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Efficiency and productivity analysis of Norwegian savings banks for the period 2007-2013

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Preface

This study contains the final contribution of a master degree in logistics at Molde Universty College – Specialized University in Logistics, and yields 30 ECTS.

The topic for the thesis was discovered through a series of coincidences. The work on this research has proven to be very interesting, inspirational and academically challenging. During the last months I have gained much knowledge about the problem topic and the related solution methods. I have also learned some important life lessons.

I would like to dedicate this thesis to my dear fiancé Asgeir Vikan, and my daughter Lilli Arnhild. This challenging assignment could not have been possible to conduct if it was not for the support of you, my loving family. I would also like to thank my mother and father and Gerd and Helge Vikan for all of the support during my five years as a student.

My supervisor, Johan Oppen, certainly deserves much gratitude for the help and support he has given throughout the moths working on this research. Also, a special thanks to the other master students at Molde University Collage, especially Håkon Bentsen and Katrine Larsen, for two memorable years is in order.

Astrid Svendsli Otnes
Kvisvik
May 2015.

Summary

This study analyze the efficiency and productivity of Norwegian savings bank for the period 2007 -2013. It is the first study in over 10 years where a large number of Norwegian savings banks have been analyzed in terms of efficiency.

The purpose of the study has been to investigate the average level of efficiency and productivity for these banks during a time with rapidly changing market terms and difficulties related to the finance crisis. Also, the relationships between sizes of the banks and memberships in strategic alliances on the efficiency and productivity levels have been addressed. The effects of the finance crisis have been investigated for banks that received governmental support after the crisis, the largest bank in Norway, DNB Nor, and the industry as a whole.

The empirical analysis has been performed with a non-parametric frontier model, data envelopment analysis, in order to find the efficiency of the banks. A generalization of this method, super-efficiency analysis, has been used to rank the most efficient firms, and to test hypothesis about mean scores and correlation of scores in different settings. A Malmquist productivity index method has been used to obtain the productivity change between the years in the period.

Throughout the study, choices that were made have been backed up using previous research. A thorough preliminary data analysis has also been performed in order to detect outliers and errors in the data set.

The findings from this study indicate that the banks have had relatively equal efficiency throughout the period. The average efficiency scores decreased in the years 2009 and 2011. The productivity levels of the banks have increased every year in the analysis except from a small decrease in 2009. It cannot be claimed that the efficiency scores and the sizes of the banks are related. The analysis suggest that independent banks are more likely to have larger efficiency scores in some of the years. However, sensitivity analysis reveal that the results are strongly dependent on the absence of errors in the data of the most efficient banks. The results are also dependent on the choice of variables included in the study.

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List of abbreviations

AE	Allocative efficiency
CDO	Collateralized debt obligation
CE	Cost efficiency
CRS	Constant return to scale
DEA	Data envelopment analysis
DFA	Distribution free approach
DMU	Decision making unit
FDH	Free disposal hull
FTE	Full time equivalents
GDP	Gross domestic product
GMM	Generalized method of moments
IFRS	International financial reporting standards
ISB	Independent savings banks
KPI	Key performance indicator
LP	Linear program
MPI	Malmquist productivity index
OLS	Ordinary least squares
PAT	Profit after tax
PE	Profit efficiency
PEC	Pure efficiency change
SE	Scale efficiency
SFA	Stochastic frontier approach
TC	Technical change
TE	Technical efficiency
TFA	Thick frontier approach
VB	Visual Basic
VRS	Variable return to scale

1.0 Introduction

"An efficient financial sector reduces the cost and risk of producing and trading goods and services and thus makes an important contribution to raising the standard of living." [1] pg. 1.

The quote above says something about the importance of an efficient finance sector. These sectors are important institutions for all countries. They can act as a medium for minimizing risk by allowing to move money through time and space. The development of a financial sector can also help reduce poverty and support economic growth [2].

In Norway, banks have over 1000 branches across the country, where about 690 of these belong to savings banks [3]. In 2013, Norwegian customers had a total of 1 963 220 million NOK in deposits and the banks had 3 469 519 million NOK in gross lending. In 2012 there were made over 1,62 billion card transaction in Norway, which corresponds to about 323 transactions per inhabitant [4]. Bank services are used by most persons every day, and have a large effect on the personal life of inhabitants as well as the economy of the country. It is safe to say that the banking industry is very important for Norway in many ways, and that the aim should be that this sector should be as efficient as possible.

This research will focus on measuring the efficiency of Norwegian savings banks in the period 2007-2013. In the next sections, some history of the bank industry in Norway will be presented, and the background for the necessity of this research will be clarified.

1.1 Banking in Norway from 1822 to 2015

June 29th 1822 was the opening day for the first savings bank in Norway: Christiania Sparebank [5]. Before this day, the only bank that existed in the country was the bank of Norway. With the opening of Christiania Sparebank, the people could now get an interest rate at their savings, and had an option to keeping them "under the mattress". Today Christiania Sparebank is the largest bank in Norway, DNB Nor. It has grown from having a few uncompensated directors to having a staff of over 12 500 employees [5]. Some even say that this bank now is too large, and waste resources due to the perceived image of government bail outs [6].

In the early days, all the savings banks were philanthropic, and the deposits were the core business. To encourage people to save was the goal of operations [5]. This was because there was a need to ensure that households and businesses had a buffer if expenses increased or incomes decreased. Often the banks in the 1830's had a minimum limit for deposits, and restrictions for taking out the money from the account.

Today there are 105 savings banks in Norway. Since the top in the 1960's with over 600 banks, there has been a decrease in the number of banks almost every year. This is mostly a result of mergers and centralization. The commercial banks have had more mergers than the savings banks, and opposed to DNB Nor which up until 2013 was a stock savings bank, there are no large commercial banks in Norway today [5]. Most of the larger commercial banks are branches of large foreign banks. The gravity of the sector has shifted from the local to the international and global and the savings banks have become more and more dependent of the international money market to get cash. Local bank branches are also less and less important due to new technology such as online banks, and video meetings with bank clerks. The regulations that the banks are faced with are to a larger degree determined by the EU, and are getting more and more complicated. The fact that Norwegian savings banks are either organized as self-owned institutions or as "Egenkapitalbevisbanker", make them hard to buy for foreign companies, therefore they could be viewed as bottlenecks by the EU, in its way to develop large competitive and efficient European banks [5]. The regulations from the EU introduces a new set of economics of scale, namely having competent personnel that understand and can handle this complex regulations. [6] suggest that the implementation of the new Basel III regulations after 2011 forces the European banking industry to increase its labor stock with over 70 000 full time equivalents (FTE's) just to be able to interpret the complex rulers. This results in a larger pressure for the smaller banks to merge, and remove themselves from their identity as local institutions. Also the customers have changed, especially in the last decades. They are more educated, more price aware and less loyal to their local banks.

1.2 Crisis in the Norwegian banking industry.

Crises in the Norwegian banking system have occurred almost as long as banks have existed in the country. In the early periods, when the currency was related to the gold standard, finance crises happened almost every decade. After the Second World War, the world

economy went into a long stable period. Almost 60 years went by from the last crisis before the war and to the next crisis from 1988-1993 [7].

The most recent finance crisis was in Norway introduced by the Terra scandal [5]. This scandal started when some counties in Norway became involved in agreements where they took loans that were to be paid back with money from energy licenses. The counties relationships with the Terra alliance developed, and they were advised to invest money in more and more dodgy and risky saving products. In May/June 2007 the counties started to invest in the county fund of City Group. In the summer of 2007 the problems in the American housing market started to show. Subprime loans were especially affected, resulting in a panic sale of so called collateralized debt obligations (CDO's) that the Norwegian counties had invested in. In November 2007, the Terra group received a warning form the Norwegian credit supervision department that their license to manage investment services were annulled due to deficient counseling. The eight counties took a loss of one billion NOK, and Terra Securities was declared bankrupt. This scandal took a hard turn on the reputation of the Terra group, therefore they changed their name back to the original, Eika, in 2013.

The Terra scandal was an omen of the international crisis that was on its way. In 2007 and 2008, the situation in USA got worse, and the crisis was a fact with the bankruptcy of Lehman Brothers. This financial crisis was a trust crisis of the financial markets [5]. Measures from central banks and governments around the world helped the situation to stabilize in the entrance to 2009, but in the aftermath of the financial crisis, one of the largest economic crisis the world has seen followed. Many countries around the world still struggles due to this.

Norway was one of the countries that handled the crisis well. But also Norwegian banks got problems with liquidity due to restricted access to money in the international money market [5]. Some export businesses got problems, and the interest rates increased. In the last quarter of 2008, and the first half of 2009, there was a decrease in the Norwegian GDP. The bank of Norway granted many of the Norwegian banks more liquidity, and 26 savings banks received in total four billion NOK in funding form "Statens finansfond". According to [5], the Norwegian banks handling of the crisis was not only due to the good economy in Norway, but also a result of a local anchoring that is stronger than in the neighboring countries. Also, the bank unions have been very good in lobbying, and have a very good relationship with the government.

In good economic times the savings banks have traditionally been more similar to the commercial banks. In these times they have been less risk avert, and often gone into new markets. At the same time, experiences from financial crisis and regulations have created a need for the banks to act more in accordance with the tradition of savings banks. This have been the case after the crisis both in the 1920's and the 1980's [5].

One can argue that the government saved the banks through the crisis. But did the measures contribute to increase the competition and thereby increase the efficiency and productivity of the banks?

In the next section, the problem topic will be defined and described. Section 3 provides the selection and description of an appropriate solution method, while at the same time defining key terms and procedures through relevant literature. In section 4 a more specific literature review will be provided. In section 5 the selected data is described and a preliminary data analysis is performed. Some key results of the analysis if presented in section 6, and in section 7 some concerns about validity and verification of the research are discussed. Finally, section 8 will sum up the main results and encourage to further research on unanswered questions.

2.0 Problem description

In the literature, the terms performance, productivity and efficiency often get used inconsistently. Therefore, a definition of these key terms as they will be understood in this research is necessary, in order to avoid confusion and to help express the research problem.

In [8] a review of literature on performance analysis resulted in the PPP-model as seen in Figure 1. In the inner layer of the figure is the relation between outputs and inputs. This relation is described as the productivity, and is defined as a physical term. This means that to measure productivity, it is necessary to know the physical units of the inputs or outputs.

The layer surrounding productivity is profitability, where also prices has been taken into account when analyzing the relation of outputs and inputs. [8] uses the term "price recovery" to describe the ratio between unit prices and unit costs. In a large degree of literature, the term productivity is used for what actually is profitability. This is the case for most of the

research concidering productivity analysis for banking. This could be confusing, but it seems best to follow the practice of previous research on this subject and use the term productivity to indicate what actually is profitability.

The next circle in the figure is the performance. In this level, also quality, delivery, speed and flexibility is included in addition to the previously mentioned elements, thus it is considered an umbrella term. The reasons that also qualitative measures such as quality is included in this level is intuitively that a company does not perform well even if they can produce outputs with high productivity and profitability if these are not of good quality.

[8] also suggests that effectiveness and efficiency is a part of the term performance. Effectiveness is defined as "the degree to which desired results are achieved" and efficiency is defined as "how well the resources of the transformation process are utilized"[8]. From the figure it is suggested that efficiency is related to the inputs part of the model, as it is positioned at the lower half of the circle. This is due to the fact that efficiency considers the utilization of resources, i.e inputs. The effectiveness element is more difficult to quantify since it is considered to be more linked to the output-part of the figure. This is about creating value for the customers and achieving organizational goals.

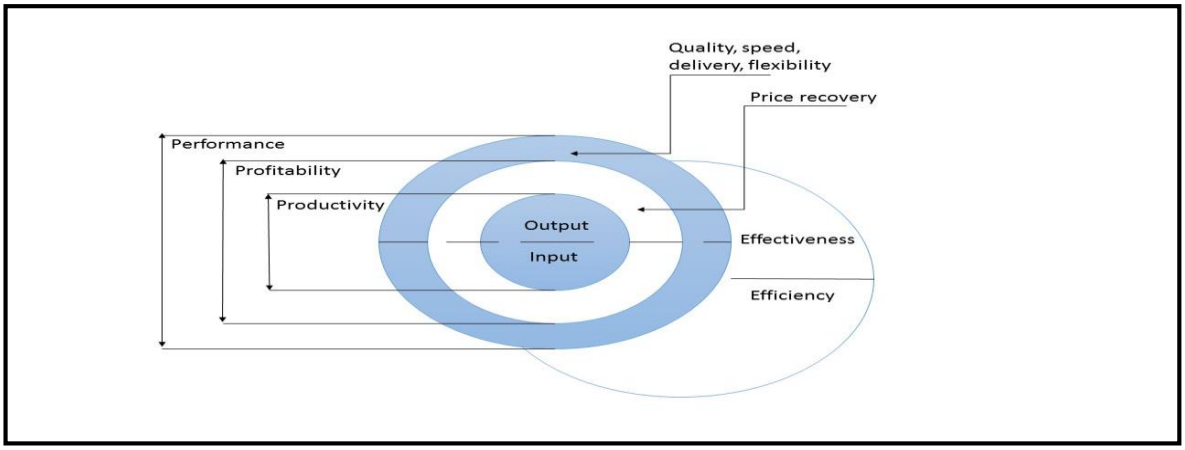

Figure 1: Definition of key terms. Based on figure in [8].

