank and market specific factors in high and low concentration markets respectively. We were attempting to use a hypothesis derived from our literature review to source out relevant data from a set of secondary data on the Norwegian banking industry provided to us by the Norwegian Ministry of Finance[26]. The data set contained panel data on all deposits and loans in Norwegian banks from 1997 – 2008. As Wooldridge (2006) explains, panel data contains both a time-series and a cross-sectional dimension. This means that our study was longitudinal in its nature, which is to say that we studied the change and development of repeated observations across time (Saunders et al., 2007). As noted above, we were following the general structure of a deductive approach, and since we were studying casual relationships

[26] This type of secondary data, where a government collects obligatory data from an entire population, is called a census (Saunders, et al., 2007).

our research design is explanatory. The most accurate strategy for conducting an explanatory study is to use an experiment. However, given the scope and nature of our research, an experiment strategy was not possible to conduct and would in any case not serve our purposes well. Instead, the data set from the Ministry of Finance provided us with more suitable empirical data to test our hypothesis. This data set contains interest rates on all deposits and loans of every bank in Norway. As displayed graphically in our research model, *interest rate spread* is the dependent variable, whereas the other variables in the model serve as independent variables. A strategy that involves the use of administrative records and documents is called an archival research strategy (Saunders et al., 2007). As Saunders et al. (2007) point out; an archival research strategy is suitable when doing research on the past and when studying changes over time. Since our starting point was to do an empirical analysis of the Norwegian bank market this strategy suited our purposes well.

4.5 Data Collection

At the most generic level, there are two different ways to collect data for a research project. Data that are gathered for the specific purposes of the research project undertaken are called *primary data*, whereas data that are obtained from sources that originally used the data for other purposes are labeled *secondary data*. What ultimately determines the data collection strategy most appropriate for a particular research project, is the extent to which the data may answer your research question and meet the objectives of the study (Saunders et al., 2007). As noted above, we based our study on panel data collected by the Norwegian Ministry of Finance. Although the data we used were initially collected for other purposes, the data material was unmodified and raw when we received it and had to be cleansed and customized to a great extent before we could work with it. As such, the distinction between primary and secondary data is not entirely without nuances in this case and labeling the data as one or the other essentially comes down to a matter of where to draw the line. However, Saunders et al. (2007) refer to data that have been collected using a survey and that have been analyzed for their original purpose before being used in another setting as survey-based secondary data. In the case where a government collects obligatory data from an entire population, such as when the Norwegian Ministry of Finance obtains yearly data regularly from all Norwegian banks, the data are called a census. Although a census is not technically a survey, since participation is mandatory, it still falls under the subcategory survey-based secondary data (Saunders et al., 2007). Census data that contain a time-series of the same individual subjects viewed over several moments in time are categorized as panel data (Murray, 2006). The data that provided

the main framework for our analysis are a combination of data sets on deposits and loans through the years 1997 – 2008 and fit this label.

4.6 Data Analysis

In this section we will describe scales that fit the data in the data set that we used in our analysis and explain the various techniques that we made use of in order to do the actual testing. We describe the use of scales in our data set in detail so that the reader can easily understand the methodical assumptions that our analysis builds on. This section is meant to provide the reader with a walkthrough guide of how the various analyses in this thesis were carried out and an understanding of the assumptions about the data that these analyses build on.

4.6.1 Scales

As mentioned above, the data sets that we used as basis for this study were panel data with deposits and loans over a certain period of time, which means that the data were quantitative. Quantitative data are data that belong to one of two distinct groups, categorical or quantifiable (Saunders et al., 2007). *Categorical data* are data that cannot be measured numerically, but whose values can either be 1) placed in different categories depending on their specific characteristics or 2) ranked according to their specific values. The technical term for data that can be placed in different categories, but cannot be ranked, is nominal data. We divided our data set into different geographical regions to define the various markets. These markets were delineated and distinguished from each other based on relative commuter distance. Because the banks in these markets cannot be ranked per se (as opposed to for instance their size) they fall under the label nominal data, i.e. we were able to distinguish them from each other based on their category. Data that can be ranked, but whose numerical positions cannot be measured and compared with other data in the data set, are called ordinal data. This implies that it is possible to decide whether or not one variable has more of a specific property than another variable, although it is not possible to decide how much more (Gripsrud et al., 2005). This would be the case if we had based our data collection on a survey. The data on which we based our analysis however, were on a more precise scale level. *Quantifiable data* can, contrary to categorical data, be measured numerically. It means that quantifiable data can be assigned with a position on a numerical scale, and that they can be analyzed with a far wider range of statistics (Saunders et al., 2007). Data that are quantifiable can be subdivided into interval data and ratio data. Interval data are data where, in addition to be able to rank the

data, it is possible to state how large the difference between the values for a given variable is. However, the relative difference between data on the interval level cannot be measured. In other words this type of data cannot be multiplied and divided, only added and subtracted (Saunders et al., 2007). The other sub-category of quantifiable data is ratio data. Ratio data can, in contrast to interval data, be multiplied and divided so it is possible to calculate the relative difference between data values for a particular variable. In the data set from the Ministry of Finance that we used, the data subject to actual testing were ratio data. Hence, we did not have to assume the relative difference between data for a given variable, but could instead observe these differences directly and be confident that any observed differences would be accurate and precise.

The fact that we were using a panel of time series data had implications for several underlying assumptions for our testing. Panel data are, as opposed to cross-sectional data, not drawn randomly from a population. This does not mean, however, that the data are not subject to randomness. As Wooldridge (2006: 343) explains:

> *'…a sequence of random variables indexed by time is called a stochastic process. When collecting a time series data set we obtain one possible outcome, or realization, of the stochastic process. We can only see a single realization, because we cannot go back in time and start the process over again. However, if certain conditions in history had been different, we would generally obtain a different realization for the stochastic process, and this is why we think of time series data as the outcome of random variables.'*

This means that our bank data represent one particular series of realizations (the series that actually happened) and are "drawn" from a set of all possible realizations that is analogous to a population.

4.6.2 Preliminary Analysis

In order to formulate a regression equation that would accurately measure the variables we wanted to test, we made use of several exploratory analysis techniques before conducting the actual testing. This helped us identify patterns and confirm assumptions that had to be established before we could do any further testing. First, we had to compare the interest rate spreads and the HHI for all the regions (commuter belts) over the years 1998 – 2008 to verify that the variables correlated over time (lest our assumption that there is some kind of coherence between interest rate spreads and market concentration would not hold and it

would be meaningless to expose our hypotheses to any further testing). Although the year 1997 was included in the original data sets, we omitted this year from the entire analysis because we had no opening balance data for this year. We began by dividing all the banks in our data set into different sub-markets based on the region each bank belonged to. After we had defined the markets for all the banks, we calculated the mean interest rate spreads for each bank in every region as well as the regional means. We then compared the region mean with each region's HHI. This allowed us to see graphically whether or not there seemed to be any correlation between the variables over time. The interest rate spread was calculated as follows:

$$iratespread_{i,r,t} = \left(\sum i\_loans_{i,r,t} \Big/ \left(\frac{\sum loans,ob_{i,r,t} - \sum loans,cb_{i,r,t}}{2} \right) \right) - NIBOR$$

(4.1)

where $\sum i\_loans_{i,r,t}$ is the sum of all interest income from loans for bank i in region r in year t, $\sum loans,ob_{i,r,t}$ is the opening balance of all loans and $\sum loans,cb_{i,r,t}$ is the closing balance. The first part of the right hand side of the equation gives us the average loan rate for any given bank. In order to obtain a realistic measurement of the rates, we removed all loan rates that were greater than one from our data set and then winsorized the remaining loan rates by 90 percent. The underlying assumptions of such a 90 percent winsorization are that the data below the fifth percentile will be set to the fifth percentile and the data above the 95th percentile will be set to the 95th percentile. The motivation for winsorizing the data was to exclude extreme values from the analysis. Without winsorizing the data, the extreme values can cause inconsistent interest rate spread calculations. We chose a 90 percent winsorization because this seemed to be the most appropriate cut-off (see Appendix A). Adding the opening and closing balances and dividing by two gave us an approximation of the average loans over a given year[27]. By deducting the NIBOR[28] from the interest rate, we arrived at the actual spread. We used a yearly average of the 3-month NIBOR to arrive at a relevant yearly NIBOR. An alternative way to calculate the spread is to deduct the deposit rates from the loan rates:

[27] Because there are no opening balances in the first year a bank enters a new market, we chose to let opening balances be equal to closing balances in cases of entry. The alternative would be to exclude these banks from the analysis in the year they entered.

[28] NIBOR is the Norwegian Inter Bank Offered Rate. It is often used as a reference rate for the inter bank money market rate. In other words the NIBOR is the rate at which banks lend to each other. If deposits only amount to a small proportion of a bank's funding, the NIBOR may reflect a more accurate measure of the bank's funding costs.

$$iratespread_{i,r,t} = \left(\sum i\_loans_{i,r,t} \Big/ \left(\frac{\sum loans,ob_{i,r,t} - \sum loans,cb_{i,r,t}}{2} \right) \right) - \left(\sum i\_deposits_{i,r,t} \Big/ \left(\frac{\sum deposits,ob_{i,r,t} - \sum deposits,cb_{i,r,t}}{2} \right) \right)$$

(4.2)

The first part of the right hand side of the equation remains the same as in 4.1. The second part is the deposit rate and is calculated in the same way as the loan rate. $\sum i\_deposits_{i,r,t}$ is the sum of all interest paid on deposits, $\sum deposits,ob_{i,r,t}$ and $\sum deposits,cb_{i,r,t}$ are the opening and closing balances on deposits, respectively. Controlling for robustness of the results, we performed all the tests in our analysis with this measure as well. In order to further examine the correlation properties between the interest rate spread (loan rate – NIBOR) and HHI we calculated the Pearson correlation coefficient for each region. The correlation coefficient is a number between – 1 and + 1 that represents the strength of the relationship between the variable (Saunders et al., 2007). A value of + 1 indicates perfect positive correlation. Conversely, a value of – 1 represents a perfect negative correlation and a value of 0 suggests that there is no correlation at all. The correlation coefficient is calculated by dividing the covariance of the two variables by the product of the two variables' standard deviation:

$$Corr(X,Y) = \frac{Cov\,(X,Y)}{\sigma_X\,\sigma_Y} \qquad (4.3)$$

The covariance is another way to measure how strongly two variables vary together and can, unlike the correlation coefficient, take on any value (Murray, 2006). It is defined as:

$$Cov(X,Y) = \frac{\sum_{t=1}^{n}(X_t - \bar{X})(Y_t - \bar{Y})}{n-1} \qquad (4.4)$$

The correlation between the interest rate spread (IRS) and the HHI in any of the regions was therefore defined as:

$$Corr(IRS,HHI) = \frac{(\sum_{t=1}^{n}(IRS_t - \overline{IRS})(HHI_t - \overline{HHI}))/n-1}{\sigma_{IRS}\sigma_{HHI}} \qquad (4.5)$$

where n = total number of banks in the region and i = bank. We examined the correlations both at the regional level and the aggregated Norwegian bank market level. Before we could formulate the regression equation that would ultimately test our main hypotheses, we put our data through several different t-tests to check for differences between banks in markets with a HHI higher than 0.20 and banks in markets with a HHI equal to or lower than 0.20. In addition to this, we tested for significant differences between banks in regions in the top 25 percent regions and bottom 25 percent regions, ranked by HHI. When testing for differences between two independent samples, the appropriate test is the independent samples t-test (Gripsrud et al., 2005). The independent samples t-tests give an indication of whether or not there is a difference in the mean of a particular variable between two different groups. We assumed that the groups had equal variances. The purpose of conducting the t-tests was to see whether high and low concentration markets tended to differ in regards to several critical variables, testing for each variable, one at the time. We tested for differences between the groups in the following variables:

- Interest rate spread (loan rate – NIBOR)
- Interest rate spread (loan rate – deposit rate)
- Mean loan size per region
- Mean size of banks per region (size measured by loans)
- Number of customers (loans) per region
- Number of accounts (loans) per region
- Number of banks per region
- Market share (calculated by the sizes of the banks' total loans)
- Number of customers per bank per region
- Number of accounts (loans) per bank per region
- Loan size per bank per region

In other words, we tested if there were significant differences between markets with HHI > 0.20 and markets with HHI ≤ 0.20 in regards to these variables, and whether there were significant differences between the top and bottom 25 percent groups in regards to the same variables. We did the t-tests for all the years in our data set from 1998 – 2008. When conducting a t-test, two hypotheses are formulated, a null-hypothesis and an alternative hypothesis (Gripsrud, et al., 2005). The null-hypothesis states that there is no difference between the two samples, whereas the alternative-hypothesis states that there is a difference. For all our t-tests we used a significance level of 0.05. For any significance level $\leq$ 0.05, the

alternative hypotheses were confirmed and we could assume that differences found could not be attributed to random variation. Since our hypotheses tested for *differences* between groups, and not for whether the particular values were *larger* or *smaller* for one group compared to the other, the tests were two-sided.

4.6.3 Regression Analysis

With the use of a regression analysis we wanted to find out how differences in market structure affect the interest rate spreads in the regions in our study. In order to do so we had to estimate how the year-by-year changes in interest rate spreads were affected by HHI and the other control variables over the years 1998 – 2008. As we mentioned briefly above, this type of analysis required us to construct a panel data set consisting of data from all the years in our study. When analyzing panel data econometrically, it is not reasonable to assume that the observations are independently distributed across time (Wooldridge, 2006). In a panel data set, unobserved commonalities (factors) that affect an individual in one period, will also affect that individual in the next period. Consequently, all the observations on one individual bank share some commonality that is idiosyncratic to this bank and not shared with other banks. Such commonalities can also be shared by all the observations in a single time period, but not by any observations in other time periods (Murray, 2006). In short, unobserved commonalities that affect the dependent variables are either constant or vary over time (Wooldridge, 2006). An unobserved effects model that takes into account such unobserved commonalities could be formulated as follows:

$$y_{i,t} = \beta_0 + \beta_1 x_{1,i,t} + ... + \beta_k x_{k,i,t} + a_i + u_{i,t} \quad t = 1,...,T \quad i = 1,...,n \qquad (4.6)$$

In the model, i denotes the individual or entity the observation is from and t indicates which time period the observation is from. a_i is an individual unobserved effect that is often referred to as unobserved heterogeneity in applications and is fixed over time. The unobserved heterogeneity captures all unobserved, time-constant commonalities that affect $y_{i,t}$, while $u_{i,t}$, often referred to as the idiosyncratic error, represents all unobserved commonalities that vary over time and affect $y_{i,t}$ (Wooldridge, 2006). The presence of these unobserved commonalities means that the observations are not independently distributed across time and do not satisfy the Gauss-Markov Assumptions[29]. For this reason, regular ordinary least

[29] The Gauss-Markov Assumptions are a set of assumptions under which OLS is the best linear unbiased estimator (BLUE) (Wooldridge, 2006; Murray, 2006). The assumptions are that the model is linear in its parameters, there is no perfect collinearity among the independent variables, and that the errors have serial conditional mean, are uncorrelated, and homoskedastic.

squares (OLS) regression is not feasible when analyzing panel data, and other analysis methods should be used.

Two methods that are frequently used to estimate unobserved effects panel data models are the *fixed effect estimator* (FE) and the *random effects estimator* (RE). The appropriateness of each method depends on the properties of the data set being analyzed. In both cases we assume that the idiosyncratic error is uncorrelated with the explanatory variables:

$$Cov(x_{j,i,t}, u_{i,t}) = 0 \text{ for all } j,\ i \text{ and } t$$

When the individual unobserved effect is contemporaneously correlated with the explanatory variables we have that

$$Cov(x_{j,i,t}, a_i) \neq 0 \text{ for at least some } j,\ i \text{ and } t$$

For this reason, a transformation method is needed to remove the unobserved effect along with any time-constant explanatory variables prior to estimation, in order to obtain a consistent estimator of the parameters (Wooldridge, 2006; Murray, 2006). This can be done with a fixed effects transformation. Starting out with an unobserved effects model (without a constant intercept, β_0) we have that:

$$y_{i,t} = \beta_1 x_{1,i,t} + ... + \beta_k x_{k,i,t} + a_i + u_{i,t} \quad t = 1,...,T \quad i = 1,...,n \qquad (4.7)$$

by averaging the equation over time for each *i*, we have:

$$\bar{y}_{i,t} = \beta_1 \bar{x}_{1,i,t} + ... + \beta_k \bar{x}_{k,i,t} + a_i + \bar{u}_{i,t} \quad t = 1,...,T \quad i = 1,...,n \qquad (4.8)$$

Finally (4.8) is subtracted from (4.7) and we arrive at the general time-demeaned equation for each *i*:

$$\ddot{y}_{i,t} = \beta_1 \ddot{x}_{1,i,i} + ... + \beta_k \ddot{x}_{k,i,t} + \ddot{u}_{i,t} \quad t = 1,...,T \quad i = 1,...,n \qquad (4.9)$$

Because the individual unobserved effect a_i is constant over the time periods it disappears in equation (4.9) and we can estimate the parameters with OLS. This is the FE. It uses the time variation of y and x within each cross-section and is sometimes referred to as the *within group estimator* because of this (Wooldridge, 2006). If the individual unobserved effect and the explanatory variables are contemporaneously uncorrelated, so that

$$Cov(x_{j,i,t}, a_i) = 0 \text{ for all } j,\ i \text{ and } t,$$

it is not feasible to eliminate the individual unobserved effect. In such instances, we can define a composite error term as $v_{i,t} = a_i + u_{i,t}$, that is serially correlated across time. The appropriate estimation method in this case is the RE[30]. Because FE allows for the explanatory variables $x_{j,i,t}$ to be correlated with the unobserved effect a_i, while RE does not, RE is only suitable when $x_{j,i,t}$ and a_i are uncorrelated. We argue that the explanatory variables in our data set are indeed correlated contemporaneously with bank specific error components. As an arbitrary example, consider the following; an observed explanatory variable that may affect a bank's interest rate spread is the number of customer loan accounts a bank has. Banks with especially risk willing managers, for which a_i > than 0, may be inclined to issue loans to high-risk projects, effectively increasing the number of loan accounts. If this is the case, we will observe that those banks with above average values for a_i are likely to have above average values for the number of customer accounts and we have that $x_{j,i,t}$ and $a_i$are correlated. Hence, the fixed effect estimator is appropriate. Wooldridge (2006) recommends including dummy variables for each time period when T (time periods) is small relative to N (banks). By using time-dummies for each year in the panel-data it is possible to control for unobserved commonalities that are common for all the banks in a given year. Hence, our unobserved effects model included dummy variables for the years 1998 – 2008[31] and analyzed with FE. The model was formulated as:

$$\begin{aligned} iratespread_{i,r,t} &= \beta_1 hhi_{r,t} + \beta_2 loansize\_reg_{r,t} + \beta_3 banksize\_reg_{r,t} + \beta_4 cust\_reg_{r,t} + \beta_5 acc\_reg_{r,t} \\ &+ \beta_6 banks\_reg_{r,t} + \beta_7 marketshare_{i,t} + \beta_8 cust\_bank_{i,t} + \beta_9 acc\_bank_{i,t} + \beta_{10} loansize\_bank_{i,t} + \delta_1 d98_t \\ &+ \delta_2 d99_t + \delta_3 d00_t + \delta_4 d01_t + \delta_5 d02_t + \delta_6 d03_t + \delta_7 d04_t + \delta_8 d05_t + \delta_9 d06_t + \delta_{10} d07_t + \delta_{11} d08 + a_i + u_{i,t} \\ t &= 1,...,T \quad i = 1,...,n \qquad (4.10) \end{aligned}$$

In this model, the $iratespread_{i,t}$ is the *interest rate spread* as calculated in (4.1). i denotes bank, r denotes region and t denotes year. Each i is the equivalent of one bank in one region. That is to say that if a given bank has branches in several regions (which is often the case), each branch is labeled by its individual i and thus represents a distinct entity in the analysis. The explanatory variables $\beta_1 hhi_{r,t}$, $\beta_2 loansize\_reg_{r,t}$, $\beta_3 banksize\_reg_{r,t}$, $\beta_4 cust\_reg_{r,t}$, $\beta_5 acc\_reg_{r,t}$, $\beta_6 banks\_reg_{r,t}$, are all region specific variables. This means that they have the same value for all the banks in a particular region. $\beta_1 hhi_{r,t}$ denotes regional HHI,

30 For a thorough review of the specifications of the random effects model we refer to Wooldridge (2006: 493-497), Murray (2006: 691-693) and Greene (2008: 200-210).

31 1997 was omitted from the data set because we had no data for 1996, while 1998 served as the base year so this dummy was practically omitted as well.

$\beta_2 loansize\_reg_{r,t}$ denotes the mean size of loans in a region , $\beta_3 banksize\_reg_{r,t}$ denotes the mean size of the all the banks in bank region r at year t, $\beta_4 cust\_reg_{r,t}$ denotes the number of customers in a region, $\beta_5 acc\_reg_{r,t}$ denotes the number of loan accounts in a region and $\beta_6 banks\_reg_{i,t}$ denotes the number of banks that issue loans in a region. $\beta_7 marketshare_{i,t}$, $\beta_8 cust\_bank_{i,t}$, $\beta_9 acc\_bank_{i,t}$ and $\beta_{10} loansize\_bank_{i,t}$ are bank specific variables. $\beta_7 marketshare_{i,t}$ denotes the market share, $\beta_8 cust\_bank_{i,t}$ the number of loan customers, $\beta_9 acc\_bank_{i,t}$ the number of accounts and $\beta_{10} loansize\_bank_{i,t}$ the size of loans for bank i in year t. Because the banks, rather than their customers, are the units of analysis in our study we assume that the effect of all firm specific variables on the customer side, such as managers' risk willingness, customers' credit risk and the industry in which the various banks' customers operate is caught up in the constant term, the year dummies and the error term. Firm specific variables are as such considered to be an average measure of the quality of the customers for each bank in our model.

Since we wanted to test for differences between markets with high concentration and low concentration, we divided the banks into two distinct groups; banks in regions with HHI higher than 0.2 were grouped in one group and those with a HHI equal to or lower than 0.2 were grouped in another. We estimated the effect the explanatory variables in the model have on the interest rate spread through the years 1998-2008 in both the high-HHI and low-HHI regions as well as the compound effect on all banks across regions.

4.6.4 Robustness Tests

The robustness of an estimator is the degree to which the estimator retains its sampling process despite nontrivial changes to the assumptions about where the data comes from (Murray, 2006). We tested our model for robustness by changing the underlying assumptions for the dependent variable, *interest rate spread,* in the regression model. As argued above, we defined the interest rate spread as the difference between the interest rates on loans and the 3-month NIBOR. There were several other ways in which we could have defined the interest rate spread. To test for robustness we used an alternative definition of the interest rate spread to see if it yielded similar results. We used the definition as shown in (4.2) using the deposit rates as an estimate of the banks' interest costs. By applying this alternative definition of the interest rate spread and running the same regression as we did previously, we were able to find out if our findings were robust to alternative definitions of the interest rate spread.

Finally, we also tested the robustness of the grouping criteria that we used to label the regions as low and high concentration. We did this by defining high and low level HHI regions as the top and bottom 25 percent regions as measured by HHI. This allowed us to control for differences in the most extreme cases.

4.7 Validity and Reliability

It is important to be aware of the pitfalls that necessarily present themselves when conducting research. In this section we will briefly discuss different types of validity and reliability and to what extent our study is subject to pitfalls arising from such criteria.