In the next section, the problem to be solved in this research will be clarified, before concretizing this into some research questions in section 2.2.

2.1 Problem description

As mentioned in section 1, the competition in the Norwegian banking industry have developed a lot since the 1980's. In the recent years, many changes have been imposed to the structure of the industry and the market they are involved in, for instance due to the finance crisis and the globalization trend. However, the banks usually still measure their performance using key performance indicators (KPI's) and partial productivity measures. The problem related to this is that these measures are incapable to assess multiple variables, and therefore present a simplified picture of the real status of the performance of the banks. A bank performing well according to one KPI could be one of the worst overall performers. In this study, a sophisticated efficiency analysis will be performed, seeking to find the efficiency level of the Norwegian banking sector on a more general level. This will point out the overall best and worst performers, and the characteristics of these. Finding the mean efficiency and the distribution of efficiencies between banks can also tell something about the effect of sizes and alliances on the ability to utilize resources.

The effect the finance crisis has had on the banks' ability to eliminate waste of resources will also be analyzed. In section 1.2, it was mentioned that 26 Norwegian banks received funding from the government finance fund ("Statens finansfond") after the crisis. Another interesting element that will be analyzed in this research is to assess the efficiency development of these banks related to those who did not receive government help. The effects of the crisis on the largest bank in Norway, DNB Nor, could also be interesting to evaluate.

The banks that have the largest productivity increase from one year to another, will be the banks that are most able to adapt to both changes in technology and improve their efficiencies. This can be used to assess the efficiency levels and determine if there have been an increase or decrease between years. The impact of alliances, sizes of the banks and the finance crisis will also be analyzed related to productivity.

2.2 Research questions

1. What was the efficiency and productivity level of Norwegian savings banks in the period 2007-2013?
2. How do sizes and alliances affect the efficiency level?
3. How has the finance crisis affected the efficiency and productivity of the savings banks?

2.2.1 Research sub questions

1.1 Which banks are the most and least efficient each year?
1.2 How have the mean efficiency and productivity developed during the period?

2.1 Are large banks more efficient than small banks?
2.2 Are large banks more productive than small banks?
2.3 Does being a member in a strategic alliance imply better performance?

3.1 Have the mean efficiency levels decreased during the finance crisis?
3.2 Have the mean productivity levels decreased during the finance crisis?
3.3 Have the banks that received funds after the crisis had better development than other banks?
3.4 How has DNB Nor been affected by the crisis?

3.0 Solution methodology

[9] contains one of the most recent literature review of efficiency analysis in banking. Here, a conceptual model for selecting the solution methodology appropriate for an efficiency study of a banking sector is presented. The model has the following steps:

1. Determining efficiency measures
2. Selection of frontier approach
3. Setting the scale of operation
4. Selection of input/output orientation
5. Selecting input-output combination
6. Identifying determinants of efficiency and productivity (second stage analysis)

This conceptual model will to a large extent be used for choosing a solution methodology for this research. In the following sections, each of these stages are elaborated and the key terms and concepts will be explained. Some possible solution methods are discussed, and the selected method is presented in detail.

3.1.1 Determination of efficiency measure

The term efficiency as explained in section 2.0 can be divided into two main parts: technical efficiency (TE) and allocative efficiency (AE). For studies concerning AE, also the choice between cost efficiency (CE) and profit efficiency (PE) exist. These terms were first introduced by [10].

[11] describe TE as the relationship between input and outputs relative to the best practice. The decision making units (DMU's), which operate as the best of the sample is considered to be 100% technically efficient, and thus their operations are considered to be "best practice". If a DMU waste resources, it is considered to be technically inefficient.

The concept of AE evaluate whether the right mix of inputs is chosen, in order to minimize the cost of production for a given level of outputs and inputs. This is done under the assumption that the DMU in question is technically efficient.

CE refers to the combination of the two earlier mentioned concepts. A firm will be cost efficient if it is technical efficient at the same time as being allocative efficient. A firm cannot be cost efficient if it is not both allocative and technically efficient at the same time. The mathematical definition of cost efficiency is therefore the product of these two components.

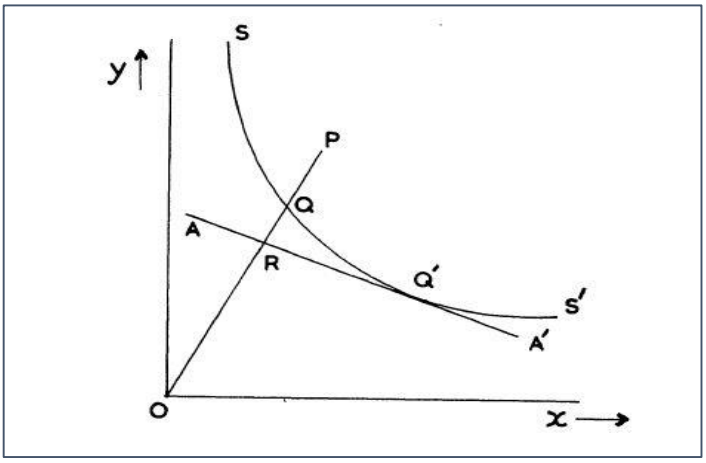

Figure 2: Efficiency analysis. From [10]

In Figure 2 the X-axis represents the level of input variable x, and the Y-axis is the level of input variable y. The curve SS' is an isoquant representing the efficient combination of the input variables, i.e the combination of inputs x and y the most efficient firms use to produce a given level of outputs. This curve can also be called the efficient front. There are some assumptions related to this isoquant. It has to be convex, and no observations can lie between O and SS'. This implies that none of the companies in the sample can have an input combination that is below the efficient front and still produce the same output.

The most efficient DMU would thus have its consumption of inputs on the curve SS'. This DMU would have a TE of 1. The relative efficiency of a DMU under evaluation, DMU_0, can therefore be defined as the distance between the observed point, and the closest point on the efficient isoquant SS'. In the figure, P represent the input combination for an inefficient DMU. The technical efficiency of this DMU can be measured as the relation between the lines OQ and OP (OQ/OP). This implies that if the DMU reduces its waste of inputs, it could improve its TE with 1-(OQ/OP).

Another relevant property of the model in [10] is what happens if a new DMU is added to the sample. This would never increase the efficiency score of the original DMU's. If the new DMU is more efficient, with an input combination in the point R for instance, the efficient isoquant would shift, and the original DMU's would become less efficient. If the new DMU had a combination of inputs that was on the curve SS', the curve would only become longer, not affecting the efficiency of the original DMU's. If the number of input variables is increased [10] state that this could increase the number of efficient DMU's, as it implies more instances of unique production technology.

The line AA' illustrates the combinations of inputs x and y that represents the same cost. This line can therefore be called a budget line. The slope of this line is the negative ratio between the price of x and y. The total cost increases the further the budget line is from the origin. This imply that a DMU operating at point Q could reduce its cost if its production shifted to point R. In this case the DMU would become allocative efficient. However, it is still not cost efficient, as it could produce more output for the same cost if it shifted its production to point Q'. In fact, the minimal cost of producing a given output, is found where the budget line is tangent to the isoquant, (in Figure 2 this is in point Q'), and this is the point where CE occurs. Having stated this, it is clearer to see that cost efficiency is a combination of TE and AE, since this measures both the mix of inputs and the efficient use of these inputs. These efficiency measures could also be used when outputs are represented on the axis.

If the goal is to measure PE instead of CE, the figure have to represent output combinations instead of inputs. The budget line must in this case represent the combination of outputs that represent the same profits or revenue [11].

The most common approach when considering the efficiency of banks is to study TE (about 50% of the studies) [9]. The argumentation for this is that price and cost data often is aggregated, so that the budget line is more difficult to measure. For this research TE is clearly the first choice for measuring. Using TE, all of the problem topics could possibly be solved. Another reason for this is that if AE was to be analyzed, additional data containing price and quantity for each of the selected inputs and outputs would be necessary. This would certainly complicate the research, but perhaps not provide very much additional information compared to measuring only TE. The conclusion will therefore be to analyze only TE in this study.

3.1.2 Selection of frontier approach

There are two main categories of frontier approaches that can be used for efficiency analysis. These are parametric methods, and non-parametric approaches.

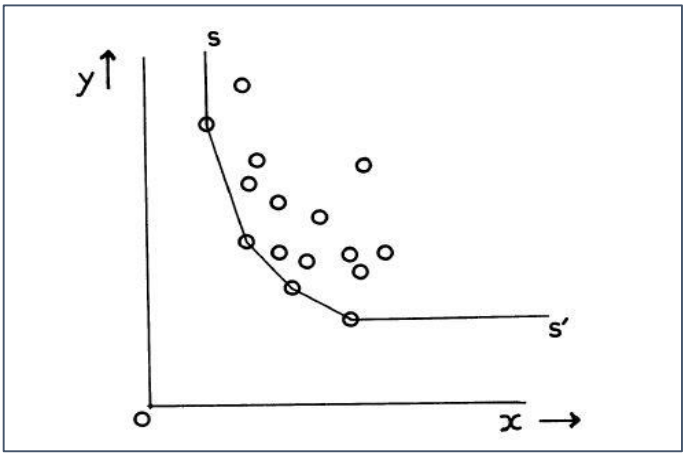

Figure 3: Non parametric frontier approach. From [10]

In Figure 3 the frontier of a non-parametric approach is illustrated. The frontier ss' could be compared to the parametric frontier SS' in Figure 2. The difference is that the frontier ss' is not a smooth curve as SS', but a piecewise linearization of a curve based on the observations of the efficient DMUs. Therefore ss' does not require an estimation of the production function, as opposed to SS'. [10] argue that non-parametric methods should be preferred in efficiency analysis since the estimation of production functions almost always would diverge from reality. On the other hand, advocates for parametric approaches state that non-parametric approaches does not allow for random errors in the data, and that these therefore could be more unreliable than parametric approaches [12].

In the next two sections, solution models from each of these categories are briefly discussed, before the most appropriate is selected and presented in detail.

3.1.2.1 Parametric approaches

[9] list three parametric approaches that have been the most popular in banking efficiency analysis: distribution free approach (DFA), stochastic frontier approach (SFA) and thick frontier approach (TFA).

3.1.2.1.1 SFA

The SFA model is also referred to as the econometric frontier approach. The model specifies a functional form for either profit, cost or the relationship between inputs, outputs and environmental factors. It was first introduced by Aigner, Lovell and Schmidt in [13] and Meeusen and Van den Broeck in [14] in 1977. The method includes a stochastic component that enables the method to measure both inefficiency and random noise that can raise or

reduce the frontier. A DMU is inefficient if it has a production which cost is above the minimum estimated cost frontier, or a profit that is below the minimum estimated profit frontier. The main issue related to the model is that it does not specify the distribution that must be selected to arrive at the inefficiency measure.

3.1.2.1.2 DFA

The DFA approach was first introduced by Berger in [15] in 1993, as a result of the criticism of the SFA approach. The DFA approach assume that the efficiency of a firm is a stable condition that does not change over time, and that random errors therefore will have an average of zero in the long run. Similarly to SFA, DFA estimates a functional form of the efficient frontier. The main difference between the two models is that DFA does not require the determination of a specific distribution related to the inefficiency term, due to the fact that DFA has different assumptions related to the concept of efficiency.

3.1.2.1.3 TFA

TFA estimates a cost function of banks divided in quartiles (thick-frontier). It then compares the banks in the lowest cost quartile to the ones in the highest cost quartile. Differences between the two measures are decomposed into random error and inefficiency. An important assumption of the method is that it perceives deviations from the predicted cost in each quartile as a result of random noise. Similar to DFA, TFA does not require assumptions about the distribution of inefficiencies or random errors. However, the method does not provide an exact measure of efficiency for the individual DMUs. TFA was first introduced by Berger and Humphrey in 1992 in [16].

3.1.2.2 Non parametric approaches

For the non-parametric approaches [9] suggests two methods that have been most commonly used in similar research. These models are data envelopment analysis (DEA) and free disposal hull (FDH).

3.1.2.2.1 DEA

The DEA method was first introduced in by Farrell [10] in 1957. Charnes and Cooper [17] and Charnes, Cooper and Rohdes [18] further developed the method in 1962 and 1978. The basic idea of the DEA model is that it evaluates the relation of inputs and outputs of one DMU to the same relation of all the DMUs under evaluation. Each DMU gets an efficiency

score between zero and one, relative to the efficient DMUs in the data set. This method does not require a functional form or assumptions about distribution of inefficiency, since the efficient frontier is a piecewise linearization of the efficient frontier developed by efficient DMUs. According to [19], DEA could be used for two main purposes. The first purpose is that it can give estimates of the mean efficiency of the industry, and the second is that it will provide with a ranking of the firms. This way it can provide useful information for policy makers, for managers and for researchers. This method has become the most preferred by researchers who want to analyze the efficiency in the banking industries [9].

3.1.2.2.2 FDH

Deprins, Simar and Tulkens [20] were the first to introduce the FDH approach in 1984. The main difference between DEA and FDH is that in FDH the frontier does not have to be assumed convex. The point on the frontier is not generated only by the most efficient firms, but also the firms that are close to the DEA frontier (free disposal hull points) [19].

3.1.2.3 Selection of approach

In Table 1, some of the arguments for and against the presented models are summarized. These arguments have to be evaluated against the purpose and scope of this research. For the parametric approaches the arguments mainly include that the method allow for random errors in the data. This is something that can be managed to a certain degree by preliminary data studies. Also, the parametric approaches require more company specific information that could be sensitive, such as the size and value of loans. Surely, data exist about the number of new loans each year, but data containing information about the size of these loans is something that the banks does not want to distribute, as this is information closely related to strategic choices.

Based on this, the decision will be to use one of the non-parametric approaches. Of these models, DEA stands out to be the preferred choice since it has been used on many similar studies before, is easy to conduct and gives much relevant information.

	Advantages	Disadvantages
SFA	- Allow random error	- Specify functional form of distribution
	- Popular in existing literature	- Require assumption of distribution of inefficiencies
		- Inefficiencies and random error can be hard to separate
DFA	- Allow random error	- Specify functional form of distribution
	- Does not require distribution of inefficiencies	- Efficiency is assumed to be stable for every firm
TFA	- Allow random error	- Specify functional form of distribution
	- Does not require distribution of inefficiencies	- Does not provide with exact measures of efficiency for individual firms
DEA	- Does not specify functional form	- Does not allow for random error
	- Does not require assumption of distribution	- Results are sensitive to the selection of inputs and outputs
	- Easy to conduct	- The number of efficient firms tend to increase with number of variables
	- The most popular in existing literature	
	- Possible to measure multiple inputs and outputs simultaneously	
FDA	- The method that require least restrictions.	- Results are sensitive to the selection of inputs and outputs
	- The least sensitive of the non-parametric method to outliers	- The number of efficient firms tend to increase with number of variables .
	- Possible to measure multiple inputs and outputs simultaneously	- A wider set of data is required to get significant information than in DEA

Table 1: Advantages and disadvantages with models for efficiency analysis.

3.1.2.4 DEA model

Before explaining the DEA model in detail, some important assumptions must be accounted for. Four main assumptions are related to the model [11]. These are:

1. All observed input-output combinations are possible. This implies that there are no errors in the data.

2. The production possibility set is convex. (see also section 3.1.1) An input/output bundle that is on a straight line between two observations is possible. This way, a reference unit to a DMU does not have to be an actual observation, but a convex combination of several observations.

3. Free disposal of inputs. If one combination of inputs and outputs is possible, then also a combination with more inputs is possible for the same outputs. (i.e. waste of resources is possible). The firm is also assumed to be able to reduce excess inputs (strong disposability of inputs).

4. Free disposal of outputs. If one combination of inputs and outputs is possible, then also a combination with less outputs is possible for the same inputs. (i.e. underproduction is possible) Also, the firm is assumed to be able to increase production of outputs.

[11] and [21] give some pedagogical explanations of the DEA model, and the presentation of the models below is made based on these descriptions.

The simplest way of introducing the DEA model is to start with the ratio form of the model. This variant of the model was first introduced by [18], and can be formulated in the following way:

$$\max e_{j_0} = \frac{\sum_{r=1}^{s} \mu_r y_{rj_0}}{\sum_{i=1}^{m} \omega_i x_{ij_0}} \quad (1)$$

Subject to

$$\frac{\sum_{r=1}^{s} \mu_r y_{rj}}{\sum_{i=1}^{m} \omega_i x_{ij}} \leq 1 \qquad j=1,\ldots,n \quad (2)$$

$$\mu, \omega \geq 0 \qquad j=1,\ldots,n \quad (3)$$

Parameters:

y_{rj} : outputs of type r for bank j. r= 1,…,s

x_{ij} : inputs of type i for bank j. i=1,…,m

Variables:

μ_r : weights for output r

ω_i : weights for input i

Explanation:

The objective function (1) seeks to maximize the weighted sum of all inputs related to all the weighted sum of outputs for the DMU under evaluation, DMU_0. (2) represents a set of constraints, one for each bank, that states that the weighted sum of all inputs related to all outputs. Also, there is no negativity constraints for all variables (3). The model must be solved one time for each DMU.

To solve the DEA model, one usually transforms the model above to a linear model. Most often this is done through a Charnes-Copper transformation, first introduced in [17].

$$\max \sum_{r=1}^{s} \mu_r y_{rj_0} \quad (4)$$

Subject to:

$$\sum_{r=1}^{s} \mu_r y_{rj} - \sum_{i=1}^{m} \omega_i x_{ij} \leq 0 \quad \text{j=1,…,n} \quad (5)$$

$$\sum_{i=1}^{m} \omega_i x_{ij_0} \leq 1 \quad (6)$$

$$\mu, \omega \geq 0 \quad (7)$$

Explanation:

The objective function (4) seeks to maximize the weighted sum of all inputs for the DMU_0. (5) represents a set of constraints, one for each bank, that ensures that the weighted sum of all outputs are larger than or equal to the weighted sum of all inputs. Constraint (6) limits the weighted sum of inputs for DMU_0 to be at most one. Also in this model the variables must be non-negative (7), and has to be solved one time for each DMU.

Using duality properties of linear programs the model in the so called envelopment form is obtained. This is the form that the DEA model usually takes when solving DEA problem.

$$\min \theta \quad (8)$$

Subject to

$$\sum_{j=1}^{n} \lambda_j x_{ij} \leq \theta x_{ij_0} \quad \text{i=1,…,m} \quad (9)$$

$$\sum_{j=1}^{n} \lambda_j y_{rj} \geq y_{r_0} \quad \text{r=1,…,s} \quad (10)$$

$\lambda \geq 0$ j=1,…,n (11)

Variables:

λ_j : weight for DMU_j

θ : the efficiency score for the DMU under evaluation

Explanation:

The objective function (8) represents the efficiency score for the DMU under evaluation. Constraints (9) ensure that the weighted sum of input i for all DMU's is less than or equal to the input i for DMU_0 compressed with the factor θ. This is a family of constraints, one for each input i. (10) states that for each output r, the weighted sum of outputs for all DMU's is larger than or equal to the outputs of DMU_0. (11) are non-negativity constraints for all variables. The model is solved one time for each DMU.

To explain the envelopment form in a more intuitive manner, one can say that it takes the i-th DMU and produces a projected point on the efficient frontier (λx, λy). This point will be a convex combination of the observed data points. If the objective function is equal to one, the DMU under evaluation is technical efficient and the observation is a part of the efficient frontier. This means that the inputs of DMU_0 does not have to be compressed in order to ensure that the projected point does not lie outside the frontier, with the given level of outputs. (The constraints ensure that the point does not lie outside the frontier.)

The envelopment form of the DEA model is the preferred form of the models presented above, since it has fewer constraints that in the multiplier form. As presented, the multiplier form have (n + 1) constraints, while the envelopment form has (m + s) constraints. Some researchers will use the multiplier form since the weights here can be interpreted as normalized shadow prices [11], but in this research the envelopment form of the model will be used.

3.1.3 Setting the scale of operation

Even as early as in the Farrell article [10], there has been a discussion around the choice of scale of operation for the industry of analysis. There exist three different possible scales of operations. If the outputs increase proportionally with an increase of inputs economies of

scale is the appropriate assumption. This can also be called constant return to scale (CRS). If the outputs decrease with an increase of inputs diseconomies of scale exist. Also there could be some situations where the outputs could sometime increase and other time decrease when inputs are increased, this is also called variable return to scale (VRS). In figure 4, the states economics and diseconomies of scale are illustrated as in [10].

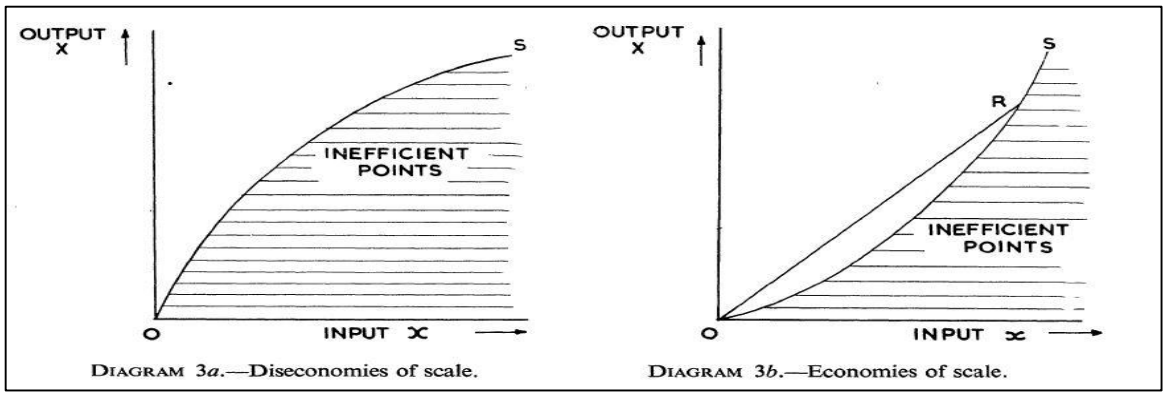

Figure 4: Diseconomies and Economies of scale. From Farrell [10]

In Figure 4, it is clear that for diseconomies of scale, increasing inputs leads to an increase in outputs up to a given point. When the inputs reach a given level, they do not result in the same level of outputs as expected for economics of scale. Therefore, one could say that in this case VRS exist.

The selection of the scale of operations will depend on if the assumption that the outputs increase proportionally with an increase of inputs for all banks is plausible (economics of scale). If this is the case, a CRS approach could be appropriate. The CRS approach assume that there does not exist an optimal size of the banks, and that the size therefore does not affect the efficiency. In a VRS approach, the assumption is that the outputs could also decrease (decreasing return to scale) or increase (increasing return to scale) if an input is increased. VRS models therefore assumes that there exists an optimal size for the companies.

The envelopment model of the DEA explained in section 3.1.2.4 represent a CRS model. In order to transform this model to include a VRS assumption, the following constraint have to be added to the model. This formulation was first formulated by Banker, Charnes and Cooper in [22], and is therefore also referred to as the BCC model.

$$\sum_{j=1}^{n} \lambda_j = 1 \qquad (12)$$

This restriction will make sure that inefficient DMUs are compared only to other DMUs that are of the approximate same size (or convex combinations of these DMU's).