Validity is the extent to which the data collection methods actually measure what they are intended to measure and the extent to which the research is really about what it claims to be about (Saunders et al., 2007). In this context, there is a distinction between *internal validity* and *external validity*. Internal validity measures to what degree the causality in the findings is actually a result of interventions rather than other stimuli that are not included in the model. As Gripsrud et al. (2005: 69) explain: If we claim that X affects Y, we have to be certain that it is indeed X that causes the variation in Y and that this variation is not caused by other factors that are not included in our model. In respect to our research models, this has implications for the degree to which the dependent variable (interest rate spread) was affected by the independent variables in our regression models. A lower R^2 will reflect whatever variation in the interest rate spread that is not caused by any of the independent variables. Since we were testing empirical data from an entire population, the risk of drawing a conclusion that is not valid is limited because we can easily observe the R^2 and determine whether or not the independent variables in our model cause significant variations in the dependent variable or not.

There is however a certain risk of backward causation in our study, meaning that there is a possibility that variation in the independent variables' values could potentially be caused by variations in the interest rate spreads. This would be the case if the performance of banks significantly impacts the market structure, more precisely if the interest rate spread would cause variations in HHI[32]. Hence, our study is not entirely precluded from threats to internal validity. External validity is the extent to which the findings from a study can be generalized (Saunders et al., 2007). The mere fact that our data set contains information on loan and

[32] This is some of the criticism that has been raised against studies that attempt to explain a one-way causality from market structure to performance (see Degryse et al., 2009).

deposit rates from all banks in Norway strengthens the validity of our study. While this makes the external validity of our study high in terms of generalizability to the population of Norwegian banks, it is apparent that the external validity would be considerably weaker if we attempted to generalize our results to foreign markets. Still, given the level of detail in our research and the fact that the markets for loans and deposits tend to function in similar ways across most market economies, we believe that it may be possible to generalize the results of our study to other bank markets as well.

Reliability is a measurement of the consistency of the research and refers to the extent to which techniques and analysis procedures used in a study will yield consistent findings (Saunders et al., 2007). In order for the study to be reliable, the random mistakes that often occur in a research setting have to be as small as possible (Gripsrud et al., 2004). The data we used in our study are official accounts of actual loan and deposit rates. This suggests that reliability is not likely to be a problem with our study, since the data we used come from a presumptively reliable public source (the Norwegian Ministry of Finance) and it is possible to do similar studies for whoever may have access to the same data.

5. Results

5.1 Introduction

In this chapter we present the findings from our analysis. In section 5.2 we provide an overview of the correlations between the interest rate spread and HHI, both on the national level including all regions and on a selection of regions used for illustrative purposes. Section 5.3 depicts the differences between regions with high and low HHI and gives fuel to our assumption that a distinction between the two groups is sensible. The most important findings, our main findings that conclude our study, are presented in section 5.4. In this section we describe the findings from our regression analyses in detail.

Summary statistics for all of the variables that are pertinent to our analysis are displayed in Table 5.1 below. The variables are summarized over the period 1998 - 2008, and the summarization is done on the same samples as the regressions that we present later in the chapter.

Table 5.1 Univariate Summary Statistics*

Variable	Obs. (bank level)	Mean	Std. Dev.	Min.	Max.
iratespread(loan rate – nibor)	22,862	0.019	0.014	-0.0099608	0.0472835
iratespread(loans - deposits)	17,959	0.036	0.019	-0.0439944	0.0863708
hhi	38,432	0.321	0.156	0.122	1
loansize_reg	38,432	3,255,346	2,902,882	161,619	4.20E+07
banksize_reg	22,862	2.48E+08	4.17E+08	492,858	3.00E+09
cust_reg	38,432	1,389	2,872	1	16,887
acc_reg	38,432	2,208	4,443	2	25,873
banks_reg	38,432	24	26	1	135
marketshare	22,862	0.084	0.167	2.54E-11	1
cust_bank	22,862	34	146	1	5,710
acc_bank	22,862	55	227	0	8,479
loansize_bank	38,432	1.48E+08	1.65E+09	0	1.29E+11

* Complete summary statistics for all the years can be found in Appendix I.

5.2 Correlation between HHI and the Interest Rate Spread

As described in section 4.5.2 in the Methods chapter, we conducted correlation analyses to assess the correlation coefficient of the two variables HHI and Interest Rate Spread (Loans – NIBOR). The correlation coefficients are calculated over the time period 1998 – 2008. This is arguably few time periods, but we still believe the calculations yield meaningful results. We conducted two sets of correlation analyses. The first set was conducted on a national level across all regions for all of the time periods, while the second set was conducted on the regional level for greater detail. Below is the result for the national level.

Table 5.2 Correlation Coefficients on the National Level

	HHI	Interest Rate Spread (Loan Rate – NIBOR)
HHI	1.000	
Interest Rate Spread (Loans – NIBOR)	0.0798*	1.0000
P		0.0000

*Significant at the 1% level.

The correlation coefficient on the national level is 0.0798, which confirms that there is some correlation between the HHI and the interest rate spread. Recall that a coefficient of 1 means that the variables perfectly correlate, 0 that they are uncorrelated, and -1 that they are perfectly negatively correlated. Albeit the correlation is somewhat weak, the result has to be interpreted in light of the fact that this is on the national level including all regions.

We estimated correlations on each region[33]. Of all the 161 regions, 39 show significant correlation coefficients at the 5 % level. Despite that the majority of the regions do not show significant results, we still observe that important regions with large market size show high correlation coefficients that are significant. For instance, Oslo, the largest region in Norway in terms of loan size, has a significant correlation coefficient of 0.2719. Bergen, Norway's third largest market in terms of loan size, has a correlation coefficient of 0.1506, which is somewhat low. Nevertheless, there is a significant positive correlation. Recall that Bergen is a region with low HHI. Among the regions with the highest correlation coefficients are Røyrvik and Rødøy, which have coefficients of 0.5659 and 0.4401, respectively. An observation worth mentioning is that these regions are small regions in terms of volume of loans, and a limited number of banks operate in these regions. This could possibly have affected the observed high correlation coefficient, but naturally, no firm conclusion can be

[33] Please refer to Appendix H for a thorough overview of all the correlation coefficients.

drawn without further analysis. Table 5.3 depicts the correlation coefficients in a selected number of regions.

Table 5.3 Correlation Coefficients in Selected Regions*

Region	Correlation Coefficient	p	HHI 1998	HHI 2008
Solund	0.1731	0.3517	0.853	0.852
Rødøy	0.4401**	0.0012	0.411	0.528
Kongsberg	0.2027**	0.0102	0.296	0.381
Røyrvik	0.5659***	0.0002	0.411	0.297
Oslo	0.2719***	0.0000	0.143	0.211
Bergen	0.1506***	0.0006	0,178	0.204
Stavanger/Sandnes	0.0731	0.1232	0,188	0.162
Trondheim	0.1408***	0.0004	0,152	0.152

* The table is sorted in descending order by the regional HHI levels (as of 2008). For results for all regions, see Appendix H.
** Significant at the 5 % level. *** Significant at the 1 % level.

Overall, we see that the variables have significant correlations both for markets with low HHI and high HHI.

5.3 Differences between High and Low Concentration Regions

To assess whether grouping the data into markets with high HHI (above 0.20) and low HHI (0.20 and below) would reveal any differences in differences between the two groups in respect to the variables in our model, we conducted a set of t-tests on all the variables in our model. In addition to these tests, we conducted a second set of tests, which we tested on the same set of variables, but with different grouping criteria. For the second set of tests, we still used HHI to group the data, but now distinguished the regions by comparing the regions in the 75th percentile (top 25 % ranked by HHI) and the regions in the 25th percentile (bottom 25 % ranked by HHI). All of the variables were tested across the whole time span in the data set[34]. Tables 5.4 and 5.5 depict the results of the t-tests on the explanatory variables when grouping by high/low level HHI and top/bottom 25 percent, respectively. To save space we reproduce only the t-test results of the first and last time periods, 1998 and 2008. The results of the t-tests on the two spread measures we use are depicted in tables 5.6 and 5.7. Recall that we interpret the results as being significant at $t \leq 0.05$.

[34] See Appendix G for complete t-test results.

Table 5.4 T-tests High/Low HHI 1998 and 2008

Year	Test variable	Mean High HHI Regions (>0.20)	Mean Low HHI Regions (≤0.20)	Results (Pr(|T| > |t|))
1998	Mean Loan Size Regional	1,767,233	2,963,352	0.0000 *
	Mean Loan Bank Size Region	71,200,000	385,000,000	0.0000 *
	Number of Loan Customers by Region	303.4865	3,992.765	0.0000 *
	Number of Loan Accounts by Region	541.7153	6,744.103	0.0000 *
	Number of Loan Banks by Region	12.086	46.97202	0.0000 *
	Market share (Loan Banks)	0.1205906	0.0335731	0.0000 *
	Number of Loan Customers by Banks in Region	20.03774	62.96882	0.0000 *
	Number of Loan Accounts by Banks in Region	36.15669	106.6427	0.0000 *
	Loan Size By Banks in Region	42,200,000	238,000,000	0.0000 *
Year	Test variable	Mean High HHI Regions (>0.20)	Mean Low HHI Regions (≤0.20)	Results (Pr(|T| > |t|))
2008	Mean Loan Size Regional	4,901,986	5,329,828	0.0173 *
	Mean Loan Bank Size Region	414,000,000	492,000,000	0.0518
	Number of Loan Customers by Region	1,832.501	2,075.068	0.2638
	Number of Loan Accounts by Region	2,858.905	3,236.549	0.2636
	Number of Loan Banks by Region	22.80029	35.73883	0.0000 *
	Marketshare (Loan Banks)	0.0835227	0.0367454	0.0000 *
	Number of Loan Customers by Banks in Region	35.25682	48.99213	0.1331
	Number of Loan Accounts by Banks in Region	55.5983	76.67454	0.1364
	Loan Size By Banks in Region	214,000,000	262,000,000	0.6666

* Significant at the 5 % level.

In 1998 there are significant differences between the high concentration and low concentration regions across all the variables. What we can read directly from the results is that the high concentration regions have significantly lower mean values than the low concentration regions, i.e. high concentration regions appear to be smaller. In 2008 not all of the results are significant however, but if we consider the whole time period (1998 – 2008), most of the variables differ significantly between the two groups (see Appendix G for a complete overview). All variables, except for market share, have higher average values in the low concentration regions. Considering the variables by the order displayed in the table above, we first observe that average size of a loan is higher in the low concentration regions. This implies that the customers in these regions have larger capital needs, which should not be surprising since the un-concentrated regions are often larger areas, and it is likely that larger firms populate them. We also see that the banks in these regions are larger on average, measured by the size of their issued loans. There are also more customers, more accounts and more banks in the low concentration regions compared to the highly concentrated ones. The market shares are higher on average in the high concentration regions, which is as expected since these regions have fewer banks on average. The banks in these regions have fewer

customers, fewer accounts and lower average loan sizes as well. The fact that the difference between the groups in regard to average loan size, both per region and per bank, is relatively smaller in 2008 compared to 1998 should not be interpreted as a comparable increase in the high concentration regions as opposed to the low concentration regions, because these values fluctuate rather rapidly between the years in the data sets. We can also observe that the regions and the banks operating in them have grown on average, which is indicated by the fact that the mean values increase from 1998 to 2008. Even though the numbers are expressed in nominal terms, the growth still reflects an increase.

Table 5.5 T-tests Top/Bottom 25 Percent 1998 and 2008

Year	Test variable	Mean Top 25 Percent Regions	Mean Bottom 25 Percent Regions	Results (Pr(|T| > |t|))
1998	Mean Loan Size Regional	1,426,477	2,893,451	0.0000 *
	Mean Loan Bank Size Region	37,300,000	372,000,000	0.0000 *
	Number of Loan Customers by Region	103.4375	3,852.975	0.0000 *
	Number of Loan Accounts by Region	195.9036	6,506.977	0.0000 *
	Number of Loan Banks by Region	12.086	46.97202	0.0000 *
	Marketshare (Loan Banks)	0.2005208	0.0345622	0.0000 *
	Number of Loan Customers by Banks in Region	12.55469	61.47926	0.0000 *
	Number of Loan Accounts by Banks in Region	23.52604	104.0461	0.0000 *
	Loan Size By Banks in Region	21,300,000	229,000,000	0.0001 *
Year	Test variable	Mean Top 25 Percent Regions	Mean Bottom 25 Percent Regions	Results (Pr(|T| > |t|))
2008	Mean Loan Size Regional	5,001,883	6,451,639	0.0000 *
	Mean Loan Bank Size Region	117,000,000	1,010,000,000	0.0000 *
	Number of Loan Customers by Region	167.0644	5,065.854	0.0000 *
	Number of Loan Accounts by Region	270.7706	7,892.851	0.0000 *
	Number of Loan Banks by Region	9.132425	46.88614	0.0000 *
	Marketshare (Loan Banks)	0.1488934	0.0316456	0.0000 *
	Number of Loan Customers by Banks in Region	15.10463	69.96994	0.0000 *
	Number of Loan Accounts by Banks in Region	24.31187	109.318	0.0000 *
	Loan Size By Banks in Region	57,400,000	563,000,000	0.0016 *

*Significant at the 5 % level.

Looking at the t-test results from the alternative grouping criteria in table 5.5, we see that the results differ little from the previous set of tests outlined in table 5.4. The only notable difference from the previous tests is that the variables tend to take on more extremes values, making the differences even more distinct. This is the reason why the results become more significant, further confirming that there are differences between regions with high and low

concentration regions and that these differences become more apparent the larger the difference in market concentration.

Table 5.6 T-tests Interest Rate Spread High/Low HHI

Year	Test variable	Mean High HHI Regions (>0.20)	Mean Low HHI Regions (≤0.20)	Results (Pr(|T| > |t|))
1998	Interest Rate Spread (Loan Rate - NIBOR)	0.0211049	0.0187486	0.0010 *
	Interest Rate Spread (Loans Rate – Deposit Rate)	0.0456089	0.0402202	0.0000 *
1999	Interest Rate Spread (Loan Rate - NIBOR)	.0244112	.0241897	0.8738
	Interest Rate Spread (Loan Rate – Deposits)	.0419802	.0408018	0.5761
2000	Interest Rate Spread (Loan Rate - NIBOR)	.012283	.008063	0.0000 *
	Interest Rate Spread (Loans Rate – Deposit Rate)	.0372247	.0291588	0.0000 *
2001	Interest Rate Spread (Loan Rate - NIBOR)	.0124759	.0107925	0.0242 *
	Interest Rate Spread (Loans Rate – Deposit Rate)	.0378661	.0339443	0.0043 *
2002	Interest Rate Spread (Loan rate - NIBOR)	.0128142	.0123952	0.5302
	I Interest Rate Spread (Loans Rate – Deposit Rate)	.0349557	.0328451	0.0427 *
2003	Interest Rate Spread (Loan rate - NIBOR)	.0294207	.0290928	0.6259
	Interest Rate Spread (Loans Rate – Deposit Rate)	.037899	.0342986	0.0003 *
2004	Interest Rate Spread (Loan rate - NIBOR)	.0288108	.0267732	0.0074 *
	Interest Rate Spread (Loans Rate – Deposit Rate)	.0377432	.0350486	0.0036 *
2005	Interest Rate Spread (Loan rate - NIBOR)	.024057	.0237438	0.6234
	Interest Rate Spread (Loans Rate – Deposit Rate)	.0350704	.0329706	0.0097 *
2006	Interest Rate Spread (Loan rate - NIBOR)	.0182238	.0177184	0.3546
	Interest Rate Spread (Loans Rate – Deposit Rate)	.0320097	.0300363	0.0098 *
2007	Interest Rate Spread (Loan rate - NIBOR)	.0144222	.0141667	0.6578
	Interest Rate Spread (Loans Rate – Deposit Rate)	.0318694	.0311251	0.4427
2008	Interest Rate Spread (Loan rate - NIBOR)	.0180415	.0163215	0.0137 *
	Interest Rate Spread (Loans Rate – Deposit Rate)	.035121	.0334066	0.1292

* Significant at the 5 % level.

When we compare the regions with respect to the interest rate spreads, we see that banks in high concentration regions have higher spreads on average in every year, if only marginally so in some of the years. In the years when the differences are relatively small, the results are not significant, meaning that the differences in the means can be attributed to chance in these cases. However, when we consider the results over the time period of analysis as a whole, the tests indicate that banks in high concentration regions are able to take out higher spreads than banks in low concentration regions. This further motivates us to make a distinction between the two groups when analyzing the determinants of the spreads. Using the alternative grouping criteria with the top and bottom 25 % regions as in table 5.7 below, we see that the t-tests yield similar, although not precisely the same, results as with the original grouping criteria.

Table 5.7 T-tests Interest Rate Spread Top/Bottom 25 percent

Year	Test variable	Mean High HHI Regions	Mean Low HHI Regions	Results (Pr(|T| > |t|))
1998	Interest Rate Spread (Loan Rate - NIBOR)	0.0226815	0.018577	0.0010 *
	Interest Rate Spread (Loans Rate – Deposit Rate)	0.0486243	0.0403318	0.0000 *
1999	Interest Rate Spread (Loan Rate - NIBOR)	0.026841	0.02364	0.0082*
	Interest Rate Spread (Loans Rate – Deposit Rate)	0.0463268	0.0398485	0.0005 *
2000	Interest Rate Spread (Loan Rate - NIBOR)	0.0140369	0.008063	0.0000 *
	Interest Rate Spread (Loans Rate – Deposit Rate)	0.0419772	0.0291588	0.0000 *
2001	Interest Rate Spread (Loan Rate - NIBOR)	0.0127854	0.0108057	0.0428*
	Interest Rate Spread (Loans Rate – Deposit Rate)	0.0382512	0.0339851	0.0171 *
2002	Interest Rate Spread (Loan Rate - NIBOR)	0.0128844	0.0125127	0.6826
	Interest Rate Spread (Loans Rate – Deposit Rate)	0.0353992	0.0329159	0.0784 *
2003	Interest Rate Spread (Loan Rate - NIBOR)	0.0294207	0.0290928	0.0327 *
	Interest Rate Spread (Loans Rate – Deposit Rate)	0.0385755	0.0346514	0.0042*
2004	Interest Rate Spread (Loan Rate - NIBOR)	0.0295192	0.0269521	0.0022 *
	Interest Rate Spread (Loans Rate – Deposit Rate)	0.0396952	0.035604	0.0000*
2005	Interest Rate Spread (Loan Rate - NIBOR)	0.0247119	0.0235683	0.1134
	Interest Rate Spread (Loans Rate – Deposit Rate)	0.0370992	0.0329865	0.0000*
2006	Interest Rate Spread (Loan Rate - NIBOR)	0.0187928	0.0177021	0.0776
	Interest Rate Spread (Loans Rate – Deposit Rate)	0.0334383	0.0303299	0.0004 *
2007	Interest Rate Spread (Loan Rate - NIBOR)	0.0143891	0.0143937	0.9941
	Interest Rate Spread (Loans Rate – Deposit Rate)	0.0335049	0.0310871	0.0183 *
2008	Interest Rate Spread (Loan Rate - NIBOR)	0.0184183	0.0171248	0.0819
	Interest Rate Spread (Loans Rate – Deposit Rate)	0.0366843	0.0338213	0.0151 *

*Significant at the 5 % level.

To sum up the results thus far, the t-tests reveal that there are significant differences in the means of the variables and we can thereby confirm that there are differences between the groups in respect to the variables tested. The results are significant for all the variables in the majority of the years, except 1999, 2004, 2007 (see Appendix G) and 2008. Within these years, the variables *Number of Loan Customers By Banks in Region*, *Number of Loan Accounts by Banks in Region* and *Loan Size By Banks in Region*, do not show significant results. However, looking at the years in which the results are significant, we see that the differences in the means are fairly large. For instance, in 2008, Number of Loan Accounts by Banks in Region has a mean of 106.64 in the low concentration regions, and 36.16 in the high concentration regions. Further, we see that under both definitions of the interest rate spread, the spread in the high concentration regions is significantly larger than in the low concentration regions. The second set of t-tests that distinguish between the top and bottom 25 percent of the regions ranked by HHI, shows results that are very similar to the first set of

t-tests. This gives us reason to believe that the findings of the first set of t-tests are robust. Overall, the results of the t-tests show that there are important differences between the high and low concentration regions in many ways, which in turn indicates that using this grouping of the data makes sense.

5.4 Fixed Effects Regression Analyses

This section describes our main findings. The tables below depict what determines the interest rate spread (defined as loan rate minus a yearly average of the 3-month NIBOR) in various markets conditions, and the extent to which the interest rate spread varies with these determinants. Recall from chapter 4 that the regression equation we used to analyze these effects was:

$$\begin{aligned} iratespread_{i,r,t} &= \beta_1 hhi_{r,t} + \beta_2 loansize\_reg_{r,t} + \beta_3 banksize\_reg_{r,t} + \beta_4 cust\_reg_{r,t} + \beta_5 acc\_reg_{r,t} \\ &+ \beta_6 banks\_reg_{r,t} + \beta_7 marketshare_{i,t} + \beta_8 cust\_bank_{i,t} + \beta_9 acc\_bank_{i,t} + \beta_{10} loansize\_bank_{i,t} + \delta_1 d98_t \\ &+ \delta_2 d99_t + \delta_3 d00_t + \delta_4 d01_t + \delta_5 d02_t + \delta_6 d03_t + \delta_7 d04_t + \delta_8 d05_t + \delta_9 d06_t + \delta_{10} d07_t + \delta_{11} d08 + a_i + u_{i,t} \\ t &= 1,...,T \quad i = 1,...,n \end{aligned}$$

(4.10)

Table 5.8 provides an overview of the various explanatory variables and their definitions.

Table 5.8 Variable Definitions

Variable	Definition
hhi	Market concentration measured by HHI
loansize_reg	Mean loan size in a commuter region
banksize_reg	Mean size of the banks in a commuter region
cust_reg	Number of customers in a commuter region
acc_reg	Number of loan accounts in a commuter region
banks_reg	Number of banks in a region
marketshare	Market shares each bank has
cust_bank	Number of customers each bank has
acc_bank	Number of loan accounts each bank has
loansize_bank	Size of each bank's loans
year_dummy	Dummy representing year specific events.

The extent to which the variables used in the regressions correlate with each other is displayed numerically in Table 5.9 below.

Table 5.9 Correlation between the Variables Used in the Regressions

	iratespread	hhi	loansize_reg	banksize_reg	cust_reg	acc_reg	banks_reg	marketshare	cust_bank	acc_bank	loansize_bank
iratespread	1										
hhi	0.0798*	1									
loansize_reg	-0.0708*	-0.1354*	1								
banksize_reg	-0.0313*	-0.2925*	0.6980*	1							
cust_reg	-0.0104	-0.3295*	0.4738*	0.9046*	1						
acc_reg	-0.0146*	-0.3358*	0.4717*	0.9031*	0.9992*	1					
banks_reg	-0.0256*	-0.4571*	0.4370*	0.8076*	0.9459*	0.9484*	1				
marketshare	-0.0286*	0.3403*	-0.1322*	-0.1812*	-0.1831*	-0.1859*	-0.2473*	1			
cust_bank	-0.0449*	-0.0870*	0.0996*	0.1761*	0.1717*	0.1728*	0.1661*	0.1907*	1		
acc_bank	-0.0458*	-0.0871*	0.0976*	0.1739*	0.1684*	0.1699*	0.1631*	0.2049*	0.9948*	1	
loansize_bank	-0.0558*	-0.0471*	0.1075*	0.1943*	0.1620*	0.1615*	0.1439*	0.1091*	0.8353*	0.8117*	1

* Significant at the 5 % level.

We see that the mean size of banks in a region, as measured in *banksize_reg*, has a correlation of 0.6980 with the mean size of loans overall in a region, *loansize_reg*. This is not surprising since the size of the banks in our analysis is measured by their total loan size. *Banksize_reg* correlates even more strongly, 0.9046, with the number of customers a region has, *cust_reg*, as well as with the number of accounts in a region *acc_reg* at 0.9031 and *banks_reg* at 0.8076. Each of these variables also correlates rather strongly with each other. On the bank level, *cust_bank* and *acc_bank* have a strong correlation with each other, at 0.9948. Also, *loansize_bank* has a fairly strong correlation with both of these variables, 0.8353 and 0.8117 respectively. The remaining variables do not seem to correlate to a large extent with each other, but the results are still significant. The fact that almost all the variables have significant results in the correlation matrix does not mean that they correlate, only that the coherence observed is significantly different from zero, which means that it is unlikely that what we see are the results of random occurrences. A graphic display of the correlations over time can be found in Appendix F.