If VRS is the assumption, then the scale efficiency (SE) could be measured as well. This is done by also calculating efficiency according to CRS, and comparing the results. [22] show how one can decompose the efficiency in SE and pure TE. Pure TE is measured by the VRS model. By dividing TE obtained from CRS orientation by the TE obtained from VRS orientation, the result will be a measure on SE, meaning how large a part of the inefficiency of a DMU that is a result of not acting on an optimal scale [23]. The mathematical formulation for SE is presented in equation (13).

$$SE=\frac{TE_{CRS}}{TE_{VRS}} \tag{13}$$

If there is a difference between the CRS and VRS efficiencies for a specific DMU, the conclusion would be that the DMU is scale inefficient. By summing the weights λ_j found by the CRS model, the result can define the scale efficiencies of the DMU. The following options exist:

$$\sum_{j=1}^{n}\lambda_j = 1 \qquad \text{The DMU is scale efficient} \tag{14}$$

$$\sum_{j=1}^{n}\lambda_j < 1 \qquad \text{The DMU is too small} \tag{15}$$

$$\sum_{j=1}^{n}\lambda_j > 1 \qquad \text{The DMU is too large} \tag{16}$$

In Figure 5, these options are illustrated for a single input/ single output situation. It is evident that the DMUs operating where the CRS frontier is tangent to the VRS frontier are operating at an optimal scale. The DMUs operating above the region with constant return to scale are scale inefficient and would benefit by reducing the size of operations. For DMUs operating below these points, an increase of the size would increase scale efficiencies.

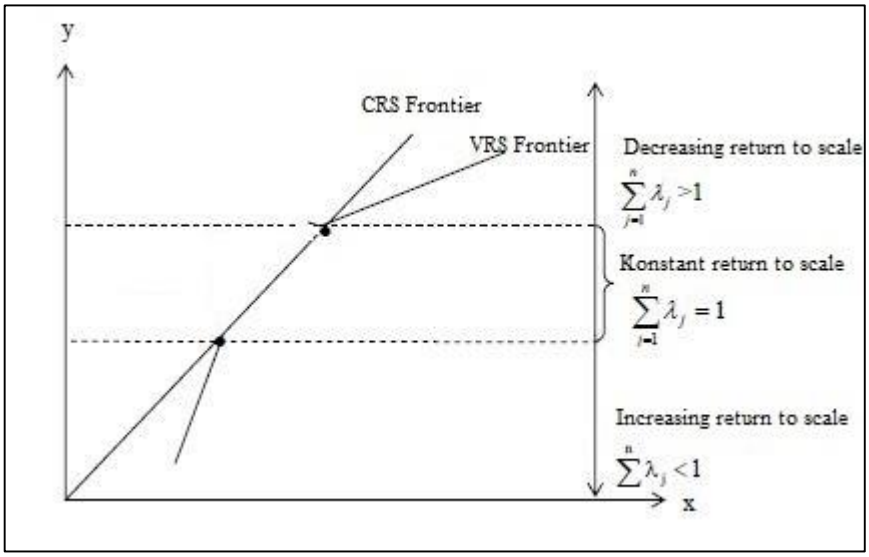

Figure 5: Scale properties. Adapted from [23].

A firm is usually not able to alter its scale in the short run. Therefore, the VRS TE is a reflection of what can be achieved in the short run, while CRS TE is something that can be achieved in the long run (optimal SE) [11].

VRS efficient DMUs could occur because there does not exist banks that perform in the same scale, and therefore these DMUs are seen as efficient. [23] state that Berg et. al.(1995) conducted a study of 218 Norwegian banks and determined that this was too small a sample to make conclusions about scale. Other sources such as [24]and [25] make conclusions about scale. In [25] the researchers analyze a large data set of banks in several European countries, while [24] analyzes a selection of 20 banks in Portugal.

[23] and [26] have both used CRS when analyzing the efficiency of Norwegian savings banks. However, they used a smaller sample, including only companies registered with "Grunnfondsbevis" in the stock exchange. In this study, the purpose is not to investigate the correlation between the efficiency and the value of "Grunnfondsbevis" for the banks, and therefore all savings banks could be included, increasing the number of DMUs to an average of over 110. The VRS approach seems more applicable to a real case. Small banks may not get the benefits of shared information technology, and may spend relatively more resources per output. A bank that is too large may be too complex in its organizational structure and could have difficulties to adjust to rapid changes in the market [27]. This is also supported by [28] and [9]. A CRS model should however be included as well, since this enables the possibility to investigate SE, and because the results gained through the VRS approach will

be more uncertain. The approach of combining CRS and VRS in the analysis is supported by many researchers and can provide relevant information with little additional effort [9].

3.1.4 Selection of input/output orientation

The explanation of the efficiency terms in the previous sections was illustrated with an input oriented method. This method find how much inputs can be reduced without changing the level of produced outputs. An output oriented method looks at efficiency the opposite way, examining how much outputs can be increased without increasing the level of inputs used. In Figure 6, the concept of this method is illustrated as presented in [11].

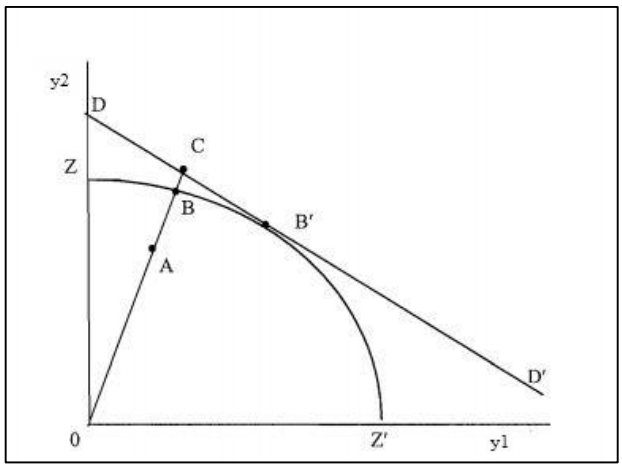

Figure 6: Output orientated efficiency. From [11].

In Figure 6, output oriented efficiency based on two outputs are illustrated. The axis y1 represent the level of output y1, and the axis y2 represent the level of output y2. The curve ZZ' represent the efficient frontier (the production possibility curve) and illustrates the upper bound of the production possibilities. DD' represent the isorevenue line, i.e. the combination of the two outputs that give the same revenue. The observations of outputs for the DMUs lies below the efficient frontier in an output orientation, like in point A. The radialy projected point for this DMU would be in point B on the efficient frontier. The DMU would become revenue efficient if it change its output combination to point B'. If the DMU had an output combination in point C, it could also be revenue efficient if it moved the production to point B'.

From a modeling point of view, both the input and output orientations would give the same efficient frontier. Only the scores for the inefficient DMU's would be different [11]. This is

because the objective function of the output orientation of the ratio form of the DEA model is to minimize the inverse ratio, $\left(\frac{1}{e_{j_0}}\right)$, of the ratio form of the input orientation [28].

In the envelopment form the output DEA model with CRS could be defined in the following way:

$$\max \varphi \tag{17}$$

Subject to

$$\sum_{j=1}^{n} \lambda_j x_{ij} \leq x_{ij_0} \qquad i=1,\ldots,m \tag{18}$$

$$\sum_{j=1}^{n} \lambda_j y_{rj} \geq \varphi y_{r_0} \qquad r=1,\ldots,s \tag{19}$$

$$\lambda \geq 0 \qquad j=1,\ldots,n \tag{20}$$

Parameters:

x_{ij}: input of type i for DMU j

y_{rj}: output of type r for DMU j

Variables:

φ : efficiency score of DMU_0.

λ_j: weights for DMU_j

Explanation:

(17) represents the objective function that seeks to maximize the efficiency score for the DMU under evaluation. (18) represents a set of constraints, one for each type of input, which ensures that the weighted sum of inputs are less or equal to the inputs of DMU_0. For each type of output, (19) ensure that the weighted sum of outputs for all DMUs is larger or equal to the outputs of DMU_0 compressed with the factor φ.

[28] argue that the purpose of the analysis is an important criteria for selecting orientation of the model. If the purpose is benchmarking then the orientation does not matter very much, because both orientations will reveal the best practice. An input oriented model would be appropriate if the goal is to find the units that are over-utilizing the resources. (Then input reduction is a good solution). If the goal is to identify the units that in the best way enhance their outputs, the output oriented approach could be the best choice. In situations where both input reduction and output enhancement is a goal for the DMUs a slack model could be used, see [29] for more information about this method. [9] state that the input orientation approach is the most common for analyzing the efficiency in banks. This could also be the best choice for this research as output enhancement is not necessarily the best strategy for a Norwegian savings bank. [30] state that for instance loan levels in the households should not be too high compared to the income levels, since this can cause losses for the banks and that the banks have a responsibility of not overheating the economy. The approach that will be used in this study is therefore an input orientation.

3.1.5 Selection of input – output combination

A common rule of thumb is that there should be not more than 1/3 as many variables in the study as there are observations in the sample. This is because "too many" DMUs could become efficient because of more possibilities of unique combinations of the inputs and outputs if the number of variables are too large. However, [28] strongly suggest that this is a rule that is applied out of convenience, and not necessarily based on statistical grounds. Here it is stated that there exist situations where large numbers of companies actually are efficient. According to [28] it is meaningless to impose a rule in DEA that the sample size should be larger than a given specific, this is because the DEA method is a benchmarking tool not so much interested in individual performances.

If the efficiency scores are not significantly changed due to the addition of an extra variable, the inclusion of this variable would not provide much additional information to the analysis. This could often happen when the variables are correlated. In [31], this fact is illustrated with an example of three inputs and two outputs. Here, two of the inputs are perfectly correlated. When one of the correlated input variables is excluded from the model, the efficiency scores for the DMUs had almost no change related to the case when all three input variables were included. However, there were small differences for some of the DMUs. [31] state that the exclusion of correlated input variables could be appropriate when the analysis

include so many DMUs and variables that the performance of the selected software is compromised. [32] state that including irrelevant variables gives an image of efficiency that is closer to reality than excluding relevant variables, therefore the risk of including too many variables in this study seems to be low.

As mentioned in section 3.1.2.3, the DEA model could be very sensitive to the selection of input- and output variables. It is evident that the variables that are used also would determine what type of efficiency that is being measured. The selection of these variables is complicated in studies of service companies such as banks, as it is not intuitive to determine what is being produced and what is being used as inputs.

[9] presents four different approaches for selection of variables to use in the DEA model. The first approach is the production approach. Here each bank is considered to be a production unit which produce loans and other financial services by the use of different inputs. Also an intermediation approach could be used if researcher see banks as an intermediary of financial services. In the production approach, deposits are considered as outputs opposite to the intermediate approach where they are considered as inputs. Another approach presented in [9] is the asset approach. This is somewhat similar to the intermediate approach since deposits are treated as inputs. The only outputs in this approach are assets that generate revenue, such as loans or investments. The third method is the value added approach where all items that generate value for the company are treated as outputs. The final approach mentioned in [9] is the operating approach. Here, interest expenses and noninterest expenses are treated as inputs, and interest income and noninterest income is considered as output variables. The production- and intermediate approaches are according to [9] the most common in the literature, 57% of studies use the intermediate approach and 22% the production approach.

The selection of approach would be based on the assumption on whether a bank is a financial intermediate or a provider of financial services. According to [33] the production approach would imply that the efficient DMUs have more deposits, whereas in the intermediate approach the efficient firms have a relatively low level of deposits. [33] state that this is a judgement call which the researcher has to make when choosing between the two approaches. The solution proposed by [33] involves using network DEA models to treat deposits as intermediate products which are both inputs and outputs simultaneously. This

approach is also supported by [28], which state that banks use deposits in two stages, as outputs in the first stage and as inputs that generate profits in the second stage. [9] argue that the intermediate approach is best suited for efficiency analysis of bank industries, whereas the production approach is best suited for efficiency analysis of bank branches.

In this study, a variant of the production approach will be used. The banks use the deposits to gain funds, and must provide liquidity, payment and safety services to the customers in order to obtain and keep the deposits, therefore it seems logical that efficient banks are the ones that have relatively large deposits from customers. This judgement call will imply that this study will be based on the assumption that efficient banks have more deposits as a result of good relations to their customers, low risk profile and high deposit interest rates.

Apart from deposits, several other variables also must be considered to be included in the study. [9] present the following list of common variables used:

	Variables	Description
Input	Labor	No. Of full time employees, personell expences, provisions for employees
	Capital	Fixed assets, liquid assets, total assets, equity
	Purchased funds	Deposits, borrowings
	Expenses	Interest expenses, operational expenses, noninterest expenses, other admin expenses
	Other	No. of branches, no. of ATM's
Output	Deposits	Transaction deposists, non-transaction deposists, demand deposits, fixed deposits, saving deposits
	Loans and advances; investments, other earning assets	Commercial and industrial loans, customer loans, real estate loans
	Fee based income	Interest income, non interest income
	Off balance sheet items	Operating lease, securitized debt
	Securities	Equity, interbank loans
	PAT	Profit after tax, operating profit

Figure 7: Efficiency analysis variables. From [9].