Tables 5.10 and 5.11 show the coefficients of the explanatory variables in high and low concentration regions, respectively. Table 5.12 displays the coefficients on the national level, including all the banks in both high and low concentration regions.

Table 5.10 Determinants of the Interest Rate Spread in Regions with HHI ≥ 0.20

Dependent Variable: Interest Rate Spread (Loan Rate – NIBOR)
Method: Fixed Effects
Number of observations: 15986

Variable	Coefficient	Std. Error	t-Statistic	P > t	[95% Conf. Interval]	
hhi	0.0036409	0.0013033	2.79	0.005**	0.0010863	0.0061955
loansize_reg	-2.23E-10	1.01E-10	-2.21	0.027*	-4.20E-10	-2.49E-11
banksize_reg	4.09E-13	2.19E-12	0.19	0.852	-3.89E-12	4.71E-12
cust_reg	1.46E-06	2.56E-06	0.57	0.569	-3.55E-06	6.46E-06
acc_reg	-8.12E-07	1.94E-06	-0.42	0.675	-4.61E-06	2.98E-06
banks_reg	-0.000021	0.0000546	-0.38	0.701	-0.000128	0.0000861
marketshare	-0.0102769	0.0012347	-8.32	0**	-0.0126971	-0.0078568
cust_bank	-0.0000181	0.0000166	-1.09	0.277	-0.0000507	0.0000145
acc_bank	0.0000227	0.0000109	2.1	0.036*	1.47E-06	0.000044
loansize_bank	-3.29E-13	1.30E-13	-2.53	0.011*	-5.83E-13	-7.38E-14
year_dummy1998	(omitted)					
year_dummy1999	0.0034138	0.0005452	6.26	0**	0.0023452	0.0044825
year_dummy2000	-0.0084577	0.0005277	-16.03	0**	-0.009492	-0.0074233
year_dummy2001	-0.0079781	0.0005337	-14.95	0**	-0.0090242	-0.0069319
year_dummy2002	-0.007333	0.0005418	-13.54	0**	-0.008395	-0.0062711
year_dummy2003	0.0094229	0.0005477	17.2	0**	0.0083493	0.0104965
year_dummy2004	0.0090148	0.0005437	16.58	0**	0.007949	0.0100806
year_dummy2005	0.0040795	0.0005468	7.46	0**	0.0030077	0.0051513
year_dummy2006	-0.0017916	0.0005471	-3.27	0.001**	-0.002864	-0.0007192
year_dummy2007	-0.0057648	0.0005607	-10.28	0**	-0.0068639	-0.0046658
year_dummy2008	-0.002147	0.000589	-3.65	0**	-0.0033015	-0.0009925
_cons	0.0204228	0.0011339	18.01	0**	0.0182003	0.0226453
R-squared (within)	0.2530					
F-Statistic	207.68					
Prob > F	0.0000**					

* Significant at the 5 % level. ** Significant at the 1 % level.

We see from table 5.10 that the R-squared (within) is 0.2530, indicating that the explanatory variables in our model explain 25.30 % of the variation in the interest rate spread[35]. The F-statistic tells us that the coherence between the explanatory variables and the interest rate spread is significant. Further, the variables *hhi*, *loansize_reg*, *market_share* and *loansize_bank* are significant at the 5 % level. Thus, it appears that part of the variation in the interest rate spread in high-concentration regions can be attributed to changes in these variables. While *hhi* has a positive effect on the interest rate spread, *loansize_reg*, *market_share* and *loansize_bank* have negative impact on the interest rate spread. The latter finding is particularly interesting, since one would ordinarily assume that higher market

[35] Since we are using a fixed effects regression we are generally only concerned with the *within* estimator, not the *between* and *overall* estimators. This is because the within estimator uses the time variation in the interest rate spread and the explanatory variables within each cross-sectional observation. The between estimator ignores information on how the variables change over time and is biased when a_i is correlated with $\overline{X}_i$ (Wooldridge, 2007).

shares would ceteris paribus lead to higher margins as predicted by the efficiency hypothesis. We will elaborate more on this in the Conclusion chapter. The coefficients, which are unstandardized, tell us by how much the interest rate changes with one unit's change in the explanatory variables. As we can see, *hhi* has very little effect on the interest rate spread. A 0.10 increase in HHI increases the spread only by 3.6 basis points (bp). Further, when the mean loan size of a region increases by NOK 1,000,000 the spread decreases by 2.23 bp. The spread decreases by 10.28 bp when a bank increases its market share by 10 percentage points, and decreases only very marginally (less than 0.001 bp) when the bank's loan size increases. The fact that all year dummies are significant (even at the 1 % level) suggests that specific events occurring at each time period contribute to the variations in the interest rate spread. In plain English, the results tell us that in concentrated regions with HHI above 0.20, a bank's interest rate spreads tend to increase when the markets become more concentrated and when a bank increases its number of loan accounts. The interest rate spread decreases when the size of the loans in the region becomes larger on average and when a bank gains market shares.

Table 5.11 Determinants of the Interest Rate Spread in Regions with HHI ≤ 0.20

Dependent Variable: Interest Rate Spread (Loan Rate – NIBOR)
Method: Fixed Effects
Number of observations: 5109

Variable	Coefficient	Std. Error	t-Statistic	P > t	[95% Conf. Interval]	
hhi	-0.0100521	0.0172938	-0.58	0.561	-0.0439585	0.0238543
loansize_reg	-2.11E-09	6.73E-10	-3.13	0.002***	-3.42E-09	-7.86E-10
banksize_reg	8.84E-12	4.10E-12	2.16	0.031**	8.10E-13	1.69E-11
cust_reg	5.98E-06	1.86E-06	3.22	0.001***	2.34E-06	9.63E-06
acc_reg	-5.17E-06	1.61E-06	-3.21	0.001***	-8.33E-06	-2.01E-06
banks_reg	0.0000109	0.0000734	0.15	0.882	-0.000133	0.0001547
marketshare	-0.0451197	0.0093262	-4.84	0***	-0.0634048	-0.0268346
cust_bank	-0.0000229	0.0000166	-1.37	0.169	-0.0000555	9.75E-06
acc_bank	0.0000213	0.0000111	1.93	0.054*	-3.28E-07	0.000043
loansize_bank	-2.28E-13	1.75E-13	-1.3	0.193	-5.71E-13	1.16E-13
year_dummy1998	(omitted)					
year_dummy1999	0.0024038	0.0013868	1.73	0.083*	-0.0003152	0.0051229
year_dummy2000	-0.0108704	0.001239	-8.77	0***	-0.0132995	-0.0084413
year_dummy2001	-0.0074436	0.0012418	-5.99	0***	-0.0098783	-0.0050089
year_dummy2002	-0.0054142	0.0012387	-4.37	0***	-0.0078428	-0.0029856
year_dummy2003	0.0109777	0.0014009	7.84	0***	0.008231	0.0137243
year_dummy2004	0.0093823	0.0013221	7.1	0***	0.0067902	0.0119744
year_dummy2005	0.0066738	0.0013259	5.03	0***	0.0040743	0.0092733
year_dummy2006	0.0011954	0.0014599	0.82	0.413	-0.0016668	0.0040576
year_dummy2007	-0.0017349	0.0015751	-1.1	0.271	-0.0048231	0.0013534
year_dummy2008	0.0015416	0.0018867	0.82	0.414	-0.0021574	0.0052407
_cons	0.0326073	0.0052494	6.21	0*	0.0223153	0.0428994

R-squared (within)	0.2973
F-Statistic	77.54
Prob > F	0.0000***

* Significant at the 10 % level. ** Significant at the 5 % level. ***Significant at the 1 % level.

As can be seen from Table 5.11, the R-squared (within) in the regression run on the low concentration regions is slightly higher than in the high concentration regions, at 0.2973. We observe that contrary to the high concentration regions, *hhi* does not have a significant effect on the interest rate spread in the low concentration regions. Also, the dummies for years 2006, 2007 and 2008 are not significant and the year dummy for 1999 is only significant at the 10 % level. The other year dummies are significant at the 1 % level. The variables that explain variations in the interest rate spread in low concentration regions are *loansize_reg*, *cust_reg*, *acc_reg*, *marketshare* (significant at the 1 % level), *banksize_reg* (significant at the 5 % level) and *acc_bank* (significant at the 10 % level). An increase in the mean loan size of a region by NOK 1,000,000 results in a 21.19 bp decrease in the interest rate spread. While an increase of 100 customers results in an increase of 5.98 bp in the interest rate spread, an increase of 100 loan accounts yields an almost similar decrease in the spread, 5.17 bp to be exact. The spread decreases by 45.12 bp when a bank's market share increases by 10 percentage points, which is over four times more than the decrease observed in the high concentration regions. The number of loan accounts that a bank has yields an interest rate spread increase of 21.3 for every 100 additional accounts opened in that bank, but is only significant at the 10 % level. These findings suggest that in regions where the HHI is 0.20 or lower, the interest rate spread is unaffected by changes in HHI, but increases as the average size of the banks in the region increases and when the number of loan accounts that a bank has increases. The interest rate spread tends to decrease when the average size of loans and the number of loan accounts in a bank's region increase and when a bank's market share increases. These results differ from the results in the high concentration regions and suggest that there is indeed a difference between the determinants of the interest rate spread in high and low concentration regions, essentially leading us to reject our null-hypothesis and accept our alternative hypothesis:

H_A: *Market structure affects banks' interest rate spreads differently in high and low concentration bank markets*

To see why a distinction of high and low concentration markets is relevant, we ran the FE regression on the entire data set without sub-dividing the markets into high and low concentration regions. Table 5.12 shows the regression coefficients of the explanatory variables when testing for determinants of the interest rate spread (loan rate – NIBOR) on the national level (that is, including both high and low concentration regions).

Table 5.12 Determinants of the Interest Rate Spread on the National Level

Dependent Variable: Interest Rate Spread (Loan Rate – NIBOR)
Method: Fixed Effects
Number of observations: 21095

Variable	Coefficient	Std. Error	t-Statistic	P > t	[95% Conf. Interval]	
hhi	0.003846	0.0012452	3.09	0.002**	0.0014053	0.0062866
loansize_reg	-3.14E-10	8.54E-11	-3.68	0**	-4.81E-10	-1.47E-10
banksize_reg	1.83E-12	1.42E-12	1.29	0.198	-9.57E-13	4.62E-12
cust_reg	3.27E-06	9.50E-07	3.45	0.001**	1.41E-06	5.13E-06
acc_reg	-2.29E-06	7.44E-07	-3.08	0.002**	-3.75E-06	-8.33E-07
banks_reg	-0.0000301	0.0000364	-0.83	0.409	-0.0001014	0.0000413
marketshare	-0.0111378	0.0012111	-9.2	0**	-0.0135116	-0.008764
cust_bank	-0.0000136	0.0000105	-1.3	0.195	-0.0000342	6.96E-06
acc_bank	0.0000168	6.86E-06	2.45	0.014*	3.38E-06	0.0000303
loansize_bank	-3.29E-13	9.57E-14	-3.43	0.001**	-5.16E-13	-1.41E-13
year_dummy1	(omitted)					
year_dummy1999	0.0029766	0.0004771	6.24	0**	0.0020415	0.0039118
year_dummy2000	-0.0094852	0.0004647	-20.41	0**	-0.010396	-0.0085743
year_dummy2001	-0.0081901	0.0004682	-17.49	0**	-0.0091079	-0.0072723
year_dummy2002	-0.007052	0.0004768	-14.79	0**	-0.0079865	-0.0061174
year_dummy2003	0.0094983	0.0004887	19.43	0**	0.0085403	0.0104563
year_dummy2004	0.0087595	0.0004817	18.19	0**	0.0078154	0.0097036
year_dummy2005	0.004116	0.0004869	8.45	0**	0.0031616	0.0050704
year_dummy2006	-0.0018791	0.0004905	-3.83	0**	-0.0028405	-0.0009177
year_dummy2007	-0.005689	0.000505	-11.27	0**	-0.0066789	-0.0046992
year_dummy2008	-0.0023365	0.000537	-4.35	0**	-0.0033891	-0.0012839
cons	0.0214241	0.0009432	22.72	0**	0.0195754	0.0232728

R-squared (within)	0.2642
F-Statistic	305.53
Prob > F	0.0000**

* Significant at the 5 % level. ** Significant at the 1 % level.

As is evident from the results, all of the variables explaining the interest rate spread in high concentration regions are significant on the national level. Except for *banksize_reg*, this is also true for the explanatory variables in the low concentration regions. Most important however, is that some of the variables that turn up significant when including all the regions in one model are not significant when we divide the markets in regions by high and low concentration. *hhi* is not a determinant of the interest rate spread in low-concentration regions, even though this is a significant explanatory variable when including all regions in the regression. The same is the case for *loansize_bank*. In regions with high concentration, *cust_reg* and *acc_reg* are not determinants of the interest rate spread, while these variables turn up significant when considering all the regions. These results strengthen the assumption that a distinction between bank markets with high and low concentration is feasible. Table 5.13 summarizes our main findings and depicts the differences between determinants of the interest rate spread in high and low concentration markets. We have also added the results when considering the entire Norwegian banking sector as a whole.

Table 5.13 Determinants of the Interest Rate Spread (Comparison)

Regions:	HHI ≥ 0.20		HHI ≤ 0.20		All regions	
Variable	Coefficient	P > t	Coefficient	P > t	Coefficient	P > t
hhi	0.0036409	0.005***	-0.0100521	0.561	0.003846	0.002***
loansize_reg	-2.23E-10	0.027**	-2.11E-09	0.002***	-3.14E-10	0***
banksize_reg	4.09E-13	0.852	8.84E-12	0.031**	1.83E-12	0.198
cust_reg	1.46E-06	0.569	5.98E-06	0.001***	3.27E-06	0.001***
acc_reg	-8.12E-07	0.675	-5.17E-06	0.001***	-2.29E-06	0.002***
banks_reg	-0.000021	0.701	0.0000109	0.882	-0.0000301	0.409
marketshare	-0.0102769	0***	-0.0451197	0***	-0.0111378	0***
cust_bank	-0.0000181	0.277	-0.0000229	0.169	-0.0000136	0.195
acc_bank	0.0000227	0.036**	0.0000213	0.054*	0.0000168	0.014**
loansize_bank	-3.29E-13	0.011**	-2.28E-13	0.193	-3.29E-13	0.001***
year_dummy1	(omitted)		(omitted)		(omitted)	
year_dummy1999	0.0034138	0***	0.0024038	0.083*	0.0029766	0***
year_dummy2000	-0.0084577	0***	-0.0108704	0***	-0.0094852	0***
year_dummy2001	-0.0079781	0***	-0.0074436	0***	-0.0081901	0***
year_dummy2002	-0.007333	0***	-0.0054142	0***	-0.007052	0***
year_dummy2003	0.0094229	0***	0.0109777	0***	0.0094983	0***
year_dummy2004	0.0090148	0***	0.0093823	0***	0.0087595	0***
year_dummy2005	0.0040795	0***	0.0066738	0***	0.004116	0***
year_dummy2006	-0.0017916	0.001***	0.0011954	0.413	-0.0018791	0***
year_dummy2007	-0.0057648	0***	-0.0017349	0.271	-0.005689	0***
year_dummy2008	-0.002147	0***	0.0015416	0.414	-0.0023365	0***
_cons	0.0204228	0***	0.0326073	0***	0.0214241	0***
R-squared (within)	0.2530		0.2973		0.2642	
F-Statistic	207.68		77.54		305.53	
Prob > F	0.0000***		0.0000***		0.0000***	

* Significant at the 10 % level. ** Significant at the 5 % level. *** Significant at the 1 % level.

By accepting that there are differences in the determinants of the interest rate spread in high and low concentration regions, and attributing these differences to the explanatory variables that cause changes in the interest rate spread in high and low concentration regions respectively (as outlined above), we are close to an answer to our research question: *How does market structure affect the interest rate spread in local Norwegian bank markets?* While the results in this chapter provide a reply to this question, we leave the discussion of the possible reasons behind our findings to the Conclusions chapter.

5.5 Robustness Tests

To test our results for robustness we ran the same FE regressions with alternative definitions of the interest rate spread, as explained in chapter 4.5.4. The results when running the regression with the interest rate spread defined as *loan rate – deposit rate* are shown in Table 5.14.

Table 5.14 Determinants of the Interest Rate Spread (Loan Rate – Deposit Rate)

Regions:	HHI ≥ 0.20		HHI ≤ 0.20		All regions	
Variable	Coefficient	P > t	Coefficient	P > t	Coefficient	P > t
hhi	0.0061254	0.002***	-0.0323598	0.235	0.005733	0.002***
loansize_reg	-3.25E-10	0.03**	-3.50E-09	0.001***	-5.32E-10	0***
banksize_reg	2.19E-12	0.51	2.49E-11	0**	7.01E-12	0.001***
cust_reg	3.29E-06	0.384	4.83E-06	0.087*	3.58E-06	0.008***
acc_reg	-2.59E-06	0.37	-6.49E-06	0.007***	-3.51E-06	0.001***
banks_reg	-6.18E-06	0.94	0.000076	0.501	-0.0000356	0.512
marketshare	-0.015058	0***	-0.059924	0***	-0.0161437	0***
cust_bank	0.0000245	0.39	-7.57E-06	0.789	0.0000164	0.367
acc_bank	-4.22E-06	0.823	8.78E-06	0.647	-3.31E-06	0.785
loansize_bank	-3.68E-13	0.038**	-6.33E-14	0.797	-3.32E-13	0.012**
year_dummy1	(omitted)		(omitted)		(omitted)	
year_dummy1999	-0.0002594	0.748	-0.0011725	0.575	-0.000688	0.33
year_dummy2000	-0.0076422	0***	-0.0105126	0***	-0.008983	0***
year_dummy2001	-0.0067027	0***	-0.0050255	0.008***	-0.0067441	0***
year_dummy2002	-0.0100545	0***	-0.006645	0***	-0.0095179	0***
year_dummy2003	-0.0068585	0***	-0.0043902	0.042**	-0.0066781	0***
year_dummy2004	-0.0072273	0***	-0.0055318	0.007***	-0.0070197	0***
year_dummy2005	-0.010144	0***	-0.0063248	0.002***	-0.0099462	0***
year_dummy2006	-0.0130328	0***	-0.0087864	0***	-0.0128572	0***
year_dummy2007	-0.0125724	0***	-0.00825	0.001***	-0.0123474	0***
year_dummy2008	-0.0093352	0***	-0.0036884	0.212	-0.0092868	0***
_cons	0.0455627	0***	0.0676016	0***	0.0479624	0***
R-squared (within)	0.0691		0.0631		0.0634	
F-Statistic	2.91		9.97		45.64	
Prob > F	0.0000***		0.0000***		0.0000***	

* Significant at the 10 % level. ** Significant at the 5 % level. *** Significant at the 1 % level.

As we can see from the table, the R-squared (within) is substantially lower when defining the interest rate as *loan rate – deposit rate*. However, there seems to be a similar pattern as to which variables explain the interest rate spread defined as *loan rate – deposit rate* compared to which variables explain the interest rate spread under the original definition of the spread. Except for *acc_bank*, which is not significant in either high or low concentration regions, all the significant explanatory variables remain the same in both high and low concentration regions. In high concentration regions, *hhi* still has a positive effect on the interest rate spread, while *loansize_reg*, *marketshare* and *loansize_bank* affect the interest rate spread negatively. In the low concentration regions, the interest rate spread increases with *bankssize_reg*. If we accept a 10 % significant level this is also the case for the variable *cust_reg*. *loansize_reg*, *acc_reg* and *marketshare* have negative impacts on the interest rate spread. The results are close to the ones found under the original definition of the interest rate spread and indicate that while the explanatory variables explain less of the interest rate spread when defining the spread as loan rate – deposit rate, the results are robust in terms of which determinants explain the variation in the spread and in which direction the spread changes as a result of the changes in these determinants. It should be noted however, that the number of banks included in the

panel when running the regression with *loan rate – deposit rate* as the dependent variable is smaller than under the original assumptions, 16,563 compared to 21,095 in total. This is largely because the number of banks with deposits is smaller than the number of banks with loans.

In order to check whether the distinction of local markets into high and low concentration commuter regions was robust, we redefined the grouping criteria. Instead of grouping the regions by a threshold of 0.20, we ran an FE regression on the regions with the 25 % highest HHI ratios and compared the results with the results of an FE regression run on the regions with the 25 % lowest HHI ratios. The results of these regressions, along with an FE regression run on the remaining 50 % of the regions are displayed in Table 5.15. The interest rate spread was defined as in our original model as *loan rate – NIBOR*.

Table 5.15 Determinants of the Interest Rate Spread (alternative grouping criteria)

Regions:	Top 25 % Regions		Bottom 25 % Regions		Mid 50 % Regions	
Variable	Coefficient	P > t	Coefficient	P > t	Coefficient	P > t
hhi	0.0031331	0.124	0.0109904	0.414	0.0049741	0.168
loansize_reg	2.23E-11	0.915	-1.78E-09	0.002***	-4.65E-10	0.008***
banksize_reg	-3.92E-12	0.544	1.03E-11	0.002***	2.10E-12	0.543
cust_reg	0.0000322	0.079*	1.80E-06	0.207	-4.65E-06	0.409
acc_reg	-0.0000224	0.06*	-2.17E-06	0.047**	3.61E-06	0.36
banks_reg	-0.0001677	0.244	0.0000973	0.138	-4.79E-06	0.95
marketshare	-0.0072509	0***	-0.0275837	0.001***	-0.0212103	0***
cust_bank	-0.0000357	0.582	-8.05E-06	0.552	-0.0000315	0.204
acc_bank	0.000046	0.208	0.0000123	0.165	0.0000327	0.052*
loansize_bank	-1.89E-12	0.066*	-2.50E-13	0.034**	-4.94E-13	0.261
year_dummy1	(omitted)		(omitted)		(omitted)	
year_dummy1999	0.0038648	0***	0.0025645	0.03**	0.0029266	0***
year_dummy2000	-0.0074832	0***	-0.01204	0***	-0.0087148	0***
year_dummy2001	-0.0079691	0***	-0.0081735	0***	-0.0076896	0***
year_dummy2002	-0.0067706	0***	-0.0062558	0***	-0.0067908	0***
year_dummy2003	0.0098633	0***	0.0091016	0***	0.0099038	0***
year_dummy2004	0.0099346	0***	0.0080752	0***	0.0093605	0***
year_dummy2005	0.0038979	0***	0.0056569	0***	0.004468	0***
year_dummy2006	-0.0014316	0.182	-0.0008545	0.508	-0.0012422	0.121
year_dummy2007	-0.0058829	0***	-0.0040963	0.003	-0.004842	0***
year_dummy2008	-0.0019913	0.082	-0.0015158	0.355	-0.0016072	0.073*
_cons	0.0226123	0***	0.0212769	0***	0.0194641	0***
R-squared (within)	0.2658		0.2496		0.2472	
F-Statistic	61.23		71.70		120.84	
Prob > F	0.0000***		0.0000***		0.0000***	

* Significant at the 10 % level. ** Significant at the 5 % level. *** Significant at the 1 % level.

We observe that at 1% and 5 % significance levels, only *marketshare* and most of the year dummies are significant in the top 25 % regions. As with the original grouping criteria, the impact that market share has on the interest rate spread differs greatly between the regions in the top and bottom 25 %. While a 0.10 increase in market share will result in a 27.58 bp

decrease in the spread in the bottom 25 % group, an increase in market share of the same magnitude makes the spread decrease by only 7.25 bp in the top 25 % group. If we expand the significant level at which we accept the variables as explanators of the interest rate spread to 10 %, *cust_reg* and *acc_reg* are also significant in the top 25 % group. The results in the top 25 % group differ substantially from those of the regression run on the high concentration regions (HHI $\geq$ 0.20). This is not necessarily very surprising; as we can see from Table 5.10 the number of observations is 15,986 in the regions with HHI levels higher than 0.20, while the number of observations in the top 25 % group is slightly less than one third of this (4,903). What still appears evident is that HHI is a determinant of the interest rate spread in high concentration regions, but the strength of this relationship is only significant up to a certain degree of market concentration. The same cannot be said for regions with low market concentration, where HHI does not have a significant effect on the interest rate spread at all. In the bottom 25 % regions, the results are almost identical to the results for the regions with HHI $\leq$ 0.20. This should not come as a surprise either, since the number of observations in the panel is 5860 in the bottom 25 %, which is just a little bit more than in the regression run on the regions with HHI $\leq$ 0.20 (these regions make up close to 25 % of the entire panel). The only difference of note is that *cust_reg* and *acc_reg* are no longer significant and that *loansize_bank* becomes significant at the 5 % level.

Finally, even if the determinants of the interest rate spread in the top 25 % group differ from the rest of the high concentration markets, the important thing is that we still observe that there is a difference in what determines the interest rate spread in the high and low concentration markets. The result of the robustness tests indicates that our main findings are, at least to a certain extent, robust to alternative definitions of the interest rate spread and alternative ways of grouping the regions. Table 5.16 below sums up the HHI-coefficients for all the regressions we have run in the analysis.

Table 5.16 Summary: HHI-Coefficients

Dependent Variable	Independent Variable	Coefficient	P > t
Interest Rate Spread (Loan Rate –Nibor)	hhi national (all regions)	0.003846	0.002**
	hhi > 0.20	0.0036409	0.005**
	hhi ≤ 0.20	-0.0100521	0.561
	hhi top 25 % regions	0.0031331	0.124
	hhi bottom 25 % regions	0.0109904	0.414
Interest Rate Spread (Loan Rate –Deposit Rate)	hhi national (all regions)	0.005733	0.002***
	hhi > 0.20	0.0061254	0.002***
	hhi ≤ 0.20	-0.0323598	0.235

* Significant at the 10 % level. ** Significant at the 5 % level. *** Significant at the 1 % level.

6. Conclusions and Discussion

6.1 Introduction

In this chapter we will discuss the results in relation to our research question and draw conclusions from our findings. The chapter follows the same structure as the Results chapter, but we will for the most part focus on the main findings from the regression analyses. We end the chapter with a brief discussion of the implications this study may have for future research.

6.2 Concluding Remarks

The positive correlation between HHI and the interest rate spread in many of the regions serves first and foremost as an indication that a significant relationship between the two exists in some of the regions but not in others, and we use it mainly to legitimize further studies and testing. However, the relationship does to some extent fortify the underlying assumptions of the SCP hypothesis, which states that higher concentration in the bank market leads to softer competition between the banks and enables them to capture more profits (Degryse, 2009), but only in the regions where a positive correlation exists. Although the correlation alone in no way confirms the cause and effect of this relationship, it serves as an argument not to reject this assumption without further investigating the adherent coherence between the interest rate spread and the HHI.

In the years between 1998 and 2008 the t-tests show significant differences between banks in regions with high (HHI > 0.20) and low (HHI ≤ 0.20) market concentration across most of the variables tested for. The first and most obvious indication that there are significant differences between these two groups is that the interest rate spread (loan rate – NIBOR) is larger in the high concentration regions than in the low concentration regions in every year included in the t-tests. Because the NIBOR remains the same for both groups, the difference between the regions is a result of higher loan rates charged by banks in the high concentration regions. These results lead us to conclude that banks in high concentration regions on average have higher margins than banks in low concentration regions. This is consistent with the findings of Kim et al. (2005) and Sapienza (2002) who argue that higher levels of market concentration in bank markets are associated with higher loan rates. (Note that this should not come as any surprise; higher levels of concentration are usually associated with softer competition (Besanko et al., 2007) and make price coordination easier.) The consistently higher margins found in high concentration regions correspond well with the consolidation trend in the Norwegian banking industry over the period of analysis. Again, no inference

about causal relationships can be made from this, but it does give credibility to the assumption that bank markets have different characteristics depending on the in-market level of concentration. The differences between high and low concentration markets become even more apparent when looking at the structural differences between the regions in the two groups. The t-tests also reveal that there are significant structural differences between these two groups. The fact that the mean loan size in the high concentration regions is smaller than in the low concentration regions over the span of the years in the analysis (significant in every year except for 2004) tells us that the high concentration regions are smaller than the low concentration regions when measured by the size of loans. At the same time, the average size of the banks measured by their loan sizes, the average number of banks in a region, and the number of loan customers and loan accounts on both regional and bank levels is smaller in high concentration regions. This suggests that the banks and the regions in which they operate are generally larger in magnitude when concentration is low. While the results from the t-tests do not allow us to infer about causal relationships between the variables, they do suggest that there are important differences between the two groups in respect to the variables selected and that these difference may help explain differences in the interest rate spread. To conclude, the results of the t-tests tell us that there are consistently higher interest rate spreads in high concentration regions than in low concentration regions. At the same time, the regions differ significantly in their structure depending on their level of concentration.

The results of the FE regressions give us reason to conclude that there are significant differences as to what determines the interest rate spread in highly concentrated and less concentrated regions. While a 0.10 increase in HHI increases the interest rate spread by 3.64 basis points (bp) in regions where concentration is high (HHI $>$ 0.20), which is similar to the findings of Kim et al. (2005), a similar increase in HHI has no effect on the interest rate spread in low concentration regions (HHI $\leq$ 0.20). However, the interest rate spread increase that banks in concentrated markets enjoy as a result of a 0.10 HHI increase is, at 3.64 bp, fairly small. Considering the trend of HHI and the interest rate spread in the years of our analysis, it is evident that HHI changes do not have a very large impact on the banks' interest rate spreads. A plausible, yet only suggestive, explanation for this is that banks in the Norwegian banking industry do not have very much market power vis-à-vis their customers in regions with low concentration, and only marginally so when regions become more concentrated. In any case, it is evident that there appears to be a threshold where HHI increases begin to have a positive impact on the interest rate spread, but once this threshold is

exceeded a further increase in market concentration does not necessarily lead to additional increases in the spread. This view is supported by the findings from the robustness tests, which show that market concentration does not have a larger impact on the spread in the top 25 percent regions than in all regions with HHI-levels above 0.20. In fact, the impact of HHI on the interest rate spread may even diminish at a certain point. The HHI-coefficient in the top 25 percent group is actually slightly smaller than in the group consisting of regions with HHI-levels above 0.20. However, the HHI-coefficient in the top 25 percent group is not significant, so this is only suggestive. What ultimately matters is that market concentration, as measured by HHI, is only a significant determinant of the interest rate spread in the regions that have HHI-levels above 0.20. At some level of market concentration this impact ceases to be significant. From this we can conclude that market concentration only impacts the interest rate spread in highly concentrated markets, and only moderately so. These findings give some support to the SCP hypothesis, which states that banks perform better as market concentration increases. However, it appears that this is only the case in markets with a certain level of concentration to begin with. As we have stated, the interest rate spread in low concentration regions appears to be unaffected by changes in HHI-levels. Since many of the larger markets, such as the regions Oslo, Bergen, Stavanger and Trondheim maintain fairly low concentration levels over the years, it gives us reason to question the validity of the SCP hypothesis. The validity of the SCP hypothesis is especially questionable when interest rate spreads are being used as a performance measure.

A somewhat at first glance surprising finding is that a banks' market share has a negative impact on the interest rate spread. Market share has a particularly strong negative effect in the interest rate spread in low concentration markets. This is an interesting observation because it contradicts with the intuitive assumption, and central argument in the efficiency hypothesis, that increased market share goes hand in hand with greater market power and thus the possibility to raise prices above competitive levels. There are several plausible reasons why we observe the reverse being the case in local Norwegian bank markets. First, it may very well be that other factors are present that limit a bank's ability to increase loan rates when its market share increases, thereby preventing the bank to gain market power when its market share rises. One such factor, which may be especially prevalent for banks in regions with very high concentration, is that the threat of new banks entering the market, or banks in other regions branching out into the region, can inhibit a bank already in the market to increase its loan rates even though it has gained market shares. In fact, lowering the loan rate on purpose

may be an effective entry barrier enabling a bank with increased market share to sustain these shares. Another factor is that competition can be so tough that an increase in loan rates above competitive levels simply would not be possible, especially in the low concentration regions where there are many banks to begin with. Second, it is not unlikely that a bank that increases its market share attracts different types of customers that have lower risk profiles and less probability of defaulting on their loans. Customers with less default risk will typically be offered lower loan rates. A switch in loan policy that aims at customers with lower risk profiles may in the end lead to higher cumulative profitability since the default risk diminishes, essentially leaving the bank better off. A third possibility as to why market share has a negative impact on the interest rate spread is that the coherence is simply a result of reverse causation between the two variables. Lowering the loan rates, and thereby also the spread, can result in an increase in market shares. Indeed, when running a regression with market share as the dependent variable and interest rate spread as an explanatory variable, the interest rate spread is a significant determinant both in high and low concentration markets. We also have to keep in mind that interest rate spreads only measure the relative performance of banks and being percentages do not reflect total profits in any way. As such, an interest rate decrease does not necessarily have to be associated with a decrease in earnings.

We will refrain from further attempts to explain the negative impact of market share on interest rate spreads here as any further elaboration would be mere guesswork, but we note that this relationship may be a topic worth exploring more thoroughly in future research. However, the fact that market share appears to be a strong determinant of the interest rate spread may help to explain the relatively small impact market concentration has on the interest rate spread. This relationship is consistent with the findings of Berger et al. (2004) who argue that the impact of market concentration on bank performance seems to diminish when a market share measure is included in the analysis. The negative impact market share has on the interest rate spread is much stronger in the low concentration regions (10.28 bp) than in the high concentration regions (45.12 bp). Although significant at all levels in both groups, this leads us to infer that market share is a relatively more important determinant of the interest rate spread in low concentration regions than in high concentration regions.

By comparing the regression results in the low concentration regions with the results in the high concentration regions we see that region specific variables, with the exception of market concentration and the average loan size in a region, seem to play a more prevalent role in determining the interest rate spread for banks in regions with low concentration than they do

for banks high concentration regions. The opposite is the case for bank specific variables. Common for both of the regions is that as the average size of loans in a region grows, indicating that the market for loans grows larger, the interest rate spread decreases. These findings indicate than not only does the interest rate spread decrease as individual banks grow larger at the expense of other banks, it also diminishes as the entire market expands its loans. This effect is much stronger in the low concentration regions than in the high concentration regions, meaning that, ceteris paribus, banks in low concentration regions are willing to grant credit at better terms for borrowers as loan size increases compared to banks in high concentration regions. The fact that the remaining region specific variables are significant in the low concentration regions but not in the high concentration regions, leads us to conclude that banks' interest rate spreads in low concentration markets are more sensitive to structural changes that are specific to their local markets than are banks in high concentration markets. In regions with high concentration the interest rate spread seems much less sensitive to such changes. The exception to this is the effect HHI has on the interest rate spreads in the respective type of regions. What we can infer from this is that banks in low concentration regions are to a lesser extent able to determine the loan rates they offer to customers, owing to the competitive forces that are present in these regions but absent in high concentration regions. This can be a possible motivation behind the increasing consolidation observed in Norwegian bank markets over the years in this study. Finally, we observe that events specific to each of the years, such as business cycle variations and sudden shocks, play a substantial role in determining the interest rate spread in both high and low concentration regions, but more so for banks in high concentration regions than for banks in low concentration regions, and we infer that banks' interest rate spreads in regions where concentration is high are more sensitive to conjectural variations and other factors that occur within specific years.

6.3 Limitations of the Study and Implications for Future Research

A possible limitation in our study is that our data sets do not adequately address all the firm specific variables that affect the interest rate banks charge on their loans. One such factor is the risk profile of the banks' customers. When determining the loan rates charged to customers, banks assess the customers' default or bankruptcy risks. Consequently, customers with high credit risk must usually pay higher loan rates. The composition of a bank's customers is among other things the result of the bank's business objectives and managers' willingness to take risk. The implication of this is that banks' average interest rate spreads may be affected by the risk profile of their pool of borrowers. The risk profile of banks'

customers could then serve as an explanatory variable in our analysis. However, we have not included this in our analysis due to limitations in the data we have used when conducting this study. Future research may find it feasible to conduct studies with explanatory variables that exploit the attributes of banks' customers, as well as the attributes of the banks themselves. Moreover, our findings suggest that increasing market shares have a negative impact in the interest rate spread. It may be interesting to elaborate further on the effect increasing market shares have on the interest rate spread in Norwegian bank markets. More research needs to be conducted to unveil the properties of this relationship and the robustness of this assessment.

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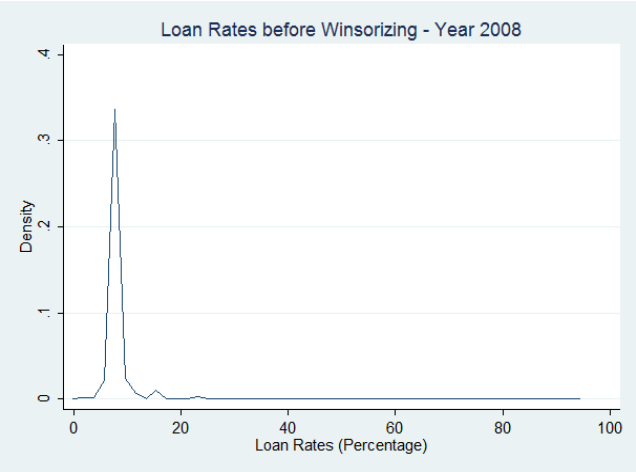
8. Appendices

Appendix A – Winsorization of Loan and Deposits Rates

Figure A.1 Loan Rates before Winsorizing for Year 2008



Percentiles		Smallest		
1 %	4.011578	0		
5 %	6.363584	0		
10 %	6.363584	0	Obs	679783
25 %	6.817157	0	Sum of Wgt.	679783
50 %	7.362967		Mean	7.580733
		Largest	Std. Dev.	1.700694
75 %	7.98303	55.59427		
90 %	8.775671	94.44444	Variance	2.892359
95 %	9.694343	94.44444	Skewness	5.635944
99 %	14.30638	94.44444	Kurtosis	116.2232

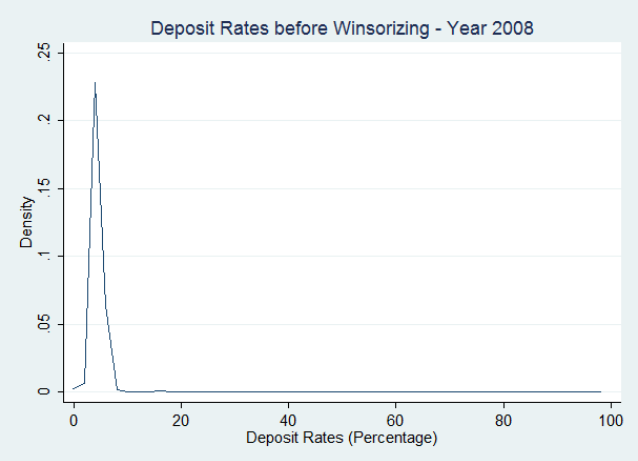
Figure A.1 shows distribution of loan rates after exclusion of loans with more than 100 percent loan rates. The summary statistics reveal that the mean loan rate was 7.581 percent, which is a plausible rate. However, there were still loans in the sample that had loan rates of 94.444 percent, which are likely to be incorrectly recorded loan rates. We therefore found it necessary to winsorize the loan rates for all years in our sample in order to smooth the outliers.

Figure A.2 Loan Rates after Winsorizing for Year 2008

Percentiles		Smallest		
1 %	6.363584	6.363584		
5 %	6.363584	6.363584		
10 %	6.363584	6.363584	Obs	679783
25 %	6.817157	6.363584	Sum of Wgt.	679783
50 %	7.362967		Mean	7.500906
		Largest	Std. Dev.	0.8880409
75 %	7.98303	9.694343		
90 %	8.775671	9.694343	Variance	0.7886167
95 %	9.694343	9.694343	Skewness	0.8451122
99 %	9.694343	9.694343	Kurtosis	3.068853

Figure A.2 shows distribution of loan rates winsorized with a fraction of 0.05 on each end. The outliers were smoothed and max loan rates decreased to 9.694 percent while minimum loan rates were 6.364. Note that the range of loan rates was narrowed to a more appropriate range.

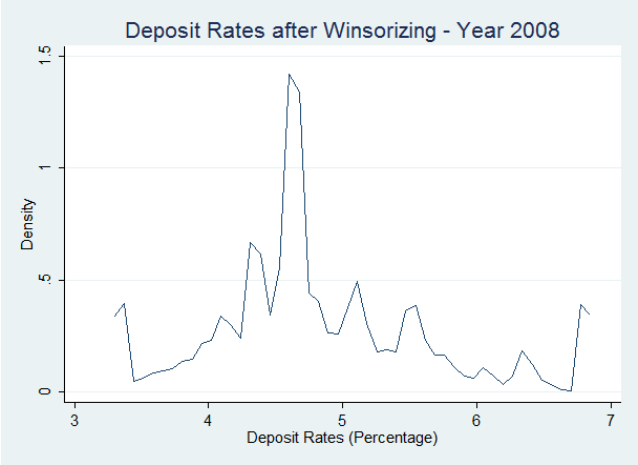
Figure A.3 Deposit Rates before Winsorizing for Year 2008



Percentiles		Smallest		
1 %	1.702617	0		
5 %	3.340697	0		
10 %	3.882268	0	Obs	666177
25 %	4.329919	0	Sum of Wgt.	666177
50 %	4.638833		Mean	4.884898
		Largest	Std. Dev.	1.535797
75 %	5.245714	98.23736		
90 %	6.068585	98.23736	Variance	2.358674
95 %	6.804098	98.23736	Skewness	11.38843
99 %	10.58099	98.23736	Kurtosis	405.0643

Figure A.3 shows distribution of deposit rates after exclusion of deposits with more than 100 percent deposit rates. As with loan rates, we found it purposeful to winsorize the deposit rates in order to smooth the outliers.

Figure A.4 Deposit Rates after Winsorizing for Year 2008



Percentiles		Smallest		
1 %	3.340697	3.340697		
5 %	3.340697	3.340697		
10 %	3.882268	3.340697	Obs	666177
25 %	4.329919	3.340697	Sum of Wgt.	666177
50 %	4.638833		Mean	4.831105
		Largest	Std. Dev.	0.8273997
75 %	5.245714	6.804098		
90 %	6.068585	6.804098	Variance	0.6845903
95 %	6.804098	6.804098	Skewness	0.6052752
99 %	6.804098	6.804098	Kurtosis	3.240568

Figure A.4 shows distribution of deposit rates winsorized with a fraction of 0.05 on each end. Note that the smoothing of outliers led to a more appropriate range in deposit rates.

Appendix B – Norwegian Concentration Measures

The table below shows various concentration measures for the Norwegian commercial bank market. The values are calculated based on the data sample that we used in our analysis. Further, the concentration measures are calculated based on lending banks. Note that the HTI values appear low. A possible explanation may be that the largest banks in Norway have unusually high market shares as opposed to their smaller peers. Another interesting observation is that all measures show that the market has become more concentrated from 1998 to 2008.

Table B.1 Concentration Measures for the Norwegian Commercial Loan Market

Index type	Range	Typical features	1998	2008
3-bank ratio	1/n < HHI < 1	Takes only large banks into account, arbitrary cut off.	0.468	0.626
4-bank ratio			0.530	0.705
5-bank ratio			0.582	0.741
HHI	1/n < HHI < 1	Considers all banks; sensitive to entrance of new banks.	0.105	0.163
HTI	0 < HTI < 1	Emphasis on absolute number of banks.	0.057	0.084
Rosenbluth	0 < RI < 1	Sensitive to changes in the size distribution of small banks.	0.056	0.080
CCI	0 < CCI < 1	Addresses relative dispersion and absolute magnitude; suitable for cartel markets.	0.331	0.432