In Figure 7, the input variables have been categorized into labor, capital, purchased funds and expenses. Outputs are categorized into deposits, loans, free based income, off balance sheet items, securities and profit after tax (PAT). Many of these are elements that can be found in the banks yearly accounts.

[23] and [26] use the production approach and select fixed assets, number of FTEs and total assets minus deposits as inputs. Net deposits and net loans are selected as outputs. [34] use credit losses, personnel expenses and interest-rate margins as inputs, and net loans, deposits

and number of bank branches as outputs. These are selected to measure the service efficiency of banks. [34] argue that savings banks have strived to obtain the image of being safe and risk averse, and that they operate under other terms than a traditional profit oriented firm. This could also be said about the savings banks in Norway [5] . Hence, one can argue that a savings bank have multiple objectives, and not only the traditional profit maximization goal. Some of these other targets could be customer value and service efficiency [34]. These objectives could be reflected in low labor cost, small margins on interests and low operating costs.

For this study it is also important that the data is possible to measure (data is available and reliable), relevant to the research questions and contributing to the efficiency analysis. The selected variables based on this are listed in Table 2.

Inputs	Outputs
Total salaries cost	Deposits
Total assets - deposits	Net loans
Interest expences	Interest income
Credit losses	

Table 2 Selected input- output combination

Total cost of salaries is the only available variable that includes labor. This variable is therefore a self-made choice as efficient use of labor is one of the most important determinants of efficiency in a service company [35]. The problem with using labor cost as a variable could possibly be that it does not differentiate between the number of workers and the skill level of these workers. Two banks with the same total salaries expense could therefore have very different efficiency per worker as one of them might have many workers with low salaries, while the other might have a small workforce that has a high pay grade. Despite this, the total salaries could reveal if the amount of money used on labor is efficient compared to other banks.

Total assets include the total value of the funds that a finance institution has at its disposal. This is equal to the sum of equity and liabilities, and will represent the capital category of inputs. Since deposits are considered as outputs, these have to be subtracted from the input variable.

The variable considering interest expenses could also be relevant to answer the research questions. This measure provides information of the bank's ability to choose an interest portfolio that minimizes the total interest expenses.

The model also includes credit losses as a variable. Credit losses will in this setting be defined as the total losses on loans for a bank in one accounting period. This is not only equal to the actual observed losses, but a budgeted sum based on the risk levels on the loans as well. Based on this, it can be claimed that this variable represents something that can be linked to the banks risk profile. For a service oriented bank this profile should be rather low implying that small credit losses is beneficial [34].

Net loans to customers is the only variable that is treated consistently as an output by all approaches, and might therefore be a solid choice for this study as well. However one could also argue that this could be a result of the customer service work over many years, and that the net loans to customers would include a portfolio of loans with varying risk and time scope. Interest income could tell something about the bank's ability to use assets in a way that generates income.

3.1.6 Productivity change and ranking of efficient DMUs

This research also seek to answer research questions about the most efficient banks in Norway as well as whether the productivity has changed during the period of analysis. The DEA method does not differentiate between the efficient firms, so other techniques must be introduced for this purpose. In the next sections, some of these methods are introduced as well as some methods for evaluating productivity change.

3.1.6.1 Selecting of method: Ranking of efficient DMUs

[36] discuss several methods for ranking the efficient banks after using DEA analysis. These are methods mentioned are cross-efficiency ranking methods, super-efficiency ranking techniques, benchmark ranking method and ranking with multivariate statistics in the DEA context. Cross-efficiency ranking methods calculate the efficiency score of each DMU j times, using the optimal weights evaluated by the j LPs in the DEA method. Super-efficiency enables an extremely efficient unit to get an efficiency score greater than one. Benchmarking ranking method was first introduced by Torgersen et.al in [37] in 1996, and is a technique that measure the importance of a DMU as a benchmark for DMUs that are inefficient with the use of slack based DEA data. Ranking the efficient DMUs by multivariate statistics

represent some other alternative approaches suggested in literature [36]. One of the goals of these methods is to eliminate the gap between DEA and statistical approaches.

[23] use both super-efficiency and benchmark ranking methods to assess the relative efficiencies of Norwegian banks. According to [36], these two methods are similar in the way that they both rank only the efficient units and they do not use a common set of weights. Super-efficiency models will not rank the inefficient DMUs with a new concept, as opposed to the benchmarking method. Another difference is that super-efficiency models occasionally have problems with infeasible solutions. In this study, a slack based DEA will not be solved in stage one of the analysis, and super-efficiency analysis will therefore be easier to conduct, while providing with sufficient information for ranking the efficient DMUs. In the next section the super-efficiency concept is described in detail.

3.1.6.2 Super-efficiency

If the DMU under evaluation is excluded from the reference set when solving the DEA model, the efficiency scores are called super-efficiency scores. The super-efficiency model was first introduced by Andersen and Pettersen in 1993 in [38]. This method could be used for ranking the DMU's or to make sensitivity analysis of the efficiency scores [21].

The main difference between the regular envelopment DEA models and the super-efficiency DEA models, is that the super-efficiency models are based on the reference technology of all DMUs except the one under evaluation.

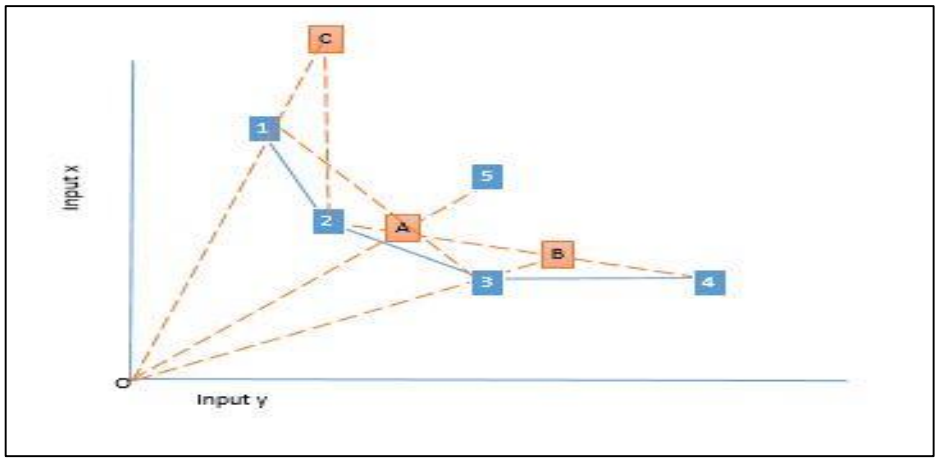

Figure 8: Super efficiency. Based on the figure in [38]

In Figure 8, the concept of the method is illustrated. Each of the blue squares with numbers represents the production point of a DMU. If the super-efficiency of DMU 2 is under evaluation, DMU 2 is evaluated by the new frontier including the line A, determined by DMUs 1 and 3. If the super efficiency score of DMU 2 is calculated now, it is clear that it would get a score that is more than one, since it lies below the new frontier. If the DMU under consideration is DMU 3, the new frontier between DMU 2 and 4 would go through B. If DMU 4 or DMU 5 is evaluated, the super efficiency scores would be the same as for the original input oriented DEA model. This is because the efficient frontier would remain the same. If DMU 1 was evaluated, it would be compared to the extended line from DMU 2, C. This method could be used for ranking DMU's as a super efficiency score of 1.24 is better that a score of 1.1, since the DMU with the highest score lies further away from its peers.

It is important to notice that the super-efficiency scores and the efficient DMUs are not compared to the same standard. Therefore the super-efficiency scores should rather be treated as potential input savings or output surpluses and not as pure efficiency scores [21].

Below, the formulation of a super-efficiency DEA model is presented:

$$\min \theta^{super} \tag{21}$$

Subject to

$$\sum_{j=1,j\neq o}^{n} \lambda_j x_{ij} \leq \theta^{super} x_{ij_0} \qquad \text{i=1,…,m} \tag{22}$$

$$\sum_{j=1,j\neq 0}^{n} \lambda_j y_{rj} \geq y_{r_0} \qquad \text{r=1,…,s} \tag{23}$$

$$\lambda_j \geq 0 \qquad \text{j=1,…,n} \tag{24}$$

For VRS orientation:

$$\sum_{j\neq 0} \lambda_j = 1 \qquad \text{j=1,…,n. } j\neq 0 \tag{25}$$

Variables:

θ^{super} : super-efficiency score for the DMU under evaluation

λ_j : weight for DMU_j

Explanation:

The objective function (21) minimizes the super-efficiency score for DMU_0. (22), (23) and (25) represents the constraints similar to (9) (10) and (12) respectively, except that DMU_0 is excluded from the left hand side of the constraints. (24) represents non-negativity constraints for the variables.

The main issue concerning the super-efficiency model is that infeasible solutions will occur with a VRS assumption. This can be dealt with using some additional techniques (see e.g. [39] and [40]). For this research, a regular super-efficiency model with a CRS assumption seems sufficient to answer the research questions, and thus this is the only method that will be used.

3.1.6.3 Selection of method: Productivity change

The efficiency scores obtained from the DEA can be used to measure the productivity change between periods in a number of different ways. The type of approach to select would depend on the goal of the analysis. Also the right kind of data should be available. Malmquist index using cone technology require a large panel data set. If this is not available only a Hicks Morsteen approach is feasible [11]. [11] gives the following advice when selecting an approach: if CRS is assumed and panel data is available the Malmquist index method could be the best approach. If VRS is assumed, a component based approach of productivity measurement outlined by [41] could be appropriate. From [9] it is clear that the Malmquist approach is most supported by existing literature. Also, this study includes many observations of data, and a relatively large panel data set is therefore available. Based on this, the Malmquist approach will be used in this research.

3.1.6.4 Malmquist productivity index method

The Malmquist productivity index (MPI) was first defined for this purpose by Caves et.al in 1982 in [42]. The method is not based on return to scale assumptions, thus there is no need to specify the scale orientation a priory. MPI captures two important causes of productivity change: efficiency change and technical change. If MPI is calculated based on VRS data,

another source of productivity change could also be measured: SE change. However, there are many arguments that this is not applicable in practical cases [11]. The SE change implies that the true production theory must be VRS, however it reflects the movement of a CRS technology. [43] illustrate that the MPI may not correctly measure productivity changes for VRS technology. Economics of scope through variations in outputs and inputs are also not included in the MPI model. However, if the technology exhibits CRS, all causes of productivity change are captured by the MPI.

$$MPI_t^I = \frac{TE_{t,t+1}^I}{TE_{t,t}^I} \tag{26}$$

(26) defines MPI as equal to improved efficiency relative to the best performers. It relates the observation in period t+1 to a benchmark technology, namely period t frontier. In Figure 9, this concept is further exemplified.

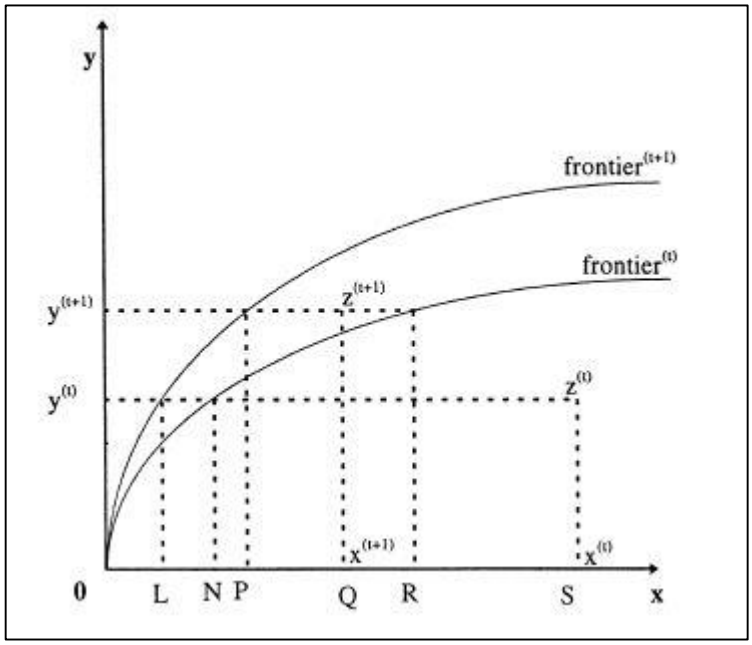

Figure 9: Concepts of MPI, from [44]

In Figure 9, a production frontier representing outputs y, and inputs x is illustrated for two time periods t and t+1. The relative movement in efficiency for a DMU (Z) must be measured based on the relative change in the DMU's position related to the frontier for each time period (TE). If the industry displays technological change (TC) between the periods, i.e. that the frontier has shifted, the relative movement of efficiency also have to be based on the relative change of the frontiers. An input based measure of efficiency for this DMU can be

found by the distance ratio, in this case ON/OS for DMU (Z) in time t. Reducing the inputs proportionally to this distance will make the DMU technically efficient. In period t+1, inputs should be multiplied by the distance ratio OR/OQ if the TE in this year were to be compared to the TE in period t. From the figure it is clear that both Z (t+1) and Z(t) are inefficient production points related to their respective production frontiers. However, since the frontier has shifted, the efficiency of Z (t+1) is more than 1, compared to the technology in period t, and the efficiency of Z (t) is much lower compared to the technology in period t+1.