Appendix C – Regions Ranked by Descending HHI

Figure C.1

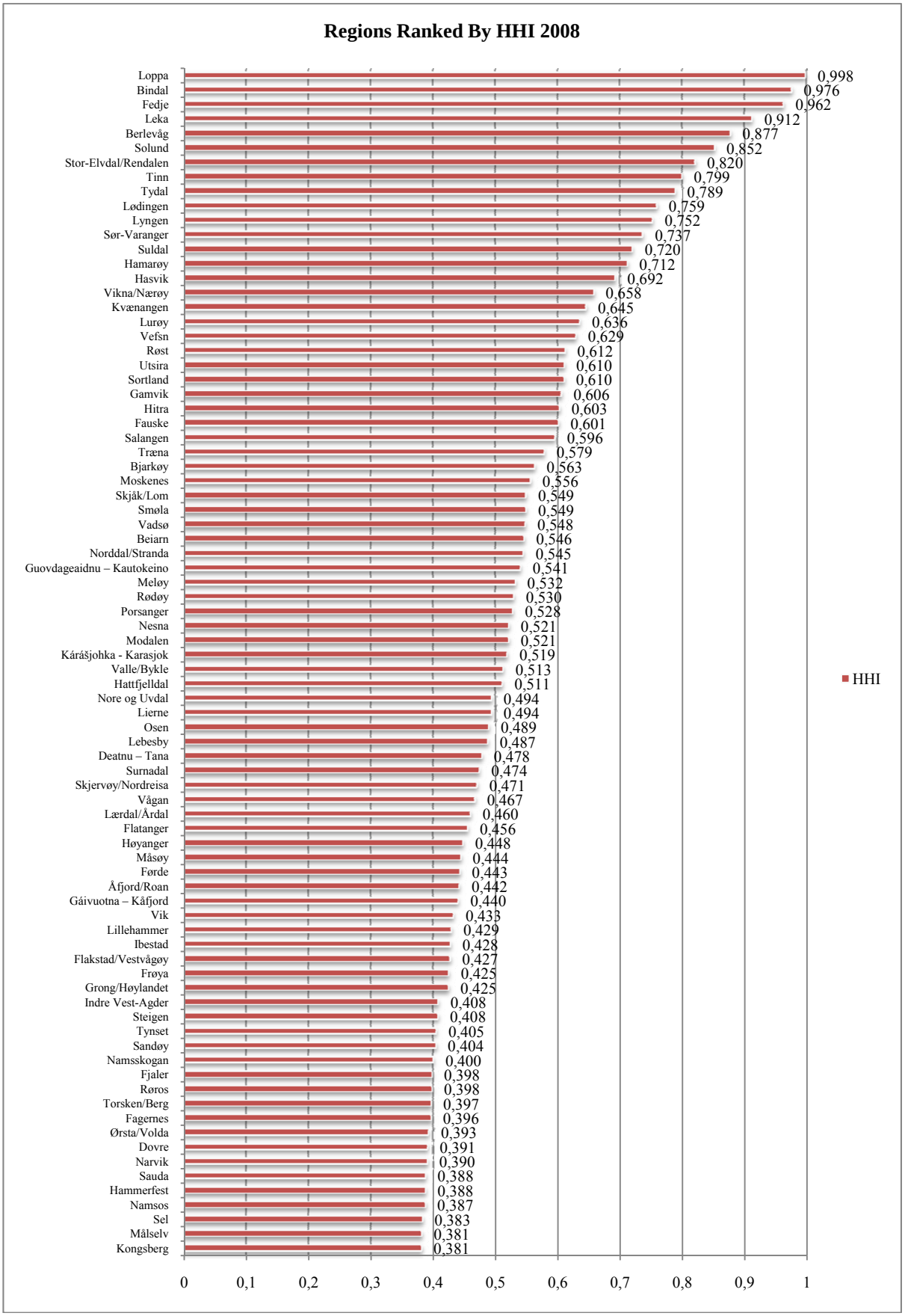


Figure C.1, Continued

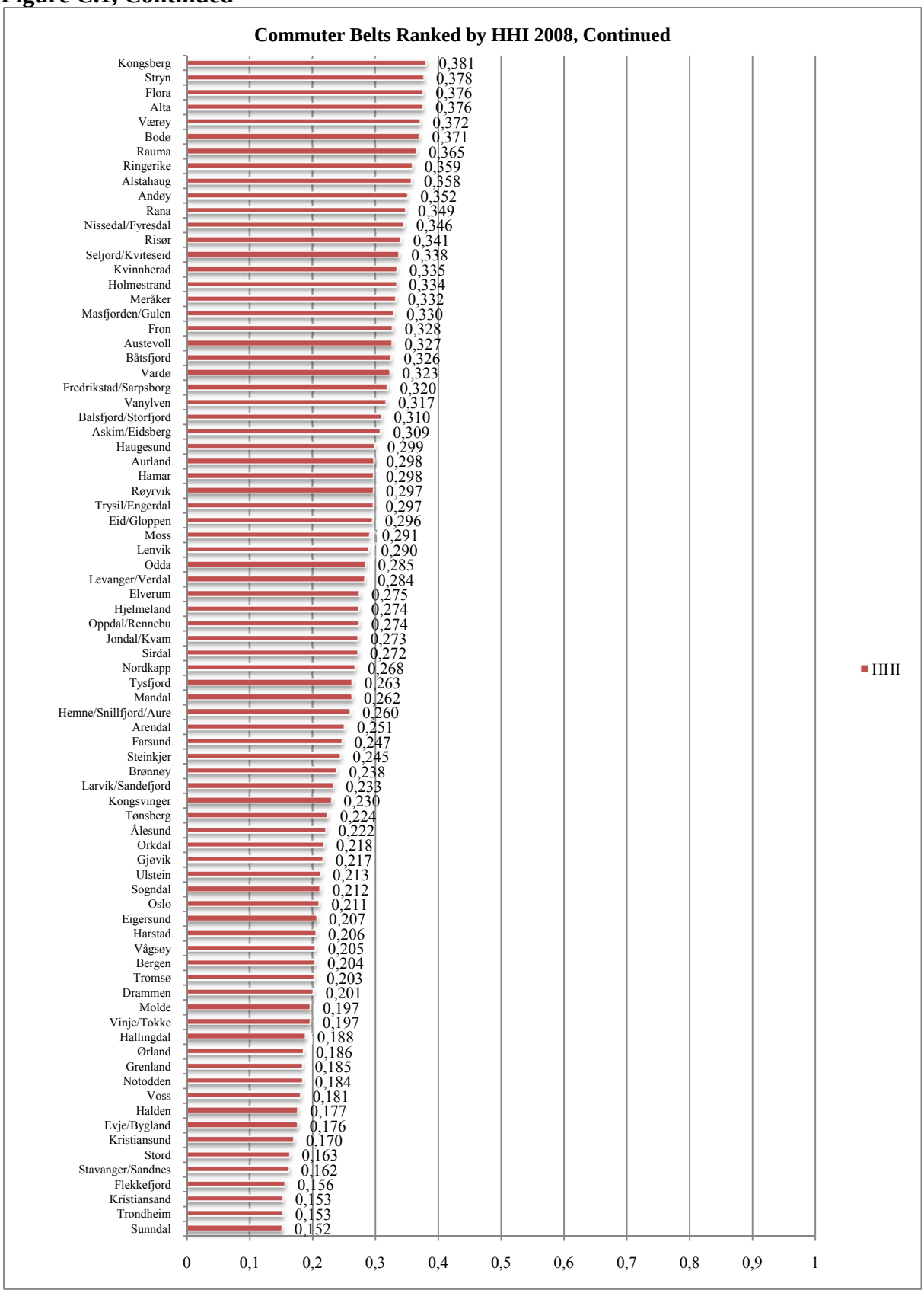


Figure 1 lists the complete set of the 161 regions (commuter belts) in Norway. The regions are sorted by descending HHI-level. In general, as expected, the most concentrated regions consist of smaller cities and rural areas of Norway. Figure 2 lists the commuter belts and HHI in 1998 to capture the change of HHI in the commuter belts.

Figure C.2

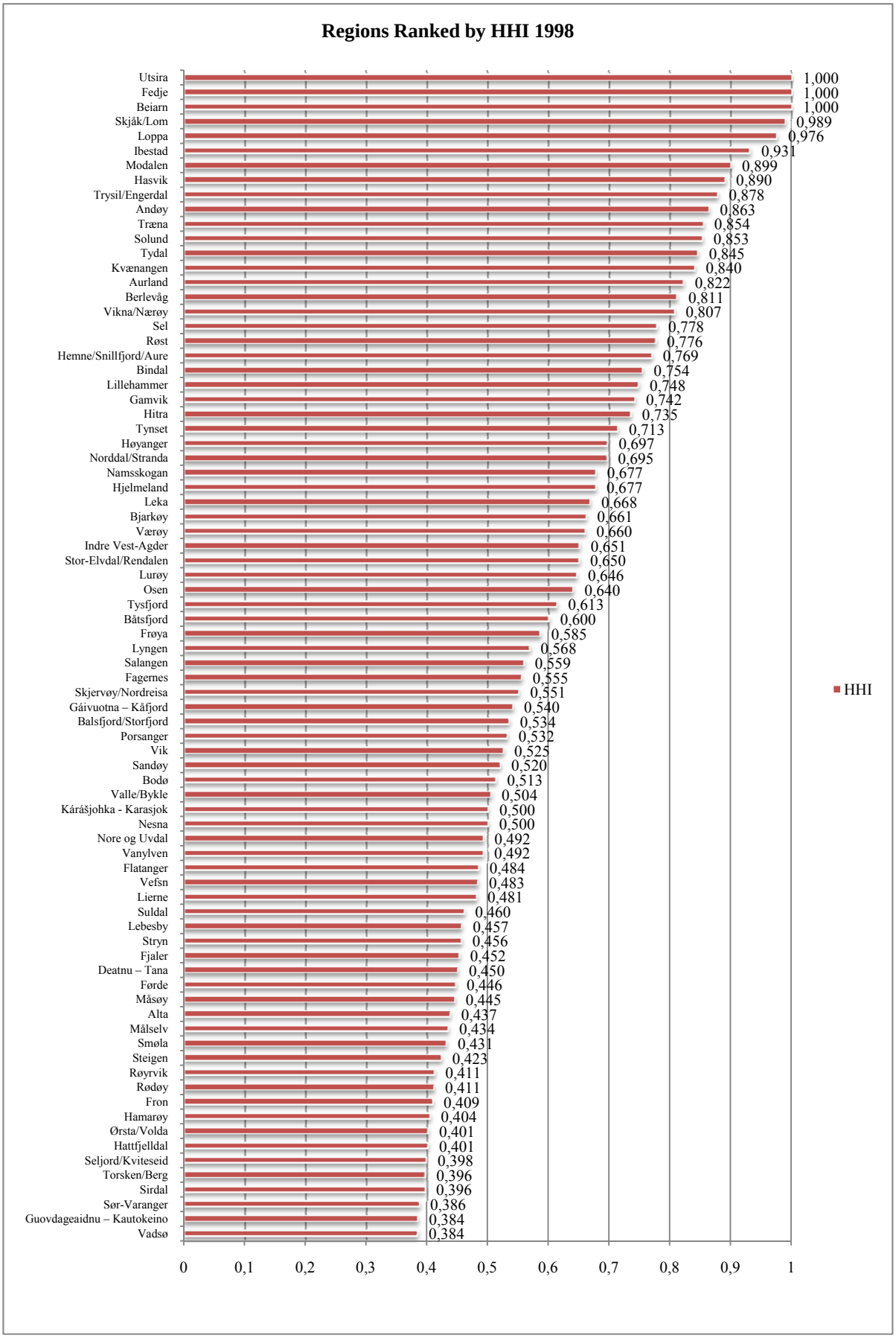
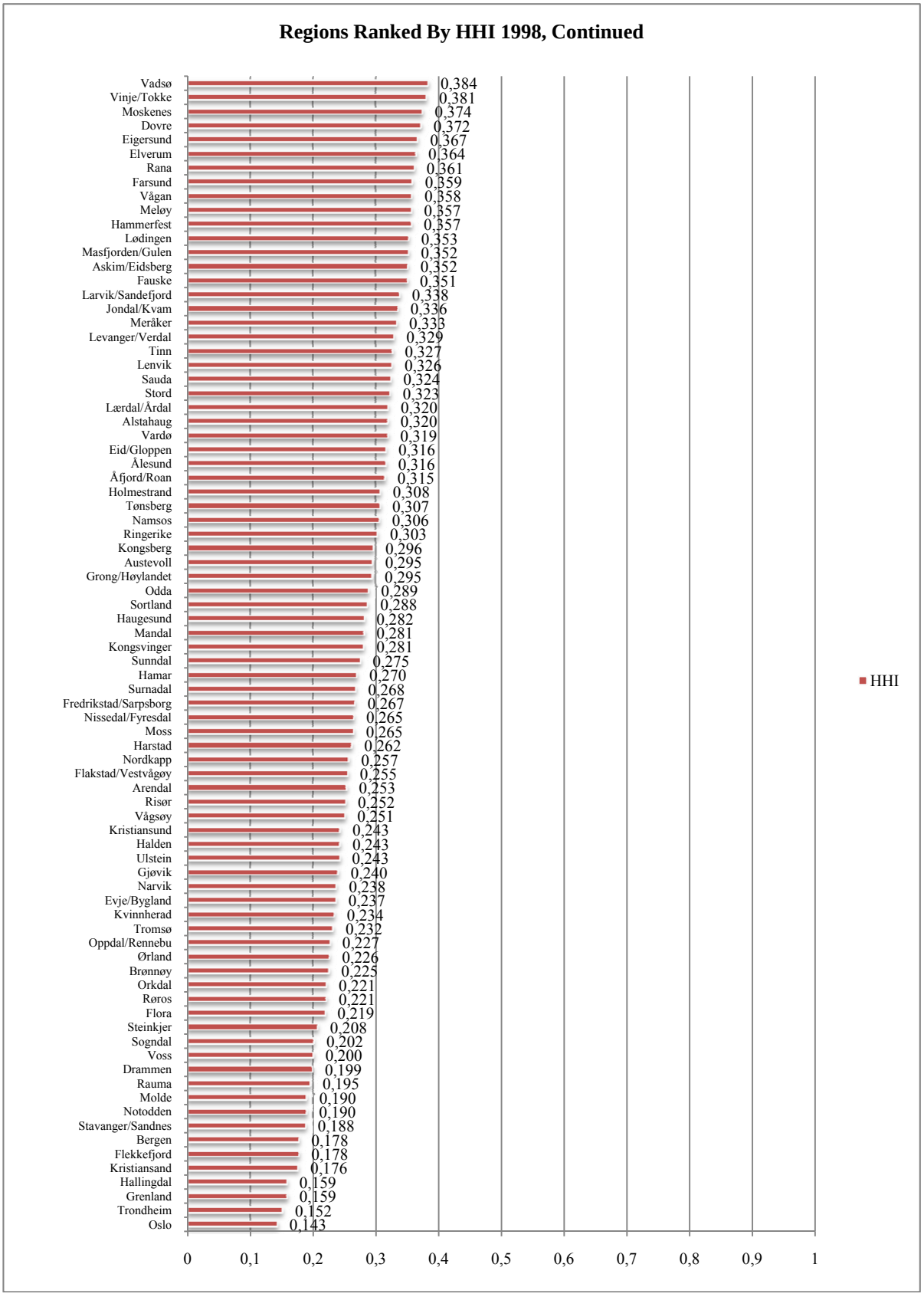

Regions Ranked by HHI 1998
Utsira 1,000
Fedje 1,000
Beiarn 1,000
Skjåk/Lom 0,989
Loppa 0,976
Ibestad 0,931
Modalen 0,899
Hasvik 0,890
Trysil/Engerdal 0,878
Andøy 0,863
Træna 0,854
Solund 0,853
Tydal 0,845
Kvænangen 0,840
Aurland 0,822
Berlevåg 0,811
Vikna/Nærøy 0,807
Sel 0,778
Røst 0,776
Hemne/Snillfjord/Aure 0,769
Bindal 0,754
Lillehammer 0,748
Gamvik 0,742
Hitra 0,735
Tynset 0,713
Høyanger 0,697
Norddal/Stranda 0,695
Namsskogan 0,677
Hjelmeland 0,677
Leka 0,668
Bjarkøy 0,661
Værøy 0,660
Indre Vest-Agder 0,651
Stor-Elvdal/Rendalen 0,650
Lurøy 0,646
Osen 0,640
Tysfjord 0,613
Båtsfjord 0,600
Frøya 0,585
Lyngen 0,568
Salangen 0,559
Fagernes 0,555
Skjervøy/Nordreisa 0,551
Gáivuotna – Kåfjord 0,540
Balsfjord/Storfjord 0,534
Porsanger 0,532
Vik 0,525
Sandøy 0,520
Bodø 0,513
Valle/Bykle 0,504
Kárášjohka - Karasjok 0,500
Nesna 0,500
Nore og Uvdal 0,492
Vanylven 0,492
Flatanger 0,484
Vefsn 0,483
Lierne 0,481
Suldal 0,460
Lebesby 0,457
Stryn 0,456
Fjaler 0,452
Deatnu – Tana 0,450
Førde 0,446
Måsøy 0,445
Alta 0,437
Målselv 0,434
Smøla 0,431
Steigen 0,423
Røyrvik 0,411
Rødøy 0,411
Fron 0,409
Hamarøy 0,404
Ørsta/Volda 0,401
Hattfjelldal 0,401
Seljord/Kviteseid 0,398
Torsken/Berg 0,396
Sirdal 0,396
Sør-Varanger 0,386
Guovdageaidnu – Kautokeino 0,384
Vadsø 0,384
0 0,1 0,2 0,3 0,4 0,5 0,6 0,7 0,8 0,9 1
HHI

Figure C.2, Continued



Appendix D – Overview Regions, Country Parts, and Provinces

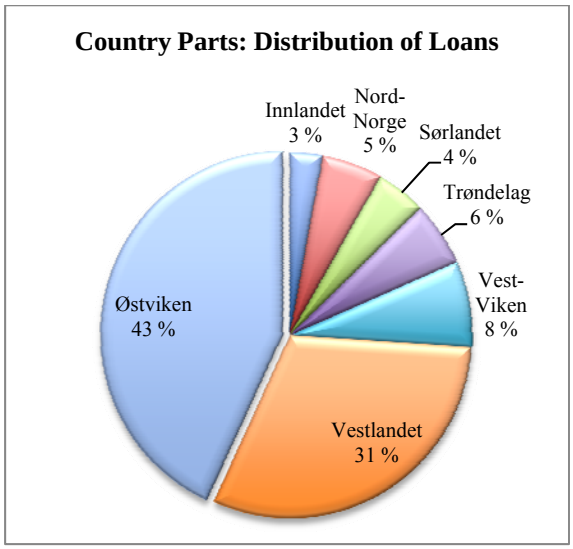
The below table shows regions (commuter belts) along with the geographical country part and province(s) they belong to. Norway has seven geographical country parts as defined by Statistics Norway (Statistisk sentralbyrå). Some regions encompass several provinces and therefore appear more than once in the list.

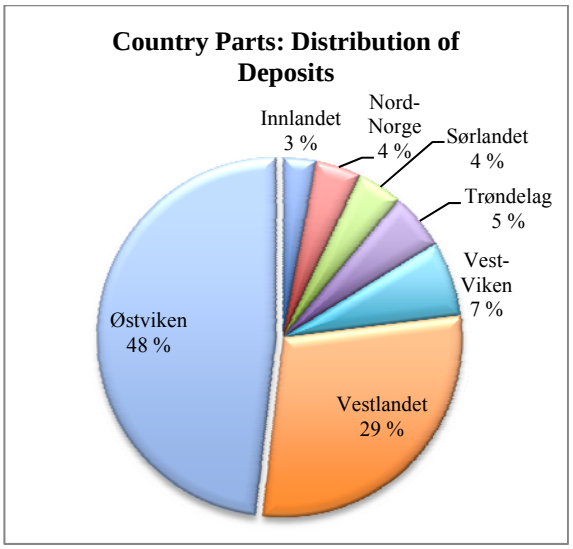
Region	Country Part	Province	Region	Country Part	Province
Alstahaug	Nord-Norge	Nordland	Hemne/Snillfjord/Aure	Trøndelag	Møre og Romsdal
Alta	Nord-Norge	Finnmark	Hemne/Snillfjord/Aure	Trøndelag	Sør-Trøndelag
Andøy	Nord-Norge	Nordland	Hitra	Trøndelag	Sør-Trøndelag
Arendal	Sørlandet	Aust-Agder	Hjelmeland	Vestlandet	Rogaland
Askim/Eidsberg	Østviken	Østfold	Holmestrand	Vest-Viken	Vestfold
Aurland	Vestlandet	Sogn og Fjordane	Høyanger	Vestlandet	Sogn og Fjordane
Austevoll	Vestlandet	Hordaland	Ibestad	Nord-Norge	Troms
Balsfjord/Storfjord	Nord-Norge	Troms	Indre Vest-Agder	Sørlandet	Vest-Agder
Beiarn	Nord-Norge	Nordland	Jondal/Kvam	Vestlandet	Hordaland
Bergen	Vestlandet	Hordaland	Kárášjohka - Karasjok	Nord-Norge	Finnmark
Berlevåg	Nord-Norge	Finnmark	Kongsberg	Vest-Viken	Buskerud
Bindal	Nord-Norge	Nordland	Kongsvinger	Innlandet	Hedmark
Bjarkøy	Nord-Norge	Troms	Kristiansand	Sørlandet	Aust-Agder
Bodø	Nord-Norge	Nordland	Kristiansand	Sørlandet	Vest-Agder
Brønnøy	Nord-Norge	Nordland	Kristiansund	Vestlandet	Møre og Romsdal
Båtsfjord	Nord-Norge	Finnmark	Kristiansund	Vestlandet	
Deatnu – Tana	Nord-Norge	Finnmark	Kvinnherad	Vestlandet	Hordaland
Dovre	Innlandet	Oppland	Kvænangen	Nord-Norge	Troms
Drammen	Vest-Viken	Buskerud	Larvik/Sandefjord	Vest-Viken	Vestfold
Drammen	Vest-Viken	Vestfold	Lebesby	Nord-Norge	Finnmark
Eid/Gloppen	Vestlandet	Sogn og Fjordane	Leka	Trøndelag	Nord-Trøndelag
Eigersund	Vestlandet	Rogaland	Lenvik	Nord-Norge	Troms
Elverum	Innlandet	Hedmark	Levanger/Verdal	Trøndelag	Nord-Trøndelag
Evje/Bygland	Sørlandet	Aust-Agder	Lierne	Trøndelag	Nord-Trøndelag
Fagernes	Innlandet	Oppland	Lillehammer	Innlandet	Oppland
Farsund	Sørlandet	Vest-Agder	Loppa	Nord-Norge	Finnmark
Fauske	Nord-Norge	Nordland	Lurøy	Nord-Norge	Nordland
Fedje	Vestlandet	Hordaland	Lyngen	Nord-Norge	Troms
Fjaler	Vestlandet	Sogn og Fjordane	Lærdal/Årdal	Vestlandet	Sogn og Fjordane
Flakstad/Vestvågøy	Nord-Norge	Nordland	Lødingen	Nord-Norge	Nordland
Flatanger	Trøndelag	Nord-Trøndelag	Mandal	Sørlandet	Vest-Agder
Flekkefjord	Sørlandet	Rogaland	Masfjorden/Gulen	Vestlandet	Hordaland
Flekkefjord	Sørlandet	Vest-Agder	Masfjorden/Gulen	Vestlandet	Sogn og Fjordane
Flora	Vestlandet	Sogn og Fjordane	Meløy	Nord-Norge	Nordland
Fredrikstad/Sarpsborg	Østviken	Østfold	Meråker	Trøndelag	Nord-Trøndelag
Fron	Innlandet	Oppland	Modalen	Vestlandet	Hordaland
Frøya	Trøndelag	Sør-Trøndelag	Molde	Vestlandet	Møre og Romsdal
Førde	Vestlandet	Sogn og Fjordane	Moskenes	Nord-Norge	Nordland
Gáivuotna – Kåfjord	Nord-Norge	Troms	Moss	Østviken	Østfold
Gamvik	Nord-Norge	Finnmark	Målselv	Nord-Norge	Troms
Gjøvik	Innlandet	Oppland	Måsøy	Nord-Norge	Finnmark
Grenland	Vest-Viken	Telemark	Namsos	Trøndelag	Nord-Trøndelag
Grong/Høylandet	Trøndelag	Nord-Trøndelag	Namsskogan	Trøndelag	Nord-Trøndelag
Guovdageaidnu –	Nord-Norge	Finnmark	Narvik	Nord-Norge	Nordland
Halden	Østviken	Østfold	Narvik	Nord-Norge	Troms
Hallingdal	Vest-Viken	Buskerud	Nesna	Nord-Norge	Nordland
Hamar	Innlandet	Hedmark	Nissedal/Fyresdal	Vest-Viken	Telemark
Hamarøy	Nord-Norge	Nordland	Norddal/Stranda	Vestlandet	Møre og Romsdal
Hammerfest	Nord-Norge	Finnmark	Nordkapp	Nord-Norge	Finnmark
Harstad	Nord-Norge	Nordland	Nore og Uvdal	Vest-Viken	Buskerud
Harstad	Nord-Norge	Troms	Notodden	Vest-Viken	Telemark
Hasvik	Nord-Norge	Finnmark	Odda	Vestlandet	Hordaland
Hattfjelldal	Nord-Norge	Nordland	Oppdal/Rennebu	Trøndelag	Sør-Trøndelag
Haugesund	Vestlandet	Hordaland	Orkdal	Trøndelag	Sør-Trøndelag
Haugesund	Vestlandet	Rogaland	Osen	Trøndelag	Sør-Trøndelag