The input-based MPI between time period t and t+1 can be defined as:

$$MPI^{I}_{t,t+1} = \left[\left\{\frac{D^{I}_{t}(Y_{t+1},X_{t+1})}{D^{I}_{t}(Y_{t},X_{t})}\right\}\left\{\frac{D^{I}_{t+1}(Y_{t+1},X_{t+1})}{D^{I}_{t+1}(Y_{t},X_{t})}\right\}\right]^{0.5} \quad (27)$$

This is a geometric mean of the method with period t+1 as base year and period t as a base year. These two methods only have equal results if the technology is Hicks output neutral [11]. In order to prevent this restriction, MPI is often illustrated as in (27). The indexing ^{I} indicates an input orientation.

$MPI^{I}_{t,t+1}$ is the productivity of the most recent production point relative to an earlier production point. The ratio in the first crucial bracket denote the input distance function of DMU's in time t+1 using the DMUs in time t as the reference technology, related to the distance functions of DMUs in time t with time t as reference technology. The ratio in the other crucial bracket denote the input distance function of the DMUs in time t+1 with the time t+1 technology as the reference technology, related to the distance function of the DMUs in time t using the technology in t+1 as a reference. This equation can be decomposed to present TC, i.e. the shift in the frontier, and pure efficiency change PEC i.e. improvement in efficiency:

$$MPI^{I}_{t,t+1} = Efficiency\ change\ x\ Technical\ change$$
$$= \frac{D^{I}_{t+1}(Y_{t+1},X_{t+1})}{D^{I}_{t}(Y_{t},X_{t})}\ x\ \left[\left\{\frac{D^{I}_{t}(Y_{t+1},X_{t+1})}{D^{I}_{t+1}(Y_{t+1},X_{t+1})}\right\}\left\{\frac{D^{I}_{t}(Y_{t},X_{t})}{D^{I}_{t+1}(Y_{t},X_{t})}\right\}\right]^{0.5} \quad (28)$$

Three possibilities exist for the values of the measure:

MPI < 1	Decline in productivity	(29)
MPI = 1	No change in productivity	(30)
MPI > 1	Increase or improvement in productivity	(31)

The MPI can be calculated using DEA. For the j'th firm one must calculate four distance functions to measure the productivity change between two periods. Four different LP's are therefore needed for each DMU. This imply that if there are N time periods and j DMU's then N x (3t-2) LP's have to be calculated. The different LP's are:

1. $D_t^I(Y_t, X_t)$: DEA similar to regular LP's for DMU's in period t
2. $D_t^I(Y_t, X_t)$: DEA similar to regular LP's for DMU's in period t +1
3. $D_t^I(Y_{t+1}, X_{t+1})$: The model presented below:

$$D_t^I(Y_{t+1}, X_{t+1}) = \min \theta \qquad (32)$$

Subject to

$$\sum_{j=1}^{n} \lambda_j {x^t}_{ij} \leq \theta {x^{t+1}}_{ij_0} \qquad \text{i=1,…,m} \qquad (33)$$

$$\sum_{j=1}^{n} \lambda_j {y^t}_{rj} \geq {y^{t+1}}_{r_0} \qquad \text{r=1,…,s} \qquad (34)$$

$$\lambda \geq 0 \qquad \text{j=1,…,n} \qquad (34)$$

Explanation:

This model compare the inputs and outputs of DMU 0 in period t+1 to the frontier at period t. The other mixed period measure can be obtained by comparing the outputs and inputs of DMU 0 in period t to the frontier in period t+1.

4. $D^{I}_{t+1}(Y_t, X_t)$: Similar to the model above, but with opposite time-period indices.

3.1.7 Stage two analysis

Most of the research considering efficiency and profitability in banking also seek to explain the causes of efficiency- and productivity change. Therefore, second stage analysis often is performed, regressing the results from the first stage on some determining factors. In this second stage, the choice of these factors can be organized into three categories [9]. Some articles have a macroeconomic determinant such as GDP or inflation. Others look at bank specific determinants such as bank size and market share. Finally, in some of the research regulatory determinants are analyzed, examining for instance the effect of ownership and reforms. The method of assessing the causes of efficiency and profitability change could be either: Tobit regression, fixed and random effects panel data regression, generalized method of moments (GMM), ordinary least squares (OLS) or logit and probit regression. [9] conclude that panel data regression, Tobit and OLS are the methods most commonly used (27%, 25% and 15% respectively). Some studies analyzed in [9] also investigated the effects of the profitability change, such as shareholder value, stock market returns, mergers and acquisitions.

3.1.7.1 Selection of second stage analysis method

Some the goals of this study are to analyze the effects of size and the effects of alliances between banks on the banks efficiency. Also, the effects of the financial crisis are to be investigated. The super-efficiency method enables both OLS and panel data regression, therefore this will be used to investigate the effect of size and the finance crisis. Using this, hypothesis testing can be performed, validating the results.

To investigate the effect of alliances, several possible methods exist. Some studies analyze the efficiency for every alliance and compare the mean efficiency scores. The problem of this method is that the mean efficiency scores are only a result of the relative efficiency of the best performer in that alliance. Other studies have solved the DEA (or super-efficiency analysis) regularly first and separated the DMU's in their respective alliances afterwards. This way, one could see if the efficiencies are higher or lower for some groups. This is done in [23] and [26], and seem to be the most suitable method for this study as well.

4.0 Literature review

In the previous section, some sources were used to explain and discuss some basic concepts relevant for the research, and some sources using the concepts were referred to. In the following sections, a literature review covering some more specific research related to the selected solution methodology and the goals of this research is presented, with a specific emphasis on the results of the second stage analysis. The literature review is organized as follows: first, relevant sources considering the effect of sizes and alliances on bank efficiency and productivity are discussed. Next, some literature concerning the effect of the finance crisis on baking industries is presented. Finally, some sources covering efficiency, as well as other topics concerning Norwegian banks that are relevant for this research, are covered.

4.1 Size and alliances

A relevant article considering DEA analysis on Swedish banks is [34]. Here, the authors measure the bank performance according to service efficiency. The term service efficiency is developed in the article when the authors is recognizing that a savings bank is more dependent on its customer than a commercial bank. Based on this [34] state that these banks are not as profit oriented, and therefore require efficiency evaluating relative to the best service performer. The banks in the sample are denoted ISBs (Independent Savings Banks), these are relatively small banks that have no private owners. The article conclude that small to medium sized independent banks are more likely to be efficient if variables including a service element are analyzed. This is something that to a certain degree is included in this thesis. From [5], it is clear that the Norwegian savings banks also operate with goals that are not only profit orientated. Therefore, smaller banks could perhaps be expected to be more efficient.

[45] explore determinants of bank performance of Brazil from 2000 – 2007. This is done by the use of SFA, and the main conclusions are among others that large banks have a higher efficiency score and that this could be a reason for many mergers and acquisitions in the period. [46] also support that large banks are the most efficient, due to the recent financial innovations and deregulation of the market. [46] study bank efficiency using DEA on a selection of US banks from 2000 – 2005. Both of these studies were conducted before the financial crisis. Therefore their conclusions might not be valid for this study. Also, these

articles did not use the same selection as intended for this thesis. However, the results can say something about the benefit of large banks before the crisis.

[47] use DEA with VRS assumption as a benchmark for the efficiency of Latvian and Lithuanian banks before and after the finance crisis. The results were used to test hypothesis about the size of banks and efficiency scores. Also in this study, larger banks were more efficient. This was observed both before and after the crisis. However, the analysis in [47] used only 25 banks, and therefore the conclusions regarding sizes and efficiency should be interpreted with disclaimer.

[48] use a different kind of model, namely a mixed logit model to assess the factors that explain the profitability of a bank. The analysis is made out of 7636 observations, representing 1384 commercial banks in the EU in the period from 1993 – 2001. The study concludes that location and legal tradition as well as bank structure and size play an important role in the bank performance. Smaller sized banks with high loan intensity were the category of banks that performed the best.

4.2 The impact of the finance crisis

There does not exist very much accessible literature where the DEA method is applied to banking efficiency analysis in order to analyze effects on bank efficiency due to the finance crisis, but some relevant articles involving other methods can also be relevant.

One of the existing articles using DEA to analyze various measures of efficiency is [49]. The selection of DMUs in this study is 255 European banks in the period from 2005-2012. The conclusion of this paper is that the crisis had a definite effect on the efficiency of the banks. However, this effect varied across the countries that was analyzed. Banks in Belgium, Denmark, Ireland and Greece were the ones that was affected most by the crisis. Also, [49] concludes that the banks in Sweden and in Denmark had the highest levels of efficiency during the period. Another conclusion here was that commercial banks were the most affected by the crisis, followed by the savings banks which also had a large decline in efficiency. One of the most interesting findings of this paper was the large drop in scale efficiencies post-crisis. In the analysis, [49] use a traditional intermediate approach.

Another article considering the effect of the crisis on European banks is [50]. Here relative efficiency of European banking just before and just after the crisis were measured using 125 large commercial banks from 14 European economies. An intermediate approach was used also in this paper. The results of [50] suggest that the efficiency of most banks increased just before the crisis, and fell during the crisis.

[51] and [52] are two of the most resent applications of efficiency analysis on banking industries. [52] measure the efficiency of Australian banks before, during and after the crisis using DEA and bootstrapping techniques. The conclusions of this study was that small banks suffered from both technical and scale inefficiency, and that they would benefit by merging with some medium sized bank. The authors suggests that mergers between small banks would increase the efficiency of the bank industry in Australia more that mergers between the major banks. [51] seek to make a DEA model that incorporates risk into the bank efficiency scores. The proposed approach includes a probabilistic DEA model, with results derived from Monte-Carlo simulation. The result give a snapshot of the efficiency of Greek bank during the crisis, and strongly suggests that the incorporation of variables capturing risk is crucial to get a clear picture of the real efficiency of the industry.

In [53], a dynamic frontier model is applied for the purpose of evaluating long- and short run efficiencies of 364 European banks from 15 different countries during the period from 2005 to 2012. Also here, a drop in efficiency for most countries after the crisis was identified. However, the long-run results suggested that there was an improvement in both TE and AE.

Also Thai banks have been measured in terms of productivity change in the years 2007-2010 using DEA and MPI. In [54], the authors conclude that Thai banks were not affected by the crisis to a large degree before 2010. Local banks remained more stable than foreign banks. The authors also draw conclusions on scale efficiency, suggesting that Thai banks are running in a decreasing return to scale situation. The analysis was made based on 27 major banks, and by using a production approach.

[55] investigate the link between financial freedom and bank efficiency by producing DEA scores for 6744 bank observations operating in 27 European countries from 2001 – 2009. Bootstrapping techniques were used to regress the efficiency scores on economic freedom indexes such as government control and regulatory framework. The conclusions were that

the efficiency scores were higher for high degrees of economic freedom. This is an interesting article as the finance crisis increases the systemic risk, and acts as a background for governments to analyze policy frameworks. One could argue that if the degree of financial freedom exceeds a certain limit, it could cause financial crises, and the equilibrium of the degree of freedom and efficiency is something that should be given concern.

From all of these articles, it seems clear that the financial crisis had an effect on the efficiency of banks over the world. Banks in the neighboring countries of Norway were also affected. This could indicate that the efficiency scores for Norwegian savings banks also have decreased. However, many of the referenced articles have used different determinants of efficiency, and Norwegian banks were not included in these studies. Therefore these studies could be used as a support of the results for this thesis, but not as a definite indication of the efficiency of Norwegian banks.

4.3 Efficiency and profitability analysis on Norwegian banking

Some articles considering efficiency analysis in Norwegian banking exist, but they are hard to access. However in [23] and [26] literature reviews on these studies are provided. Based on this, it is clear that this subject has not been analyzed to a large extent in the past. In fact, [26] is the only known study that includes an efficiency analysis using Norwegian savings bank and data observations that is not older than ten years.