Region	Country Part	Province
Oslo	Østviken	Akershus
Oslo	Østviken	Buskerud
Oslo	Østviken	Oppland
Oslo	Østviken	Oslo
Oslo	Østviken	Østfold
Porsanger	Nord-Norge	Finnmark
Rana	Nord-Norge	Nordland
Rauma	Vestlandet	Møre og Romsdal
Ringerike	Vest-Viken	Buskerud
Ringerike	Vest-Viken	Oppland
Risør	Sørlandet	Aust-Agder
Rødøy	Nord-Norge	Nordland
Røros	Trøndelag	Hedmark
Røros	Trøndelag	Sør-Trøndelag
Røst	Nord-Norge	Nordland
Røyrvik	Trøndelag	Nord-Trøndelag
Salangen	Nord-Norge	Troms
Sandøy	Vestlandet	Møre og Romsdal
Sauda	Vestlandet	Rogaland
Sel	Innlandet	Oppland
Seljord/Kviteseid	Vest-Viken	Telemark
Sirdal	Sørlandet	Vest-Agder
Skjervøy/Nordreisa	Nord-Norge	Troms
Skjåk/Lom	Innlandet	Oppland
Smøla	Vestlandet	Møre og Romsdal
Sogndal	Vestlandet	Sogn og Fjordane
Solund	Vestlandet	Sogn og Fjordane
Sortland	Nord-Norge	Nordland
Stavanger/Sandnes	Vestlandet	Rogaland
Steigen	Nord-Norge	Nordland
Steinkjer	Trøndelag	Nord-Trøndelag
Stord	Vestlandet	Hordaland
Stor-	Innlandet	Hedmark
Stryn	Vestlandet	Sogn og Fjordane
Suldal	Vestlandet	Rogaland
Sunndal	Vestlandet	Møre og Romsdal
Surnadal	Vestlandet	Møre og Romsdal
Sør-Varanger	Nord-Norge	Finnmark
Tinn	Vest-Viken	Telemark
Torsken/Berg	Nord-Norge	Troms
Tromsø	Nord-Norge	Troms
Trondheim	Trøndelag	Nord-Trøndelag
Trondheim	Trøndelag	Sør-Trøndelag
Trysil/Engerdal	Innlandet	Hedmark
Træna	Nord-Norge	Nordland
Tydal	Trøndelag	Sør-Trøndelag
Tynset	Innlandet	Hedmark
Tysfjord	Nord-Norge	Nordland
Tønsberg	Vest-Viken	Vestfold
Ulstein	Vestlandet	Møre og Romsdal
Utsira	Vestlandet	Rogaland
Vadsø	Nord-Norge	Finnmark
Valle/Bykle	Sørlandet	Aust-Agder
Vanylven	Vestlandet	Møre og Romsdal
Vardø	Nord-Norge	Finnmark
Vefsn	Nord-Norge	Nordland
Vik	Vestlandet	Sogn og Fjordane
Vikna/Nærøy	Trøndelag	Nord-Trøndelag
Vinje/Tokke	Vest-Viken	Telemark
Voss	Vestlandet	Hordaland
Værøy	Nord-Norge	Nordland
Vågan	Nord-Norge	Nordland
Vågsøy	Vestlandet	Sogn og Fjordane
Ørland	Trøndelag	Sør-Trøndelag
Ørsta/Volda	Vestlandet	Møre og Romsdal
Åfjord/Roan	Trøndelag	Sør-Trøndelag
Ålesund	Vestlandet	Møre og Romsdal

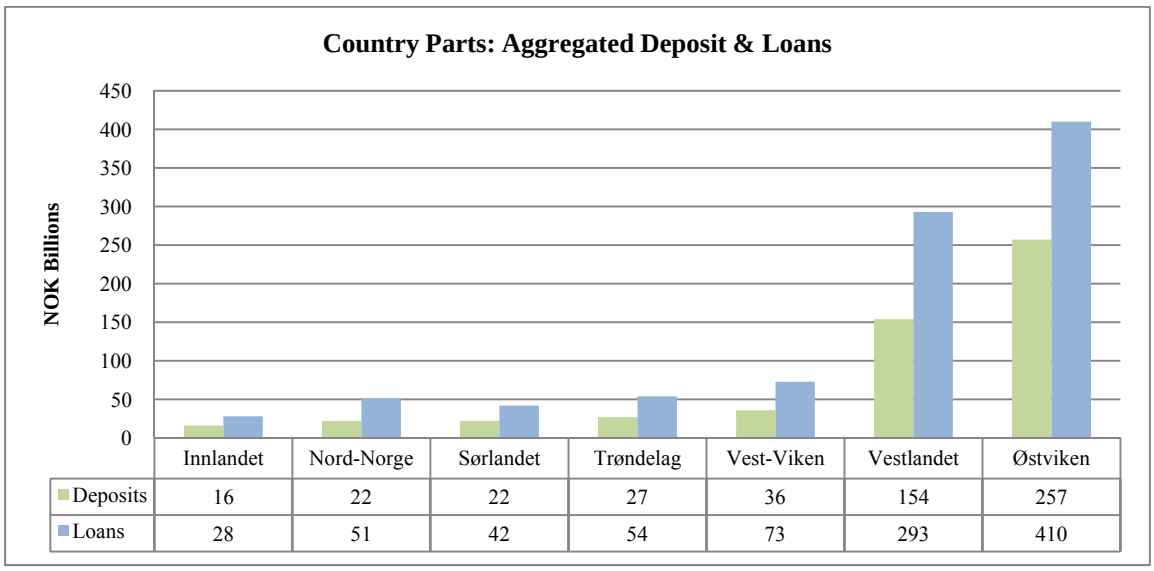
Appendix E – Country Parts

This appendix displays diagrams with various statistics for the country parts.

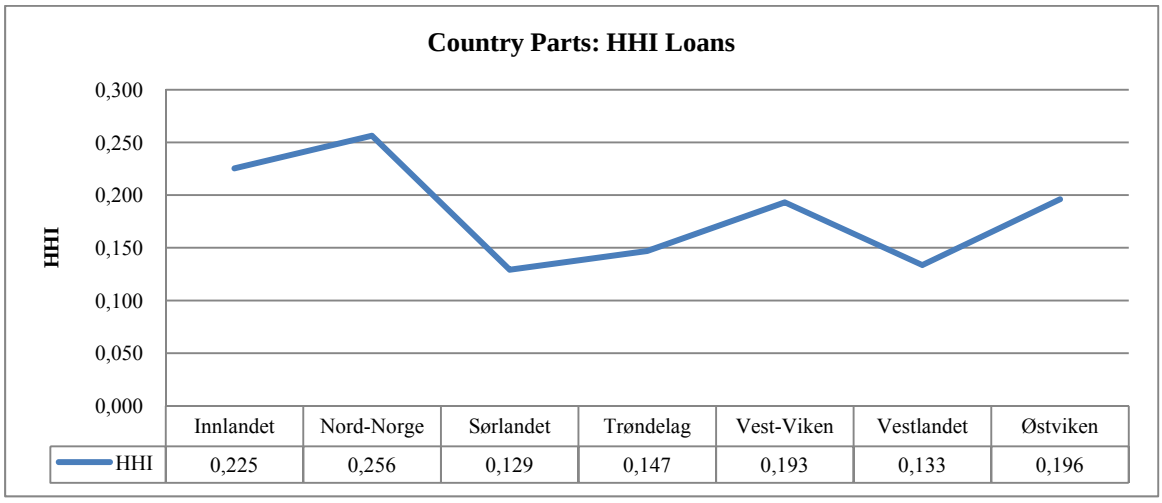




The figures Distribution of Loans and Deposits show that Østviken (which includes Oslo) clearly has the largest volumes in terms of loans and deposits. Vestlandet (includes Stavanger/Sandnes region) is the second largest country part.



	Innlandet	Nord-Norge	Sørlandet	Trøndelag	Vest-Viken	Vestlandet	Østviken
Deposits	16	22	22	27	36	154	257
Loans	28	51	42	54	73	293	410

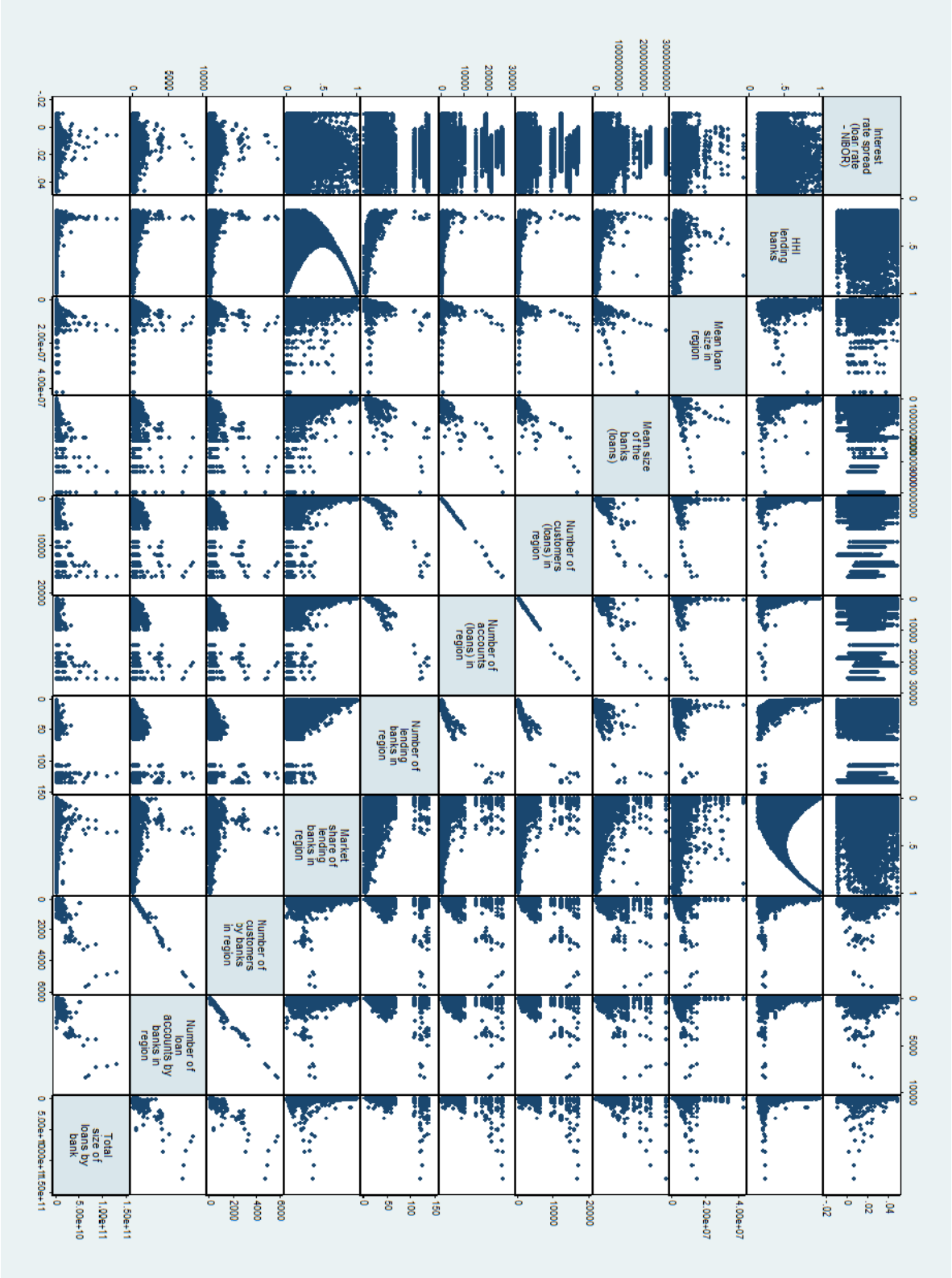


	Innlandet	Nord-Norge	Sørlandet	Trøndelag	Vest-Viken	Vestlandet	Østviken
HHI	0,225	0,256	0,129	0,147	0,193	0,133	0,196

Appendix F – Correlation Matrix

Figure F.1

Figure F.1 shows scatter plots of the correlations between all the variables used in the analysis. Observe the scatter plot of HHI lending banks and market share of the lending banks. This scatter plot shows that high market shares of banks are only present when HHI-levels are high, while low market shares can be observed regardless of the level of HHI.



Appendix G – T-tests

The tables above show the complete T-test results for the variables that we used in our analysis. There are two sets of tables, one for the main grouping of regions (High HHI Regions with HHI levels above 0.20, Low HHI Regions with levels equal to or less than 0.20) and one for the alternative grouping of the regions, top/bottom 25 percent by HHI-level.

Table G.1 T-tests High/Low HHI Period 1998-2008

Year	Test variable	Mean High HHI Regions	Mean Low HHI Regions	Results (Pr(|T| > |t|))
1998	Interest Rate Spread (Loan rate - NIBOR)	0.0211049	0.0187486	0.0010 *
	Interest Rate Spread (Loans-deposits)	0.0456089	0.0402202	0.0000 *
	Mean Loan Size Regional	1,767,233	2,963,352	0.0000 *
	Mean Loan Bank size region	7.12e+07	3.85e+08	0.0000 *
	Number of Loan Customers By Region	303.4865	3,992.765	0.0000 *
	Number of Loan Accounts By Region	541.7153	6,744.103	0.0000 *
	Number of Loan Banks By Region	12.086	46.97202	0.0000 *
	Marketshare (Loan banks)	0.1205906	0.0335731	0.0000 *
	Number of Loan Customers By Banks in Region	20.03774	62.96882	0.0000 *
	Number of Loan Accounts by Banks in Region	36.15669	106.6427	0.0000 *
	Loan Size By Banks in Region	4.2e+07	2.38e+08	0.0000 *
1999	Interest Rate Spread (Loan rate - NIBOR)	.0244112	.0241897	0.8738
	Interest Rate Spread (Loans-deposits)	.0419802	.0408018	0.5761
	Mean Loan Size Regional	2,214,018	2,438,208	0.0099 *
	Mean Loan Bank size region	1.68e+08	2.45e+08	0.0001 *
	Number of Loan Customers By Region	1,254.909	1,760.863	0.0191*
	Number of Loan Accounts By Region	2,038.658	3,012.536	0.0046 *
	Number of Loan Banks By Region	18.13778	31.37308	0.0000 *
	Marketshare (Loan banks)	.1299246	.0392157	0.0000 *
	Number of Loan Customers By Banks in Region	32.77536	51.20915	0.1172
	Number of Loan Accounts by Banks in Region	55.96899	88.06536	0.0890
	Loan Size By Banks in Region	9.02e+07	1.60e+08	0.1847
2000	Interest Rate Spread (Loan rate - NIBOR)	.012283	.008063	0.0000 *
	Interest Rate Spread (Loans-deposits)	.0372247	.0291588	0.0000 *
	Mean Loan Size Regional	2,312,183	3,632,016	0.0000 *
	Mean Loan Bank size region	9.17e+07	4.10e+08	0.0000 *
	Number of Loan Customers By Region	387.9533	4,269.235	0.0000 *
	Number of Loan Accounts By Region	675.9903	6,922.217	0.0000 *
	Number of Loan Banks By Region	14.86602	55.32815	0.0000 *
	Marketshare (Loan banks)	.1009749	.0282187	0.0000 *
	Number of Loan Customers By Banks in Region	20.37883	55.3157	0.0000 *
	Number of Loan Accounts by Banks in Region	35.99513	91.04938	0.0000*
	Loan Size By Banks in Region	6.11e+07	3.02e+08	0.0000 *

Table G.1 T-tests High/Low HHI Period 1998-2008, Continued

Year	Test variable	Mean High HHI Regions	Mean Low HHI Regions	Results (Pr(|T| > |t|))
2001	Interest Rate Spread (Loan rate - NIBOR)	.0124759	.0107925	0.0242 *
	Interest Rate Spread (Loans-deposits)	.0378661	.0339443	0.0043 *
	Mean Loan Size Regional	2,636,888	3,772,106	0.0000 *
	Mean Loan Bank size region	1.09e+08	4.18e+08	0.0000 *
	Number of Loan Customers By Region	423.5968	4,038.79	0.0000 *
	Number of Loan Accounts By Region	723.3138	6,495.576	0.0000 *
	Number of Loan Banks By Region	15.51622	52.81719	0.0000 *
	Marketshare (Loan banks)	.0999301	.0300501	0.0000 *
	Number of Loan Customers By Banks in Region	21.11041	53.01336	0.0000 *
	Number of Loan Accounts by Banks in Region	36.75332	87.21035	0.0000 *
	Loan Size By Banks in Region	7.10e+07	3.03e+08	0.0000 *
2002	Interest Rate Spread (Loan rate - NIBOR)	.0128142	.0123952	0.5302
	Interest Rate Spread (Loans-deposits)	.0349557	.0328451	0.0427 *
	Mean Loan Size Regional	2,633,441	3,732,278	0.0000 *
	Mean Loan Bank size region	9.73e+07	3.75e+08	0.0000 *
	Number of Loan Customers By Region	369.5604	3605.321	0.0000 *
	Number of Loan Accounts By Region	627.581	5674.36	0.0046 *
	Number of Loan Banks By Region	14.75909	48.70485	0.0000 *
	Marketshare (Loan banks)	.10162	.0322129	0.0000 *
	Number of Loan Customers By Banks in Region	19.84757	49.76751	0.0000 *
	Number of Loan Accounts by Banks in Region	34.17378	80.12325	0.0000 *
	Loan Size By Banks in Region	6.24e+07	2.60e+08	0.0000*
2003	Interest Rate Spread (Loan rate - NIBOR)	.0294207	.0290928	0.6259
	Interest Rate Spread (Loans-deposits)	.037899	.0342986	0.0003 *
	Mean Loan Size Regional	2,652,986	3,668,900	0.0000 *
	Mean Loan Bank size region	9.81e+07	4.25e+08	0.0000 *
	Number of Loan Customers By Region	318.8107	4,157.882	0.0000 *
	Number of Loan Accounts By Region	528.8957	6398.56	0.0000 *
	Number of Loan Banks By Region	13.51867	52.81206	0.0000 *
	Marketshare (Loan banks)	.1050671	.026041	0.0000 *
	Number of Loan Customers By Banks in Region	19.83979	55.38021	0.0000 *
	Number of Loan Accounts by Banks in Region	33.3994	87.04297	0.0000 *
	Loan Size By Banks in Region	5.99e+07	2.89e+08	0.0000 *

Table G.1 T-tests High/Low HHI Period 1998-2008, Continued

Year	Test variable	Mean High HHI Regions	Mean Low HHI Regions	Results (Pr(|T| > |t|))
2004	Interest Rate Spread (Loan rate - NIBOR)	.0288108	.0267732	0.0074 *
	Interest Rate Spread (Loans-deposits)	.0377432	.0350486	0.0036 *
	Mean Loan Size Regional	3,120,852	3,282,730	0.1642
	Mean Loan Bank size region	2.26e+08	2.30e+08	0.8452
	Number of Loan Customers By Region	1,667.83	1,519.732	0.4420
	Number of Loan Accounts By Region	2,572.25	2,396.833	0.5452
	Number of Loan Banks By Region	24.50019	32.00874	0.0000 *
	Marketshare (Loan banks)	.0886999	.0410959	0.0000 *
	Number of Loan Customers By Banks in Region	32.25213	39.98904	0.4239
	Number of Loan Accounts by Banks in Region	51.71567	63.49863	0.4249
	Loan Size By Banks in Region	1.43e+08	1.47e+08	0.9603
2005	Interest Rate Spread (Loan rate - NIBOR)	.024057	.0237438	0.6234
	Interest Rate Spread (Loans-deposits)	.0350704	.0329706	0.0097 *
	Mean Loan Size Regional	3,455,135	5,149,043	0.0000*
	Mean Loan Bank size region	2.02e+08	8.25e+08	0.0000*
	Number of Loan Customers By Region	728.3971	5,608.892	0.0000*
	Number of Loan Accounts By Region	1145.878	8470.504	0.0000*
	Number of Loan Banks By Region	16.51141	46.96172	0.0000 *
	Marketshare (Loan banks)	.1064748	.0350404	0.0000 *
	Number of Loan Customers By Banks in Region	30.46978	72.45553	0.0001 *
	Number of Loan Accounts by Banks in Region	48.55827	111.7197	0.0001*
	Loan Size By Banks in Region	1.04e+08	4.90e+08	0.0000*
2006	Interest Rate Spread (Loan rate - NIBOR)	.0182238	.0177184	0.3546
	Interest Rate Spread (Loans-deposits)	.0320097	.0300363	0.0098 *
	Mean Loan Size Regional	3,358,424	6,010,356	0.0000*
	Mean Loan Bank size region	1.68e+08	9.80e+08	0.0000*
	Number of Loan Customers By Region	650.4177	6,348.66	0.0000*
	Number of Loan Accounts By Region	1,015.124	9,658.795	0.0000*
	Number of Loan Banks By Region	16.66793	54.41971	0.0000 *
	Marketshare (Loan banks)	.0960922	.028133	0.0000 *
	Number of Loan Customers By Banks in Region	28.04741	78.79795	0.0000*
	Number of Loan Accounts by Banks in Region	44.17425	121.3836	0.0000*
	Loan Size By Banks in Region	9.12e+07	6.10e+08	0.0000*

Table G.1 T-tests High/Low HHI Period 1998-2008, Continued

Year	Test variable	Mean High HHI Regions	Mean Low HHI Regions	Results (Pr(|T| > |t|))
2007	Interest Rate Spread (Loan rate - NIBOR)	.0144222	.0141667	0.6578
	Interest Rate Spread (Loans-deposits)	.0318694	.0311251	0.4427
	Mean Loan Size Regional	2,213,970	2,438,208	0.0098 *
	Mean Loan Bank size region	1.68e+08	2.45e+08	0.0001*
	Number of Loan Customers By Region	1,254.909	1,760.863	0.0191*
	Number of Loan Accounts By Region	2,038.658	3,012.536	0.0046*
	Number of Loan Banks By Region	18.13778	31.37308	0.0000 *
	Marketshare (Loan banks)	.1299246	.0392157	0.0000 *
	Number of Loan Customers By Banks in Region	32.77536	51.20915	0.1172
	Number of Loan Accounts by Banks in Region	55.96899	88.06536	0.0890
	Loan Size By Banks in Region	9.02e+07	1.60e+08	0.1847
2008	Interest Rate Spread (Loan rate - NIBOR)	.0180415	.0163215	0.0137 *
	Interest Rate Spread (Loans-deposits)	.035121	.0334066	0.1292
	Mean Loan Size Regional	4,901,986	5,329,828	0.0173 *
	Mean Loan Bank Size Region	4.14e+08	4.92e+08	0.0518
	Number of Loan Customers By Region	1,832.501	2,075.068	0.2638
	Number of Loan Accounts By Region	2,858.905	3,236.549	0.2636
	Number of Loan Banks By Region	22.80029	35.73883	0.0000 *
	Marketshare (Loan banks)	0.0835227	0.0367454	0.0000 *
	Number of Loan Customers By Banks in Region	35.25682	48.99213	0.1331
	Number of Loan Accounts by Banks in Region	55.5983	76.67454	0.1364
	Loan Size By Banks in Region	2.14e+08	2.62e+08	0.6666

Table G.2 T-tests Top/Bottom 25 percent. Period 1998 - 2008

Year	Test variable	Mean Top 25 Percent Regions	Mean Bottom 25 Percent Regions	Results (Pr(|T| > |t|))
1998	Interest Rate Spread (Loan rate - NIBOR)	0.0226815	0.018577	0.0010 *
	Interest Rate Spread (Loans-deposits)	0.0486243	0.0403318	0.0000 *
	Mean Loan Size Regional	1,426,477	2,893,451	0.0000 *
	Mean Loan Bank size region	3.73e+07	3.72e+08	0.0000 *
	Number of Loan Customers By Region	103.4375	3,852.975	0.0000 *
	Number of Loan Accounts By Region	195.9036	6,506.977	0.0000 *
	Number of Loan Banks By Region	12.086	46.97202	0.0000 *
	Marketshare (Loan banks)	0.2005208	0.0345622	0.0000 *
	Number of Loan Customers By Banks in Region	12.55469	61.47926	0.0000 *
	Number of Loan Accounts by Banks in Region	23.52604	104.0461	0.0000 *
	Loan Size By Banks in Region	2.13e+07	2.29e+08	0.0001 *
1999	Interest Rate Spread (Loan rate - NIBOR)	0.026841	0.02364	0.0082*
	Interest Rate Spread (Loans-deposits)	0.0463268	0.0398485	0.0005 *
	Mean Loan Size Regional	1,645,267	3,104,880	0.0000*
	Mean Loan Bank size region	5.45e+07	3.82e+08	0.0000 *
	Number of Loan Customers By Region	118.2704	3,663.75	0.0000 *
	Number of Loan Accounts By Region	218.2704	5,927.605	0.0000 *
	Number of Loan Banks By Region	5.865506	44.04928	0.0000 *
	Marketshare (Loan banks)	0.2410423	0.04	0.0000 *
	Number of Loan Customers By Banks in Region	16.32899	60.645	0.0009 *
	Number of Loan Accounts by Banks in Region	30.11075	100.04	0.001 *
	Loan Size By Banks in Region	2.85e+07	2.28e+08	0.001 *
2000	Interest Rate Spread (Loan rate - NIBOR)	0.0140369	0.008063	0.0000 *
	Interest Rate Spread (Loans-deposits)	0.0419772	0.0291588	0.0000 *
	Mean Loan Size Regional	1,870,996	3,632,016	0.0000 *
	Mean Loan Bank size region	5.09e+07	4.10e+08	0.0000 *
	Number of Loan Customers By Region	147.6444	4,269.235	0.0000 *
	Number of Loan Accounts By Region	270.6616	6,922.217	0.0000 *
	Number of Loan Banks By Region	8.404696	55.32815	0.0000*
	Marketshare (Loan banks)	0.1594828	0.0282187	0.0000 *
	Number of Loan Customers By Banks in Region	14.09267	55.3157	0.0001 *
	Number of Loan Accounts by Banks in Region	25.72629	91.04938	0.0001*
	Loan Size By Banks in Region	3.26e+07	3.02e+08	0.0003 *