[23] and [26] both use the same banks in their master theses, where they asses the correlation between efficiency and the market value of the respective "Grunnfondsbevis" of the banks. [23] analyze the efficiency in the period 1998 – 2005, whereas [26] use the period from 2005 to 2009 in the studies. Both use CRS assumptions and a production approach. In [23], Sandnes Sparebank and Sparebanken Møre were the only banks that were efficient through the whole period. The mean efficiency was relatively stable for all years, varying from 0.85 to 0.9. Sparebanken Øst was the least efficient bank for most of the periods. [26] conclude that the finance crisis has affected the efficiency of Norwegian banks as efficiency scores increase from 2005 to 2007, before decreasing in 2008 and 2009. However, a critical note to these results is the small sample of banks these studies included, which could undermine results, especially when concluding about environmental effects.

Also some other studies about Norwegian banks should be mentioned, as they could be used to explain the results obtained from this study. These studies are [56], [57] and [58].

In [56] the aim was to investigate the increased cost for capital on DNB Nor, as a result of the stricter capital requirements for banks and financial institutions after the finance crisis (the Basel III standards). The study reveals that the requirements led to a cost increase between 1.26 and 1.38 %. It is claimed that DNB Nor uses this increase of expenses to increase the interest rates for their customers at a higher magnitude than what could be expected. When it comes to the effects on the efficiency from this it can be argued that if the increase in interest income is larger than the increased costs, the efficiency might increase. However, if the other banks have a cost increase that is not as high, the relative efficiency might not increase after all.

[57] considers the ethics of the Norwegian banks. This is something that could have an effect on efficiency of the banks, especially when the service element is included in the term. In [57] it is stated that the banks have a major challenge since it is difficult to detect and report unethical events. Without reporting these events, the managers therefore face some difficulties in the work of preventing them. This study will not be able to observe individual unethical events, but since the credit losses variable is included, the banks that provide loans for high risk projects, which could be seen as unethical, will be determined as inefficient.

The globalization of the banking industries in western Europe, with focus on Norwegian and Nordic banks, is discussed in [58]. The main conclusions were that even if the industry is strongly affected by the globalization, strong forces prevent the most dramatic consequences of this trend. These forces are mostly loyalty to small and local banks, laws and legislations and the fact that the economies of scale related to IT seem to be small for the time being. It is also stated that the competition on the international level seem to be limited to niche markets such as shipping, and that it is the local competition in each country that drives the industries. Based on this one could perhaps expect that the Norwegian banks have not been as affected by the finance crisis as the banks in the countries that were hit harder by the crisis, and that the smaller banks are operating at more scale efficient terms.

The comments from professor Arne J. Isachsen in [6], may also be viewed as a relevant source. Here, it is strongly suggested that DNB Nor is “too big to fail”, and that the

government should be aware of the decrease in efficiency in large banks due to the perceived promise of bail outs. If this is the case, the large banks should show decreasing return to scale results. In [6] it is also suggested that the large growth of the financial sector in the past periods is due to inflated salaries and unreasonably large profits. Based on these statements, the value of efficiency analysis of the Norwegian banking system seem higher, since it could help undermine or support these assumptions.

5.0 Data

The data used for this study are collected using accounting data for all the savings banks in Norway in the period from 2007 to 2014. This was retrieved from the Norwegian savings bank union, Sparebankforeningen [59], and Finance Norway [60] and can be categorized as secondary data available to the public. The reason for using these data is that they have been revised by accountants and that there are strict rules on how to categorize information. Many of the banks also present quarterly accounting numbers, but these numbers are not measured at a controlled standard, and could therefore include many different ways of assessing the numbers, leading to possible errors in the analysis. Quarterly accounts form banks are therefore only used to back up the information from the yearly accounts if some outliers or errors are identified.

5.1 Selection

[23] and [26], state that the total number of savings banks in Norway is the population of the study. They use the banks registered in the stock exchange as the sample. However, the correlation between prices on "Grunnfondsbevis" and the banks efficiency scores are not to be studied in this research, so the selection of banks does not have to be narrowed down to the ones listed at the stock exchange. In section 1.2, it is stated that the savings banks are not the only banks in Norway. In addition to the savings banks also commercial banks exist in the same market. Also, a number of foreign banks operate in Norway. According to statistical reasoning, the savings banks should not be determined as the sample for analysis, but as the production units [61]. The sample in this study is therefore the observed inputs and outputs of banks. These observations could be considered as a subset of a population of all theoretically possible combinations of these variables.

A demand when doing efficiency analysis is that the production units should be as homogenous as possible. According to [23], the Norwegian savings banks are to a large degree homogenous, since they mostly perform the same tasks and offer the same products. Although some of the savings banks are very large compared to the small ones (the 15 largest contribute to approximately 88 % of the total assets in 2013), the banks are organized the same way, with many small branches and one or more larger main offices [5]. [26] discuss the homogeneity of this data as some of the companies use IFRS accounting rules, while other use Norwegian standard for good accounting. In this study, there will not be made a differentiation between the companies using IFRS rules and those that does not, but this issue will be discussed further in section 7.3.

Also, a discussion on weather DNB Nor should be included or not is appropriate. DNB Nor could be viewed as a hybrid between a commercial bank and a savings bank [58]. In mid 2013, it officially became a commercial bank, as explained in section 1.2. Another issue considering DNB Nor is that it is very much larger than the other banks. The choice of including or excluding DNB Nor will be a judgement call, since it is similar to the other savings bank in many ways, but also dissimilar in other ways. Since the DEA method is based on ratios of outputs and input variables, the size of the bank should not cause large issues with a CRS assumption. However, it might be incorrectly made efficient with a VRS assumption (see section 3.1.3). Since the issue of the efficiency for DNB Nor can be an important result for this thesis, the bank will be included in the analysis as long as it does not imply too much influence on the results. This will be discovered by the preliminary data analysis.

In [61], the banks that are not operative in all of the years are removed. Also, the banks are backwards merged, so that all the years have the same selection of banks. The advantages of this method is that the analysis will consist of a homogenous group of banks, and that the banks could be compared more accurately from one year to another. On the other hand, this method would change the structure of the industry. In this study, some of the purpose is to analyze the effect of the financial crisis and the effect that size of the banks have on the efficiency, therefore doing this might corrupt the results. Also when comparing mean efficiency scores between the years, the results could be affected due to this. In this study backward merging will therefore not be done, and all the banks that are operative for each year will also be included if their data does not include errors.

On the basis of this, the selected production units for this study will be all Norwegian saving banks in the period 2007 - 2013, and the sample will consist of the observed inputs and output of these banks.

5.2 Preliminary study on data

Since the DEA method does not allow for errors, a preliminary study on the data is necessary. Through this, outlier observations can be detected and further analyzed. In the literature, there is no standard definition of when an observation should be categorized as an outlier, or when this outlier should be excluded from the analysis. A common procedure is to view observations that are extreme related to the other observations in the sample as outliers [62].

The detection of outliers in non-parametric methods is complicated because multiple inputs and outputs are involved. A bank could have extreme values in one of the dimensions, a subset of the dimensions or all of the dimensions [62]. It will be difficult to observe abnormal data which possibly are due to measurement errors just by looking at them. Therefore, some techniques for finding suspect values must be used.

Since it is important that the DMUs are homogenous in the analysis, a source of error could also occur if banks that are much more efficient than the others are included in the study. Some studies therefore use the super-efficiency scores of DMUs as a criterion for excluding observations from the analysis. For instance is DMUs with super-efficiency scores over 2 considered as outliers in [26]. For this research it seems unlikely that homogenous banks operating at more or less equal conditions and markets could have efficiency that are more than 100% larger than the mean scores. In order to be consistent, DMUs that get super-efficiency scores of over 2 are therefore removed from the analysis that year.

The DEA method will be most sensitive to errors in the efficient DMUs, since these could affect the efficiency scores for all the others. However, inefficient DMUs could be excluded from the efficient front because of errors in the data, so also these DMUs must be investigated before performing the DEA [62].

The preliminary study for detecting outliers as suggested by [11] include the following, for each data set:

1. Checking for outliers using means, standard deviations, maximum and minimum values and plots. Investigate suspicious observations in detail.
2. Look for zeroes in the data. If some are revealed, further investigation is necessary.
3. Use alternative sources to analyze suspect data, if this is possible.
4. Compute some basic ratios, and plot these for each unit in the data set.

Influential observations will not automatically be categorized as errors as done in [63], but will be treated in section 7.2.2.

In Appendix 14, some descriptive statistics for the data is presented, according to stage one in the preliminary data analysis. Here it is clear that the banks have very varying sizes, as the standard deviations for all variables are high. For instance, the standard deviation for total assets – deposits in 2013 was about seven times as high as the mean observation. It is also clear from these tables that the observed values are not very different for each year, indicating that there might not be many mistakes in the data.

Appendix 14 reveal a suspect number for credit losses. The minimum value for 2007 is 0, which seems unlikely. This zero value origins from Spareskillingbanken. To investigate this value further, the yearly accounts for 2007 for this bank, [64], was analyzed. Here it is clear that due to accounting techniques, the credit losses for the year was negative. This would cause a problem considering the DEA model. Therefore this bank will be excluded from the analysis in 2007.

Stage four in the primary data analysis encourages to make some basic ratios of variables and plot these in order to identify outliers. In this case, relevant ratios would be all outputs related to all inputs. For each year twelve possibilities for such ratios exist. These are presented in Table 3.

	Outputs	Inputs
1	Deposits	Labor
2	Deposits	Total assets - deposits
3	Deposits	Interest expences
4	Deposits	Credit losses
5	Net loans	Labor
6	Net loans	Total assets - deposits
7	Net loans	Interest expences
8	Net loans	Credit losses
9	Interest income	Labor
10	Interest income	Total assets - deposits
11	Interest income	Interest expences
12	Interest income	Credit losses

Table 3: Basic ratios for preliminary data analysis.

For each of these basic ratios, some statistics were calculated for each year, to find which data could contain outliers. This was done because making plots of all these ratios for all years would yield in 84 plots, and narrowing down the search would ease the analysis. These statistics are presented in Appendix 15. The values that are highlighted are values that could need further investigation. For instance does the values for ratio five in 2012 have a larger difference between maximum and minimum values and it has a relatively high standard deviation compared to the other periods. In Figure 10, a scatter plot of this ratio is illustrated:

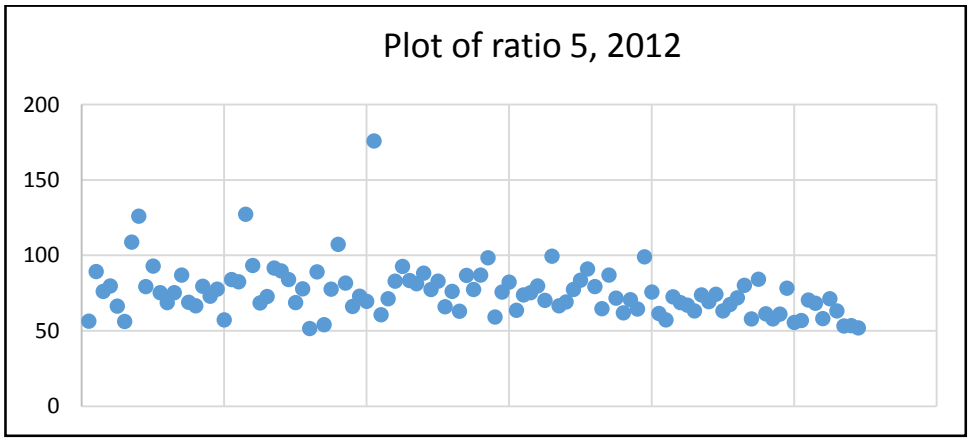

Figure 10: Plot of ratio 5, 2012

Here, it seems that there exist at least one outlier. In this case, this is Bamle Sparebank. Even if this is an outlier in this plot, this does not necessarily imply that the bank should be excluded from the analysis. [23] find that some of the banks that seem to be outliers in one plot, have the same atypical ratio for all the years, implying that the specific bank has a relative high or low productivity for these specific variables. If this is the case, the bank does not need to be taken out of the analysis, as it does not represent a source of error in the data,

but a specific technology in the set of possible technologies on the frontier. To identify if this is the case, the ratio for the specific bank for all years is plotted in Figure 11 below:

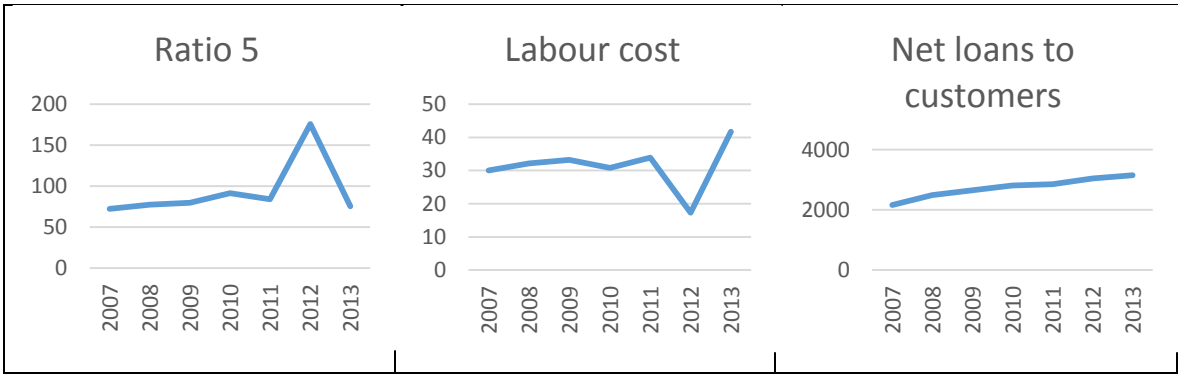

Figure 11: Ratios for Bamle Sparebank

Here, it seems clear that Bamle Sparebank indeed is an outlier for 2012. It seems that the labor cost in this period were exceptionally low compared to the other years. When analyzing the yearly accounts for this bank in 2012, it is clear that the irregularity was due to a change in the pension regime for the banks employees. The actual labor and administrations cost for 2012 for this bank was in fact 37,165 million NOK [65]. Inserting the "correct" number will ensure that the remote value is prevented.