Table G.2 T-tests Top/Bottom 25 percent. Period 1998 – 2008, Continued

Year	Test variable	Mean Top 25 Percent Regions	Mean Bottom 25 Percent Regions	Results (Pr(|T| > |t|))
2001	Interest Rate Spread (Loan rate - NIBOR)	0.0127854	0.0108057	0.0428*
	Interest Rate Spread (Loans-deposits)	0.0382512	0.0339851	0.0171 *
	Mean Loan Size Regional	2,502,895	3,963,477	0.0000 *
	Mean Loan Bank size region	8.33e+07	4.49e+08	0.0000 *
	Number of Loan Customers By Region	152.9707	4,362.837	0.0000 *
	Number of Loan Accounts By Region	277.9184	7,012.279	0.0000 *
	Number of Loan Banks By Region	15.51622	52.81719	0.0000 *
	Marketshare (Loan banks)	14.43724	0.0272232	0.0000 *
	Number of Loan Customers By Banks in Region	8.450535	55.96552	0.0000 *
	Number of Loan Accounts by Banks in Region	26.2113	91.84936	0.0000 *
	Loan Size By Banks in Region	5.32e+07	3.25e+08	0.0006 *
2002	Interest Rate Spread (Loan rate - NIBOR)	0.0128844	0.0125127	0.6826
	Interest Rate Spread (Loans-deposits)	0.0353992	0.0329159	0.0784 *
	Mean Loan Size Regional	2,652,879	3,956,853	0.0000 *
	Mean Loan Bank size region	7.24e+07	4.38e+08	0.0000 *
	Number of Loan Customers By Region	160.914	4,425.159	0.0000 *
	Number of Loan Accounts By Region	287.0734	6,949.733	0.0046 *
	Number of Loan Banks By Region	8.75651	56.30653	0.0000 *
	Marketshare (Loan banks)	0.1551363	0.0268817	0.0000 *
	Number of Loan Customers By Banks in Region	14.37736	56.33513	0.0000 *
	Number of Loan Accounts by Banks in Region	25.60797	90.23118	0.0000 *
	Loan Size By Banks in Region	4.50e+07	3.07e+08	0.0004*
2003	Interest Rate Spread (Loan rate - NIBOR)	0.0294207	0.0290928	0.0327 *
	Interest Rate Spread (Loans-deposits)	0.0385755	0.0346514	0.0042*
	Mean Loan Size Regional	2,082,477	3,115,718	0.0000 *
	Mean Loan Bank size region	6,.6e+07	2.60e+08	0.0000 *
	Number of Loan Customers By Region	194.6998	2,048.188	0.0000 *
	Number of Loan Accounts By Region	339.2495	3,281.506	0.0000 *
	Number of Loan Banks By Region	9.133574	40.68927	0.0000 *
	Marketshare (Loan banks)	0.1521298	0.0296684	0.0000 *
	Number of Loan Customers By Banks in Region	17.30426	45.34206	0.0000 *
	Number of Loan Accounts by Banks in Region	30.21501	73.06632	.0001 *
	Loan Size By Banks in Region	3.89e+07	1.68e+08	0.0000 *

Table G.2 T-tests Top/Bottom 25 percent. Period 1998 – 2008, Continued

Year	Test variable	Mean Top 25 Percent Regions	Mean Bottom 25 Percent Regions	Results (Pr(|T| > |t|))
2004	Interest Rate Spread (Loan rate - NIBOR)	0.0295192	0.0269521	0.0022 *
	Interest Rate Spread (Loans-deposits)	0.0396952	0.035604	0.0000*
	Mean Loan Size Regional	2,807,200	3,1736,11 0	0.0007 *
	Mean Loan Bank size region	1.28e+08	2.18e+08	0.0000 *
	Number of Loan Customers By Region	356.9979	1,424.749	0.0000 *
	Number of Loan Accounts By Region	583.355	2,268.48	0.0000*
	Number of Loan Banks By Region	12.74395	32.15567	0.0000 *
	Marketshare (Loan banks)	0.144958	0.0411765	0.0000 *
	Number of Loan Customers By Banks in Region	21.21849	38.03922	0.0041 *
	Number of Loan Accounts by Banks in Region	35.59034	61.20196	0.0069 *
	Loan Size By Banks in Region	7.74e+07	1.39e+08	0.0508
2005	Interest Rate Spread (Loan rate - NIBOR)	0.0247119	0.0235683	0.1134
	Interest Rate Spread (Loans-deposits)	0.0370992	0.0329865	0.0000*
	Mean Loan Size Regional	3,104,688	4,681,969	0.0000*
	Mean Loan Bank size region	1.37e+08	6.66e+08	0.0000*
	Number of Loan Customers By Region	330.1513	4,475.425	0.0000*
	Number of Loan Accounts By Region	523.4137	6,773.266	0.0000*
	Number of Loan Banks By Region	16.51141	46.96172	0.0000 *
	Marketshare (Loan banks)	0.1654846	0.0386179	0.0000 *
	Number of Loan Customers By Banks in Region	22.91489	62.20325	0.0085 *
	Number of Loan Accounts by Banks in Region	37.34515	96.27439	0.0083*
	Loan Size By Banks in Region	7.03e+07	3.88e+08	0.0084*
2006	Interest Rate Spread (Loan rate - NIBOR)	0.0187928	0.0177021	0.0776
	Interest Rate Spread (Loans-deposits)	0.0334383	0.0303299	0.0004 *
	Mean Loan Size Regional	2,936,318	5,169,526	0.0000 *
	Mean Loan Bank size region	8.68e+07	7.73e+08	0.0000 *
	Number of Loan Customers By Region	178.758	4,994.313	0.0000 *
	Number of Loan Accounts By Region	293.0107	7,597.853	0.0000 *
	Number of Loan Banks By Region	8.184422	47.21413	0.0000 *
	Marketshare (Loan banks)	0.1627409	0.0316574	0.0000 *
	Number of Loan Customers By Banks in Region	17.18201	68.40596	0.0001*
	Number of Loan Accounts by Banks in Region	27.97859	105.2998	0.0001*
	Loan Size By Banks in Region	4.72e+07	4.59e+08	0.0019 *

Table G.2 T-tests Top/Bottom 25 percent. Period 1998 – 2008, Continued

Year	Test variable	Mean Top 25 Percent Regions	Mean Bottom 25 Percent Regions	Results (Pr(|T| > |t|))
2007	Interest Rate Spread (Loan rate - NIBOR)	0.0143891	0.0143937	0.9941
	Interest Rate Spread (Loans-deposits)	0.0335049	0.0310871	0.0183 *
	Mean Loan Size Regional	4,064,345	5,695,833	0.0000 *
	Mean Loan Bank size region	1.16e+08	8.80e+08	0.0000 *
	Number of Loan Customers By Region	163.5561	5,371.251	0.0000 *
	Number of Loan Accounts By Region	267.6453	8,207.021	0.0000 *
	Number of Loan Banks By Region	8.072961	47.35033	0.0000 *
	Marketshare (Loan banks)	0.1647597	0.0313531	0.0000 *
	Number of Loan Customers By Banks in Region	17.09611	74.7805	0.0000*
	Number of Loan Accounts by Banks in Region	27.83753	115.4241	0.0000 *
	Loan Size By Banks in Region	5.54e+07	5.04e+08	0.0015 *
2008	Interest Rate Spread (Loan rate - NIBOR)	0.0184183	0.0171248	0.0819
	Interest Rate Spread (Loans-deposits)	0.0366843	0.0338213	0.0151 *
	Mean Loan Size Regional	5,001,883	6,451,639	0.0000 *
	Mean Loan Bank Size Region	1.17e+08	1.01e+09	0.0000 *
	Number of Loan Customers By Region	167.0644	5,065.854	0.0000 *
	Number of Loan Accounts By Region	270.7706	7,892.851	0.0000 *
	Number of Loan Banks By Region	9.132425	46.88614	0.0000 *
	Marketshare (Loan banks)	0.1488934	0.0316456	0.0000 *
	Number of Loan Customers By Banks in Region	15.10463	69.96994	0.0000 *
	Number of Loan Accounts by Banks in Region	24.31187	109.318	0.0000 *
	Loan Size By Banks in Region	5.74e+07	5.63e+08	0.0016 *

Appendix H – Correlation Coefficients

Table 1 shows the complete list of correlation coefficients of the variable HHI and Interest Rate Spread (Loan Rate – NIBOR). A star behind the coefficient denotes significance at the 5 percent level.

Table H.1 Correlation Coefficients of HHI and Interest Rate Spread (Loan Rate –NIBOR)

Region	Correlation Coefficient	P	Region	Correlation Coefficient	P
Alstahaug	0.1812	0.0757	Ibestad	0.1687	0.2140
Alta	-0.1844	0.0736	Indre Vest-Agder	0.2548*	0.0209
Andøy	-0.2223	0.1132	Jondal/Kvam	-0.0473	0.5930
Arendal	-0.0921	0.1175	Kongsberg	0.2027*	0.0102
Askim/Eidsberg	0.0109	0.8613	Kongsvinger	0.1348	0.0659
Aurland	-0.0014	-0.0014	Kristiansund	0.0958	0.1350
Austevoll	-0.0750	0.4448	Kvinnherad	-0.0307	0.7081
Balsfjord/Storfjord	0.0544	0.6642	Kvænangen	0.1253	0.4801
Beiarn	0.2476	0.1718	Kárášjohka -	-0.1916	0.3018
Bergen	0.1506*	0.0006	Larvik/Sandefjord	0.2501*	0.0000
Berlevåg	0.1892	0.2487	Lebesby	0.3766*	0.0091
Bindal	0.4608*	0.0269	Leka	-0.0154	0.9241
Bjarkøy	0.1678	0.3507	Lenvik	0.3404*	0.0000
Bodø	-0.1400*	0.0403	Levanger/Verdal	0.0552	0.5124
Brønnøy	-0.4333*	0.0000	Lierne	0.0330	0.8440
Båtsfjord	0.1067	0.4702	Lillehammer	0.1489*	0.0455
Deatnu – Tana	0.2858	0.0600	Loppa	-0.2646	0.1502
Dovre	0.0945	0.3401	Lurøy	0.1658	0.2822
Drammen	0.1306*	0.0033	Lyngen	0.3280*	0.0099
Eid/Gloppen	-0.1669	0.0857	Lærdal/Årdal	0.3844*	0.0000
Eigersund	-0.0022	0.9785	Lødingen	0.0484	0.6698
Elverum	0.2378*	0.0020	Mandal	0.1415	0.0842
Evje/Bygland	-0.2269*	0.0239	Masfjorden/Gulen	0.3345*	0.0020
Fagernes	0.0375	0.6419	Meløy	0.3291*	0.0070
Farsund	0.0379	0.6421	Meråker	0.1644	0.2394
Fauske	0.1064	0.3153	Modalen	-0.0134	0.9506
Fedje	-0.1384	0.4501	Molde	0.0595	0.3344
Fjaler	-0.0701	0.4926	Moskenes	-0.2835*	0.0359
Flakstad/Vestvågøy	-0.1320	0.2048	Moss	0.0952	0.1056
Flatanger	0.0220	0.8927	Målselv	0.1973	0.0834
Flekkefjord	-0.0001	0.9988	Måsøy	-0.0483	0.7071
Flora	0.3633*	0.0000	Namsos	0.1651	0.0704
Fredrikstad/Sarpsborg	0.1937*	0.0001	Namsskogan	0.0343	0.8169
Fron	-0.0046	0.9620	Narvik	0.3188*	0.0001
Frøya	-0.0475	0.7256	Nesna	-0.0337	0.8407
Førde	-0.0428	0.5666	Nissedal/Fyresdal	0.0905	0.3730
Gamvik	0.1638	0.2880	Norddal/Stranda	-0.0268	0.8218
Gjøvik	0.1690*	0.0119	Nordkapp	-0.0245	0.8153
Grenland	-0.0855	0.0913	Nore og Uvdal	0.1488	0.3291
Grong/Høylandet	0.1752	0.2051	Notodden	0.2113*	0.0018
Guovdageaidnu –	0.3221	0.0591	Odda	0.2232*	0.0156
Gáivuotna – Kåfjord	-0.2795	0.0892	Oppdal/Rennebu	-0.0923	0.2779
Halden	0.1506*	0.0441	Orkdal	0.1244	0.1584
Hallingdal	0.1304	0.0745	Osen	0.4268*	0.0010
Hamar	0.1246*	0.0339	Oslo	0.2719*	0.0000
Hamarøy	-0.3215*	0.0228	Porsanger	-0.3761*	0.0141
Hammerfest	0.1382	0.1480	Rana	0.0756	0.3764
Harstad	-0.0318	0.6863	Rauma	-0.2581*	0.0031
Hasvik	00.2226	0.2207	Ringerike	0.2214*	0.0007
Hattfjelldal	0.2160	0.2603	Risør	0.1703	0.0587
Haugesund	0.2850*	0.0000	Rødøy	0.4401*	0.0012
Hemne/Snillfjord/Aure	-0.0025	0.9816	Røros	-0.0023	0.9784
Hitra	0.1749	0.1418	Røst	0.1273	0.4401
Hjelmeland	-0.1255	0.3437	Røyrvik	0.5659*	0.0002
Holmestrand	-0.1838*	0.0225	Salangen	-0.0396	0.7764
Høyanger	-0.0470	0.7080	Sandøy	0.1270	0.3379

Region	Correlation Coefficient	P
Sauda	-0.2110	0.1456
Sel	0.1180	0.3166
Seljord/Kviteseid	0.0961	0.2942
Sirdal	0.2581*	0.0120
Skjervøy/Nordreisa	0.1393	0.1982
Skjåk/Lom	-0.0253	0.8632
Smøla	-0.1544	0.2268
Sogndal	-0.1409	0.0920
Solund	0.1731	0.3517
Sortland	0.1929*	0.0234
Stavanger/Sandnes	0.0731	0.1232
Steigen	-0.0122	0.9305
Steinkjer	-0.0115	0.8676
Stor-Elvdal/Rendalen	0.0687	0.5804
Stord	0.0752	0.2922
Stryn	0.1825	0.0870
Sulda	0.0328	0.7831
Sunndal	0.3263*	0.0000
Surnadal	-0.0445	0.5988
Sør-Varanger	0.0239	0.8407
Tinn	0.2170	0.0652
Torsken/Berg	0.0737	0.5356
Tromsø	0.3391*	0.0000
Trondheim	0.1408*	0.0004
Trysil/Engerdal	0.1477	0.1827
Træna	-0.0234	0.8987
Tydal	-0.2788	0.0815
Tynset	0.0860	0.5135
Tysfjord	0.0653	0.6555
Tønsberg	0.1736*	0.0005
Ulstein	0.0142	0.8513
Utsira	0.3062	0.2166
Vadsø	-0.0086	0.9436
Valle/Bykle	0.1191	0.2990
Vanylven	-0.0214	0.8496
Vardø	-0.2230	0.0676
Vefsn	0.2561*	0.0097
Vik	0.2486	0.0576
Vikna/Nærøy	0.2452*	0.0284
Vinje/Tokke	0.4239*	0.0000
Voss	0.1480*	0.0461
Vågan	0.2226*	0.0301
Vågsøy	0.0135	0.8847
Værøy	0.0740	0.6373
Ørland	0.1810*	0.0386
Ørsta/Volda	-0.0955	0.2448
Åfjord/Roan	-0.1016	0.3491
Ålesund	-0.1317*	0.0270

Appendix I – Summary Statistics of the Panel Data

The tables presented in this appendix present summary statistics of the panel data that were used in the regressions. The standard deviations are decomposed into components of overall, between and within.

Table I.1 Years 1998 - 2008

Variable	Components of Std.Dev	Mean	Std. Dev.	Min	Max	Observations
iratespread(loans-deposits)	overall	0.0361171	0.0193205	-0.0439944	0.0863708	N = 16,563
	between		0.0155797	-0.0439944	0.0863708	n = 3,054
	within		0.0145865	-0.0401494	0.100075	T-bar = 5.42338
iratespread(loans-nibor)	overall	0.0191034	0.0147472	-0.0099608	0.0472835	N = 21,095
	between		0.010976	-0.0099608	0.0472835	n = 4061
	within		0.0120597	-0.0219113	0.0584596	T-bar = 5.19453
hhi	overall	0.3210468	0.1560644	0.122954	1	N = 35792
	between		0.1494844	0.127712	1	n = 6713
	within		0.0714773	-0.0828383	0.9098529	T-bar = 5.33174
loansize_reg	overall	3,363,550	2,967,746	161,619.4	4.20E+07	N = 35,792
	between		2,800,861	183,949	3.33E+07	n = 6,713
	within		1,563,107	-1.02E+07	3.66E+07	T-bar = 5.33174
banksize_reg	overall	2.59E+08	4.30E+08	492,858	3.00E+09	N = 21,095
	between		3.37E+08	65,6546.9	3.00E+09	n = 4,061
	within		1.91E+08	-7.33E+08	1.85E+09	T-bar = 5.19453
cust_reg	overall	1,410.789	2,910.392	1	16,887	N = 35,792
	between		2,311.587	1	16,754	n = 6,713
	within		5.12E+02	-2,919.211	5.18E+03	T-bar = 5.33174
acc_reg	overall	2,234.437	4.49E+03	2.00E+00	2.59E+04	N = 35,792
	between		3,588.548	2	25,874	n = 6,713
	within		702.2751	-3,875.786	7,573.437	T-bar = 5.33174
banks_reg	overall	24.19714	25.82592	1	135	N = 35,792
	between		21.31119	1	134	n = 6,713
	within		3.527815	5.397139	41.53047	T-bar = 5.33174
marketshare	overall	0.0839535	0.1665599	2.54E-11	1	N = 21,095
	between		0.1244456	2.54E-11	0.9515683	n = 4,061
	within		0.0675457	-0.6035411	0.7802306	T-bar = 5.19453
cust_bank	overall	34.33615	148.7971	1	5710	N = 21,095
	between		107.6428	1	3,825.273	n = 4,061
	within		45.39647	-2.08E+03	1,919.063	T-bar = 5.19453
acc_bank	overall	55.83792	230.2614	0	8479	N = 21095
	between		172.227	0.8571429	5691.818	n = 4061
	within		67.56627	-3086.162	2843.02	T-bar = 5.19453
loansize_bank	overall	1.54E+08	1.70E+09	0	1.29E+11	N = 35792
	between		1.04E+09	0	5.95E+10	n = 6713
	within		9.05E+08	-3.84E+10	6.94E+10	T-bar = 5.33174

Table I.2 - Year 1998

Variable	Components of Std.Dev	Mean	Std. Dev.	Min	Max	Observations
iratespread(loans-deposits)	overall	0.0441326	0.0179954	0.0039341	0.0763559	N = 1,325
	between		0.0179954	0.0039341	0.0763559	n = 1,325
	within		0	0.0441326	0.0441326	T = 1
iratespread(loans-nibor)	overall	0.0205043	0.0126337	0.0010855	0.0357468	N = 1,636
	between		0.0126337	0.0010855	0.0357468	n = 1,636
	within		0	0.0205043	0.0205043	T = 1
hhi	overall	0.3307779	0.1829264	0.1427994	1	N = 2,772
	between		0.1829264	0.1427994	1	n = 2,772
	within		0	0.3307779	0.3307779	T = 1
loansize_reg	overall	2,060,211	1,203,829	183,949	5,996,901	N = 2,772
	between		1,203,829	183,949	5,996,901	n = 2,772
	within		0	2,060,211	2,060,211	T = 1
banksize_reg	overall	1.51E+08	2.18E+08	589,825	8.35E+08	N = 1,636
	between		2.18E+08	589,825	8.35E+08	n = 1,636
	within		0	1.51E+08	1.51E+08	T = 1
cust_reg	overall	1,133.347	2.34E+03	1	1.03E+04	N = 2,772
	between		2340.052	1.00E+00	1.03E+04	n = 2,772
	within		0	1,133.347	1133.347	T = 1
acc_reg	overall	1,935.519	3,947.416	2	17,487	N = 2,772
	between		3,947.416	2	17,487	n = 2,772
	within		0	1,935.519	1,935.519	T = 1
banks_reg	overall	20.63131	23.4498	1	109	N = 2,772
	between		23.4498	1	109	n = 2,772
	within		0	20.63131	20.63131	T = 1
marketshare	overall	0.0984108	0.182831	5.98E-10	1	N = 1,636
	between		0.182831	5.98E-10	1	n = 1,636
	within		0	0.0984108	0.0984108	T = 1
cust_bank	overall	30.98044	120.9629	1.00E+00	2,617	N = 1,636
	between		120.9629	1	2,617	n = 1,636
	within		0	30.98044	30.98044	T = 1
acc_bank	overall	54.12347	200.8354	1	3,946	N = 1,636
	between		200.8354	1	3,946	n = 1,636
	within		0	54.12347	54.12347	T = 1
loansize_bank	overall	9.01E+07	7.08E+08	0	2.19E+10	N = 2,772
	between		7.08E+08	0	2.19E+10	n = 2,772
	within		0	9.01E+07	9.01E+07	T = 1

Table I.3 – Year 1999

Variable	Components of Std.Dev	Mean	Std. Dev.	Min	Max	Observations
iratespread(loans-deposits)	overall	0.0441909	0.0208227	0.0026679	0.0781361	N = 1,170
	between		0.0208227	0.0026679	0.0781361	n = 1,170
	within		0	0.0441909	0.0441909	T = 1
iratespread(loan rates-nibor)	overall	0.024386	0.0162334	0.0017885	0.0465331	N = 1,346
	between		0.0162334	0.0017885	0.0465331	n = 1,346
	within		0	0.024386	0.024386	T = 1
hhi	overall	0.3759929	0.1948375	0.1662146	1	N = 2,568
	between		0.1948375	0.1662146	1	n = 2,568
	within		0	0.3759929	0.3759929	T = 1
loansize_reg	overall	2,236,694	1,328,515	168,605.6	8,288,619	N = 2,568
	between		1,328,515	168,605.6	8,288,619	n = 2,568
	within		0	2,236,694	2,236,694	T = 1
banksize_reg	overall	1.77E+08	2.24E+08	650549.5	7.83E+08	N = 1,346
	between		2.24E+08	6.51E+05	7.83E+08	n = 1,346
	within		0	1.77E+08	1.77E+08	T = 1
cust_reg	overall	1,106.558	2,190.309	3	9,413	N = 2,568
	between		2,190.309	3	9,413	n = 2,568
	within		0	1,106.558	1,106.558	T = 1
acc_reg	overall	1,823.248	3,490.587	5	14,979	N = 2,568
	between		3,490.587	5	14,979	n = 2568
	within		0	1,823.248	1,823.248	T = 1
banks_reg	overall	19.4778	24.07892	1	107	N = 2,568
	between		24.07892	1	107	n = 2,568
	within		0	19.4778	19.4778	T = 1
marketshare	overall	0.1196137	0.21095	4.66E-10	1	N = 1,346
	between		0.21095	4.66E-10	1	n = 1,346
	within		0	0.1196137	0.1196137	T = 1
cust_bank	overall	34.87073	136.9944	1	2,780	N = 1,346
	between		136.9944	1	2,780	n = 1,346
	within		0	34.87073	34.87073	T = 1
acc_bank	overall	59.61664	219.7551	1	4,145	N = 1,346
	between		219.7551	1	4,145	n = 1,346
	within		0	59.61664	59.61664	T = 1
loansize_bank	overall	9.73E+07	8.10E+08	0	2.70E+10	N = 2,568
	between		8.10E+08	0.00E+00	2.70E+10	n = 2,568
	within		0	9.73E+07	9.73E+07	T = 1

Table I.4 – Year 2000

Variable	Components of Std.Dev	Mean	Std. Dev.	Min	Max	Observations
iratespread(loans-deposits)	overall	0.0347327	0.027731	-0.0439944	0.0823123	N = 1,395
	between		0.027731	-0.0439944	0.0823123	n = 1,395
	within		0	0.0347327	0.0347327	T = 1
iratespread(loan rates-nibor)	overall	0.0110884	0.0153959	-0.00895	0.0321043	N = 2,003
	between		0.0153959	-0.00895	0.0321043	n = 2,003
	within		0	0.0110884	0.0110884	T = 1
hhi	overall	0.2958795	0.1528451	0.1444712	1.00E+00	N = 2,928
	between		0.1528451	0.1444712	1	n = 2,928
	within		0	0.2958795	0.2958795	T = 1
loansize_reg	overall	2,659,653	1.71E+06	212,211.1	1.37E+07	N = 2,928
	between		1,708,934	2.12E+05	1.37E+07	n = 2,928
	within		0	2,659,653	2,659,653	T = 1
banksize_reg	overall	1.82E+08	2.46E+08	1,456,177	9.45E+08	N = 2,003
	between		2.46E+08	1,456,177	9.45E+08	n = 2,003
	within		0	1.82E+08	1.82E+08	T = 1
cust_reg	overall	1,313.908	2,660.007	3	12,015	N = 2,928
	between		2,660.007	3	12,015	n = 2,928
	within		0	1,313.908	1,313.908	T = 1
acc_reg	overall	2,169.434	4,250.937	6	19,163	N = 2,928
	between		4,250.937	6	19,163	n = 2,928
	within		0	2,169.434	2,169.434	T = 1
banks_reg	overall	25.52049	28.37983	1.00E+00	134	N = 2,928
	between		28.37983	1	134	n = 2,928
	within		0	25.52049	25.52049	T = 1
marketshare	overall	0.0803794	0.1582103	1.93E-10	1	N = 2,003
	between		0.1582103	1.93E-10	1	n = 2,003
	within		0	0.0803794	0.0803794	T = 1
cust_bank	overall	30.2686	125.5437	1	2,703	N = 2,003
	between		125.5437	1	2,703	n = 2,003
	within		0	30.2686	30.2686	T = 1
acc_bank	overall	51.58213	2.01E+02	1	4.02E+03	N = 2,003
	between		200.7635	1.00E+00	4.02E+03	n = 2,003
	within		0	51.58213	51.58213	T = 1
loansize_bank	overall	1.24E+08	1.04E+09	0	3.26E+10	N = 2,928
	between		1.04E+09	0	3.26E+10	n = 2,928
	within		0	1.24E+08	1.24E+08	T = 1

Table I.5 - Year 2001

Variable	Components of Std.Dev	Mean	Std. Dev.	Min	Max	Observations
iratespread(loans-deposits)	overall	0.0366759	0.0251547	-0.0107949	0.0863708	N = 1,585
	between		0.0251547	-0.0107949	0.0863708	n = 1,585
	within		0	0.0366759	0.0366759	T = 1
iratespread(loan rates-nibor)	overall	0.0119792	0.0153554	-0.0099608	3.08E-02	N = 2,030
	between		0.0153554	-0.0099608	0.0308328	n = 2,030
	within		0	0.0119792	0.0119792	T = 1
hhi	overall	0.3004264	1.53E-01	0.1362995	9.25E-01	N = 3,015
	between		0.1534881	1.36E-01	9.25E-01	n = 3,015
	within		0	0.3004264	0.3004264	T = 1
loansize_reg	overall	2,947,913	2,080,879	161,619.4	1.43E+07	N = 3,015
	between		2,080,879	161,619.4	1.43E+07	n = 3,015
	within		0	2,947,913	2,947,913	T = 1
banksize_reg	overall	2.00E+08	2.69E+08	9,69,716.3	1.02E+09	N = 2,030
	between		2.69E+08	9,69,716.3	1.02E+09	n = 2,030
	within		0	2.00E+08	2.00E+08	T = 1
cust_reg	overall	1,340.01	2,685.581	3	12,232	N = 3,015
	between		2,685.581	3	12,232	n = 3,015
	within		0	1,340.01	1,340.01	T = 1
acc_reg	overall	2,192.194	4,235.424	4.00E+00	19,198	N = 3,015
	between		4,235.424	4	19,198	n = 3,015
	within		0	2,192.194	2,192.194	T = 1
banks_reg	overall	25.73532	27.82403	2	132	N = 3,015
	between		27.82403	2	132	n = 3,015
	within		0	25.73532	25.73532	T = 1
marketshare	overall	0.0793103	0.1558145	4.18E-10	0.9615608	N = 2,030
	between		0.1558145	4.18E-10	0.9615608	n = 2,030
	within		0	0.0793103	0.0793103	T = 1
cust_bank	overall	30.52414	1.25E+02	1	2.76E+03	N = 2,030
	between		125.2783	1.00E+00	2.76E+03	n = 2,030
	within		0	30.52414	30.52414	T = 1
acc_bank	overall	51.64138	199.826	1	4,090	N = 2,030
	between		199.826	1	4,090	n = 2,030
	within		0	51.64138	51.64138	T = 1
loansize_bank	overall	1.35E+08	1.12E+09	0	3.31E+10	N = 3,015
	between		1.12E+09	0	3.31E+10	n = 3,015
	within		0	1.35E+08	1.35E+08	T = 1

Table I.6 - Year 2002

Variable	Components of Std.Dev	Mean	Std. Dev.	Min	Max	Observations
iratespread(loans-deposits)	overall	0.0342231	0.0199569	-0.0084086	6.46E-02	N = 1,619
	between		0.0199569	-0.0084086	0.0646097	n = 1,619
	within		0	0.0342231	0.0342231	T = 1
iratespread(loan rates-nibor)	overall	0.0126698	1.44E-02	-0.0087701	2.95E-02	N = 2,072
	between		0.0144371	-8.77E-03	2.95E-02	n = 2,072
	within		0	0.0126698	0.0126698	T = 1
hhi	overall	0.2903574	0.1455015	0.127712	1	N = 3,147
	between		0.1455015	0.127712	1	n = 3,147
	within		0	0.2903574	0.2903574	T = 1
loansize_reg	overall	2,993,048	1,968,967	196,390	1.57E+07	N = 3,147
	between		1,968,967	196,390	1.57E+07	n = 3,147
	within		0	2,993,048	2993048	T = 1
banksize_reg	overall	1.93E+08	2.53E+08	960,590.7	9.88E+08	N = 2,072
	between		2.53E+08	960,590.7	9.88E+08	n = 2,072
	within		0	1.93E+08	1.93E+08	T = 1
cust_reg	overall	1,318.027	2,635.9	3.00E+00	12,173	N = 3,147
	between		2,635.9	3	12,173	n = 3,147
	within		0	1,318.027	1,318.027	T = 1
acc_reg	overall	2,112.657	4,070.076	6	18,714	N = 3,147
	between		4,070.076	6	18,714	n = 3,147
	within		0	2,112.657	2,112.657	T = 1
banks_reg	overall	25.8694	27.93957	1	134	N = 3,147
	between		27.93957	1	134	n = 3,147
	within		0	25.8694	25.8694	T = 1
marketshare	overall	0.0777027	1.53E-01	2.07E-10	1.00E+00	N = 2,072
	between		0.1533047	2.07E-10	1.00E+00	n = 2,072
	within		0	0.0777027	0.0777027	T = 1
cust_bank	overall	30.15782	121.9428	1	2,586	N = 2,072
	between		121.9428	1	2,586	n = 2,072
	within		0	30.15782	30.15782	T = 1
acc_bank	overall	50.00772	191.675	1	3,807	N = 2,072
	between		191.675	1	3,807	n = 2,072
	within		0	50.00772	50.00772	T = 1
loansize_bank	overall	1.27E+08	1.05E+09	0	3.53E+10	N = 3,147
	between		1.05E+09	0	3.53E+10	n = 3,147
	within		0	1.27E+08	1.27E+08	T = 1

Table I.7 – Year 2003

Variable	Components of Std.Dev	Mean	Std. Dev.	Min	Max	Observations
iratespread(loans-deposits)	overall	0.0365563	1.93E-02	-0.0107414	6.61E-02	N = 1,617
	between		0.0193377	-1.07E-02	6.61E-02	n = 1,617
	within		0	0.0365563	0.0365563	T = 1
iratespread(loan rates-nibor)	overall	0.0293014	0.0148625	0.0068553	0.0472835	N = 2,110
	between		0.0148625	0.0068553	0.0472835	n = 2,110
	within		0	0.0293014	0.0293014	T = 1
hhi	overall	0.2991742	0.1498129	0.122954	1	N = 3,324
	between		0.1498129	0.122954	1	n = 3,324
	within		0	0.2991742	0.2991742	T = 1
loansize_reg	overall	2,997,736	2,273,799	231,883.5	1.90E+07	N = 3,324
	between		2,273,799	231,883.5	1.90E+07	n = 3,324
	within		0	2,997,736	2997736	T = 1
banksize_reg	overall	2.17E+08	3.17E+08	6.04E+05	1.26E+09	N = 2,110
	between		3.17E+08	603582.7	1.26E+09	n = 2,110
	within		0	2.17E+08	2.17E+08	T = 1
cust_reg	overall	1,479.714	3,048.374	5	14,415	N = 3,324
	between		3,048.374	5	14,415	n = 3,324
	within		0	1,479.714	1,479.714	T = 1
acc_reg	overall	2,313.836	4,592.932	6	21,611	N = 3,324
	between		4,592.932	6	21,611	n = 3,324
	within		0	2,313.836	2,313.836	T = 1
banks_reg	overall	26.85289	2.82E+01	1	1.35E+02	N = 3,324
	between		28.21652	1.00E+00	1.35E+02	n = 3,324
	within		0	26.85289	26.85289	T = 1
marketshare	overall	0.0763033	0.1551849	1.36E-10	1	N = 2,110
	between		0.1551849	1.36E-10	1	n = 2,110
	within		0	0.0763033	0.0763033	T = 1
cust_bank	overall	32.77583	141.0108	1	3,296	N = 2,110
	between		141.0108	1	3,296	n = 2,110
	within		0	32.77583	32.77583	T = 1
acc_bank	overall	52.92464	217.0364	1	5,075	N = 2110
	between		217.0364	1	5,075	n = 2110
	within		0	52.92464	52.92464	T = 1
loansize_bank	overall	1.38E+08	1.39E+09	0	5.79E+10	N = 3,324
	between		1.39E+09	0	5.79E+10	n = 3,324
	within		0	1.38E+08	1.38E+08	T = 1

Table I.8 - Year 2004

Variable	Components of Std.Dev	Mean	Std. Dev.	Min	Max	Observations
iratespread(loans-deposits)	overall	0.0372566	0.0141281	0.0052146	0.0565282	N = 1,567
	between		0.0141281	0.0052146	0.0565282	n = 1,567
	within		0	0.0372566	0.0372566	T = 1
iratespread(loan rates-nibor)	overall	0.028441	0.0131463	0.0082187	0.0430466	N = 2,011
	between		0.0131463	0.0082187	0.0430466	n = 2,011
	within		0	0.028441	0.028441	T = 1
hhi	overall	0.3243501	0.144513	0.1427265	0.9948181	N = 3,169
	between		0.144513	0.1427265	0.9948181	n = 3,169
	within		0	0.3243501	0.3243501	T = 1
loansize_reg	overall	3,150,087	2,519,533	226272.7	1.86E+07	N = 3,169
	between		2,519,533	226272.7	1.86E+07	n = 3,169
	within		0	3,150,087	3,150,087	T = 1
banksize_reg	overall	2.27E+08	3.30E+08	654,084	1.26E+09	N = 2,011
	between		3.30E+08	654,084	1.26E+09	n = 2,011
	within		0	2.27E+08	2.27E+08	T = 1
cust_reg	overall	1,473.186	2,928.72	5	13,665	N = 3,169
	between		2,928.72	5	13,665	n = 3,169
	within		0	1,473.186	1,473.186	T = 1
acc_reg	overall	2,293.463	4,419.979	6	2,0516	N = 3,169
	between		4,419.979	6	2,0516	n = 3,169
	within		0	2,293.463	2,293.463	T = 1
banks_reg	overall	25.85547	26.8482	2	129	N = 3,169
	between		26.8482	2	129	n = 3,169
	within		0	25.85547	25.85547	T = 1
marketshare	overall	0.0800597	0.1615952	2.58E-10	0.9974023	N = 2,011
	between		0.1615952	2.58E-10	0.9974023	n = 2,011
	within		0	0.0800597	0.0800597	T = 1
cust_bank	overall	33.65639	167.1839	1	5,710	N = 2,011
	between		167.1839	1	5,710	n = 2,011
	within		0	33.65639	33.65639	T = 1
acc_bank	overall	53.8538	255.1607	1	8,479	N = 2011
	between		255.1607	1	8,479	n = 2011
	within		0	53.8538	53.8538	T = 1
loansize_bank	overall	1.44E+08	1.46E+09	0	6.27E+10	N = 3,169
	between		1.46E+09	0	6.27E+10	n = 3,169
	within		0	1.44E+08	1.44E+08	T = 1

Table I.9 - Year 2005

Variable	Components of Std.Dev	Mean	Std. Dev.	Min	Max	Observations
iratespread(loans-deposits)	overall	0.034616	0.0127886	0.0037272	0.0525087	N = 1,460
	between		0.0127886	0.0037272	0.0525087	n = 1,460
	within		0	0.034616	0.034616	T = 1
iratespread(loan rates-nibor)	overall	0.0239911	0.0109124	0.0060636	0.0366301	N = 1,761
	between		0.0109124	0.0060636	0.0366301	n = 1,761
	within		0	0.0239911	0.0239911	T = 1
hhi	overall	0.342676	0.1517904	0.1391347	1	N = 3,345
	between		0.1517904	0.1391347	1	n = 3,345
	within		0	0.342676	0.342676	T = 1
loansize_reg	overall	3,772,673	3,855,410	226,612.7	4.20E+07	N = 3,345
	between		3,855,410	226,612.7	4.20E+07	n = 3,345
	within		0	3,772,673	3772673	T = 1
banksize_reg	overall	3.33E+08	5.07E+08	492,858	1.89E+09	N = 1,761
	between		5.07E+08	492,858	1.89E+09	n = 1,761
	within		0	3.33E+08	3.33E+08	T = 1
cust_reg	overall	1,462.425	3,011.526	4	14,377	N = 3,345
	between		3,011.526	4	14,377	n = 3,345
	within		0	1,462.425	1,462.425	T = 1
acc_reg	overall	2,252.1	4,522.863	5	21,491	N = 3,345
	between		4,522.863	5	21,491	n = 3,345
	within		0	2,252.1	2,252.1	T = 1
banks_reg	overall	22.21913	24.28082	1	120	N = 3,345
	between		24.28082	1	120	n = 3,345
	within		0	22.21913	22.21913	T = 1
marketshare	overall	0.0914253	0.1767707	3.49E-11	1	N = 1,761
	between		0.1767707	3.49E-11	1	n = 1,761
	within		0	0.0914253	0.0914253	T = 1
cust_bank	overall	39.31516	179.4471	1	5,554	N = 1,761
	between		179.4471	1	5,554	n = 1,761
	within		0	39.31516	39.31516	T = 1
acc_bank	overall	61.86428	271.0811	0	8,227	N = 1,761
	between		271.0811	0	8,227	n = 1,761
	within		0	61.86428	61.86428	T = 1
loansize_bank	overall	1.77E+08	1.89E+09	0	7.05E+10	N = 3,345
	between		1.89E+09	0	7.05E+10	n = 3,345
	within		0	1.77E+08	1.77E+08	T = 1

Table I.10 - Year 2006

Variable	Components of Std.Dev	Mean	Std. Dev.	Min	Max	Observations
iratespread(loans-deposits)	overall	0.0315847	0.0123654	0.0027669	0.0486579	N = 1,546
	between		0.0123654	0.0027669	0.0486579	n = 1,546
	within		0	0.0315847	0.0315847	T = 1
iratespread(loan rates-nibor)	overall	0.0181226	0.0096524	0.0026363	0.0292453	N = 1,952
	between		0.0096524	0.0026363	0.0292453	n = 1,952
	within		0	0.0181226	0.0181226	T = 1
hhi	overall	0.3229391	0.1396047	0.1567824	0.9829303	N = 3,538
	between		0.1396047	0.1567824	0.9829303	n = 3,538
	within		0	0.3229391	0.3229391	T = 1
loansize_reg	overall	3829980	3,083,203	318,308.3	2.24E+07	N = 3,538
	between		3,083,203	318,308.3	2.24E+07	n = 3,538
	within		0	3,829,980	3,829,980	T = 1
banksize_reg	overall	3.31E+08	5.35E+08	875,663	2.17E+09	N = 1,952
	between		5.35E+08	875,663	2.17E+09	n = 1,952
	within		0	3.31E+08	3.31E+08	T = 1
cust_reg	overall	1,533.862	3,202.634	3	15,632	N = 3,538
	between		3,202.634	3	15,632	n = 3,538
	within		0	1,533.862	1,533.862	T = 1
acc_reg	overall	2,359.94	4,843.704	5	23,563	N = 3,538
	between		4,843.704	5	23,563	n = 3,538
	within		0	2,359.94	2,359.94	T = 1
banks_reg	overall	23.37959	24.10169	2	122	N = 3,538
	between		24.10169	2	122	n = 3,538
	within		0	23.37959	23.37959	T = 1
marketshare	overall	0.0824795	0.1648653	7.23E-11	0.991402	N = 1,952
	between		0.1648653	7.23E-11	0.991402	n = 1,952
	within		0	0.0824795	0.0824795	T = 1
cust_bank	overall	38.21311	166.7513	1	4,993	N = 1,952
	between		166.7513	1	4,993	n = 1,952
	within		0	38.21311	38.21311	T = 1
acc_bank	overall	59.63883	250.9966	1	7364	N = 1,952
	between		250.9966	1	7364	n = 1,952
	within		0	59.63883	59.63883	T = 1
loansize_bank	overall	1.83E+08	2.04E+09	0	8.48E+10	N = 3538
	between		2.04E+09	0	8.48E+10	n = 3538
	within		0	1.83E+08	1.83E+08	T = 1

Table I.11 - Year 2007

Variable	Components of Std.Dev	Mean	Std. Dev.	Min	Max	Observations
iratespread(loans-deposits)	overall	0.0317287	0.0152443	-0.0014121	0.0538908	N = 1,614
	between		0.0152443	-0.0014121	0.0538908	n = 1,614
	within		0	0.0317287	0.0317287	T = 1
iratespread(loan rates-nibor)	overall	0.014374	0.010164	-0.0001968	0.0267245	N = 2,033
	between		0.010164	-0.0001968	0.0267245	n = 2,033
	within		0	0.014374	0.014374	T = 1
hhi	overall	0.3224919	0.1411149	0.1575334	1	N = 3,835
	between		0.1411149	0.1575334	1	n = 3,835
	within		0	0.3224919	0.3224919	T = 1
loansize_reg	overall	4,189,031	3,500,483	372,635.9	2.87E+07	N = 3,835
	between		3,500,483	372,635.9	2.87E+07	n = 3,835
	within		0	4,189,031	4,189,031	T = 1
banksize_reg	overall	3.67E+08	5.78E+08	1,376,988	2.34E+09	N = 2,033
	between		5.78E+08	1,376,988	2.34E+09	n = 2,033
	within		0	3.67E+08	3.67E+08	T = 1
cust_reg	overall	1,602.523	3,360.882	4	16,887	N = 3,835
	between		3,360.882	4	16,887	n = 3,835
	within		0	1,602.523	1,602.523	T = 1
acc_reg	overall	2,463.64	5,102.111	7	25,568	N = 3,835
	between		5,102.111	7	25,568	n = 3,835
	within		0	2,463.64	2,463.64	T = 1
banks_reg	overall	24.24641	24.37143	1	125	N = 3,835
	between		24.37143	1	125	n = 3,835
	within		0	24.24641	24.24641	T = 1
marketshare	overall	0.0791933	0.161528	4.71E-10	1	N = 2,033
	between		0.161528	4.71E-10	1	n = 2,033
	within		0	0.0791933	0.0791933	T = 1
cust_bank	overall	39.46778	169.402	1	4,893	N = 2,033
	between		169.402	1	4,893	n = 2,033
	within		0	39.46778	39.46778	T = 1
acc_bank	overall	61.46188	255.5365	0	7,187	N = 2,033
	between		255.5365	0	7,187	n = 2,033
	within		0	61.46188	61.46188	T = 1
loansize_bank	overall	1.96E+08	2.28E+09	0	1.08E+11	N = 3,835
	between		2.28E+09	0	1.08E+11	n = 3,835
	within		0	1.96E+08	1.96E+08	T = 1

Table I.12 – Year 2008

Variable	Components of Std.Dev	Mean	Std. Dev.	Min	Max	Observations
iratespread(loans-deposits)	overall	0.0348141	0.0176727	-0.0044051	0.0635365	N = 1,665
	between		0.0176727	-0.0044051	0.0635365	n = 1,665
	within		0	0.0348141	0.0348141	T = 1
iratespread(loan rates-nibor)	overall	0.0177354	0.0123523	0.0013358	0.0346434	N = 2,141
	between		0.0123523	0.0013358	0.0346434	n = 2,141
	within		0	0.0177354	0.0177354	T = 1
hhi	overall	0.331168	0.1510989	0.1489888	1	N = 4,151
	between		0.1510989	0.1489888	1	n = 4,151
	within		0	0.331168	0.331168	T = 1
loansize_reg	overall	4,976,342	4,379,193	468,861.7	3.33E+07	N = 4,151
	between		4,379,193	468,861.7	3.33E+07	n = 4,151
	within		0	4,976,342	4,976,342	T = 1
banksize_reg	overall	4.28E+08	7.07E+08	1,210,953	3.00E+09	N = 2,141
	between		7.07E+08	1,210,953	3.00E+09	n = 2,141
	within		0	4.28E+08	4.28E+08	T = 1
cust_reg	overall	1,547.873	3,202.862	5	16,621	N = 4151
	between		3,202.862	5	16,621	n = 4151
	within		0	1,547.873	1,547.873	T = 1
acc_reg	overall	2,415.689	4,983.47	7	25,874	N = 4,151
	between		4,983.47	7	25,874	n = 4,151
	within		0	2,415.689	2,415.689	T = 1
banks_reg	overall	25.03204	23.6258	1	120	N = 4,151
	between		23.6258	1	120	n = 4,151
	within		0	25.03204	25.03204	T = 1
marketshare	overall	0.0751985	0.1612633	2.54E-11	1	N = 2,141
	between		0.1612633	2.54E-11	1	n = 2,141
	within		0	0.0751985	0.0751985	T = 1
cust_bank	overall	37.70107	161.8337	1	4,724	N = 2,141
	between		161.8337	1	4,724	n = 2,141
	within		0	37.70107	37.70107	T = 1
acc_bank	overall	59.3475	250.4156	0	7,028	N = 2,141
	between		250.4156	0	7,028	n = 2,141
	within		0	59.3475	59.3475	T = 1
loansize_bank	overall	2.22E+08	2.71E+09	0	1.29E+11	N = 4,151
	between		2.71E+09	0	1.29E+11	n = 4,151
	within		0	2.22E+08	2.22E+08	T = 1