This procedure of finding outliers was conducted for all the values marked with a highlight in Appendix 15. The results of this analysis are presented in Appendix 16 and Appendix 17, and summed up in Table 4 below.

Ratio	Possible outliers	Cause
3	Cultura Sparebank	Low interest expences
4	Strømmen Sparebank	Low credit losses
7	Cultura Sparebank	Low interest expences
12	Strømmen Sparebank	Low credit losses
	Birkenes Sparebank	Low credit losses

Table 4: Outliers based on ratios.

The reason for the outlier values for ratios 3 and 7 seems to be that Cultura Sparebank has overall low interest expenses compared to net loans and deposits. This is something that is consistent for this bank for all the years in the period. When analyzing this bank further it also seem that this bank differs from the rest of the banks through its concept as well, as it is defined as an ethical bank [66]. Strømen Sparebank has extremely low credit losses in

2008, 2009 and 2010, and will therefore be removed from the analysis these years. For Birkenes sparebank, this is the case for the years 2009 and 2010.

Of the observations in Appendix 15, Appendix 16 and Table 4 it is clear that credit losses is the variable that seem to fluctuate the most, and contain the most extreme values. From Appendix 14, it is evident that the ratios where this variable is included have large standard deviations, and large gaps between the highest and lowest values. This does not automatically entail that the data for credit losses include many outliers. The reason for this could also be that it is independent of the other variables. To investigate the relations between the variables further, a correlation analysis was performed.

	Labour cost 2013	*Tot.assets - deposits 2013*	*Interest expences 2013*	*Credit losses 2013*	*Deposits 2013*	*Net loans 2013*	*Interest income 2013*
Labour cost 2013	1						
Total assets - deposits 2013	0,9984	1,0000					
Interest expences 2013	0,9956	0,9914	1,0000				
Credit losses 2013	0,9986	0,9967	0,9935	1,0000			
Deposits 2013	0,9998	0,9988	0,9946	0,9990	1,0000		
Net loans 2013	0,9961	0,9920	0,9999	0,9939	0,9951	1,0000	
Interest income 2013	0,9990	0,9963	0,9988	0,9974	0,9985	0,9989	1

Table 5: Correlation of variables 2013

In Table 5, the correlation between the selected variables for 2013 is presented. Here it seems that each of them are strongly correlated. This is a natural phenomenon since it mostly is the size of the banks that drive these variables. A large bank would have more employees and also more deposits from customers. It is also logical that the correlation between input and output variables are positive. A negative correlation between labor costs and total deposits would imply that having many employees would decrease the "production" of deposits, which is an unrealistic assumption. It is evident that the credit losses are also highly correlated with the size of the banks.

	Labor cost/Ta	*Interest expences/Ta*	*Deposits/Ta*	*Credit losses/Ta*	*Net loans/Ta*	*Interest expences/Ta*
Labor cost/Ta	1,0000					
Interest expences/Ta	-0,4254	1,0000				
Deposits/Ta	0,0997	0,1341	1,0000			
Credit losses/Ta	0,5584	-0,3118	0,1928	1,0000		
Net loans/Ta	0,0969	0,3395	0,1071	0,3121	1,0000	
Interest income/Ta	0,2913	0,4433	0,2626	0,2690	0,6140	1,0000

Table 6: Correlation of variables relative to total assets, 2013

In Table 6, the correlations of the variables adjusted for the sizes of the banks by dividing each variable with the total assets are listed. From this table, it is clear that a very strong trend of correlation between most of the variables, when the size of the banks are dealt with, is absent. Still it seems that there is a positive correlation between the input and output variables although the correlations are now not so strong. The strongest correlation in the table is between interest income and net loans to customers. Here it seems that the interest income would increase with an increased net loan to the customers, which is a very intuitive result. There also is a relatively large positive correlation between credit losses and labor cost. There is a negative correlation between the labor cost and the interest expenses, implying that low labor cost might imply high interest expenses. The other negative correlation is between credit losses and interest expenses, meaning that it is a tendency for more credit losses if the interest expenses are low.

Based on this it seems that there might be more outliers in the credit losses variable, as it is not totally independent of the other variables. To analyze this further, a plot of the ratio credit losses/total assets could be a helpful tool.

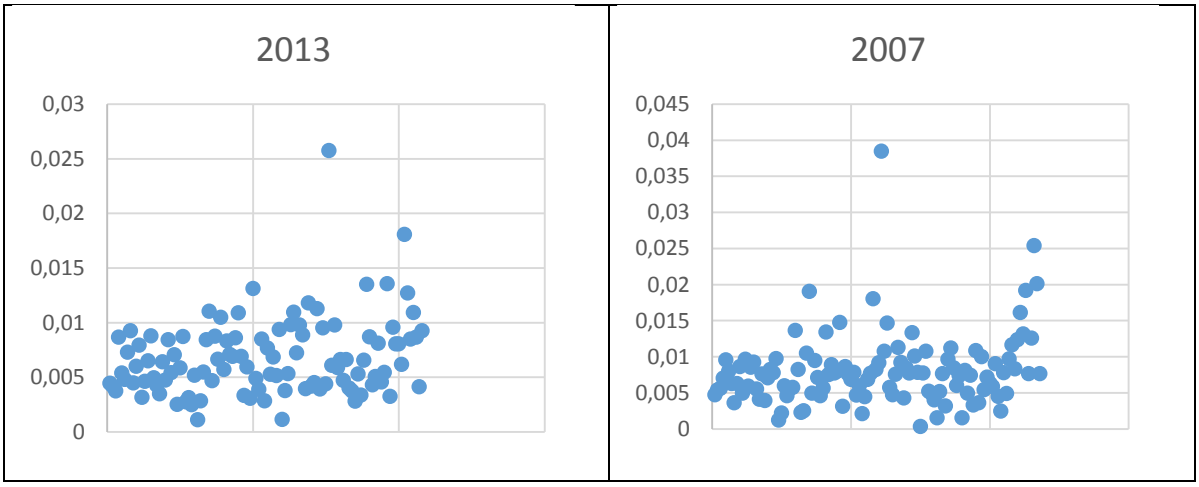

Figure 12: Ratio of credit losses/total assets

In Figure 12, two plots of the ratio credit loses/total assets are presented. The ratio plots of the rest of the years can be seen in Appendix 18. The banks in the plots are sorted in descending order according to the size of the total assets. This way it could be easier to see if the relative credit losses are higher for small or large banks. In 2007 it seems that the relation is fairly constant for the large banks. For the small banks the ratio seem to increase very much. This is something that is consistent for some of the years that are analyzed, but after 2009 this trend is not so evident. From 2009, it seems that the credit losses are relatively

small for a larger portion of the banks. This might imply that the banks risk profiles have changed. From Figure 12 it also seems that there exist some outliers. This is the case for most of the years, and in Table 7 the identified outliers are listed:

Year	Outlier 1	Outlier 2
2013	KVINESDAL SPAREBANK	
2012	VANG SPAREBANK	KVINESDAL SPAREBANK
2011	KVINESDAL SPAREBANK	SPAREBANK 1 GUDBRANDSDAL FRON SPAREBANK
2010	No spesific outlier	
2009	HJELMELAND SPAREBANK	
2008	HJELMELAND SPAREBANK	ETNEDAL SPAREBANK
2007	ETNEDAL SPAREBANK	

Table 7: Possible outliers based on credit losses.

For all of these banks, the ratio of credit losses/total assets, credit losses and total assets were plotted for all the years in the analysis. This way it could be identified weather the extreme values are caused by isolated events or because of the risk profiles or for instance the way of accounting credit losses (see section 5.1).

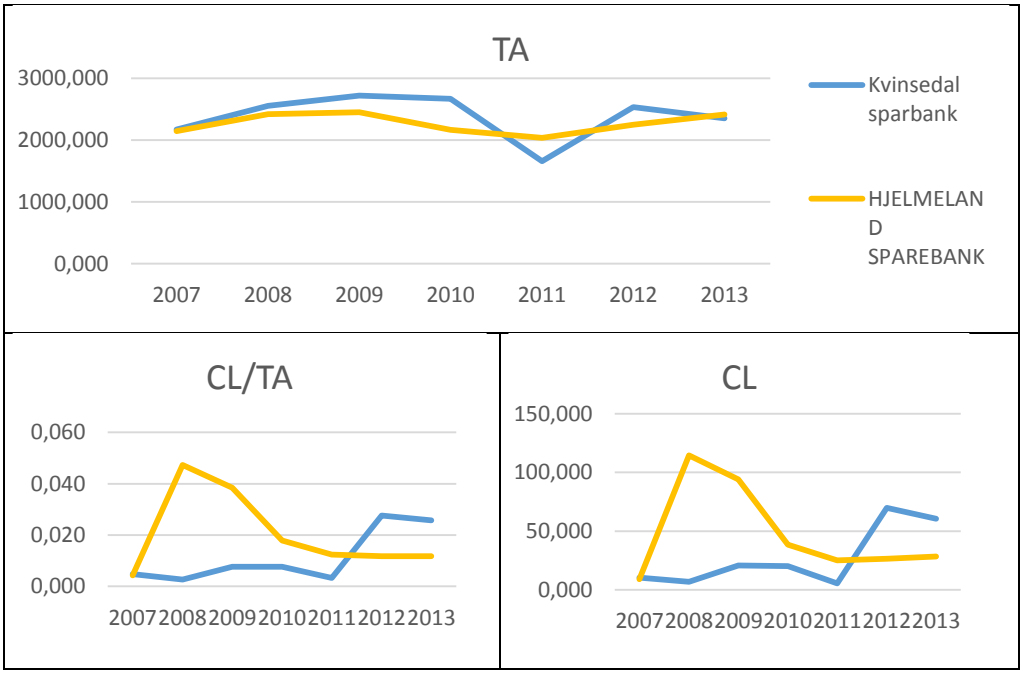

Figure 13: Ratios of credit losses and total assets for Kvinsedal Sparebank and Hjelmeland Sparebank.

In Figure 13 above, the ratio of credit losses and total assets, the credit losses and the total assets are displayed for two possible outliers, Kvinsedal sparebank and Hjelmeland sparebank. It is clear from the figure that the cause of the irregularity in the ratio is due to changes in the credit losses. Both banks had a minimum value of total assets in 2011, but in this period both banks had relative low credit losses. It is also clear from the figure that the

credit losses for these banks are in extreme points when the outlier values were observed, indicating that these values are not typical for the specific bank. Similar figures for all the outlier banks is presented in Appendix 19. Based on this, the outliers in defined in Table 7 could be excluded from the analysis the year that the extreme value is observed.

As previously mentioned, DMUs that get super-efficiency scores of over 2 will be excluded from the analysis that year. In Figure 14 the super-efficiency scores for 2013 are plotted with and without removal of outliers.

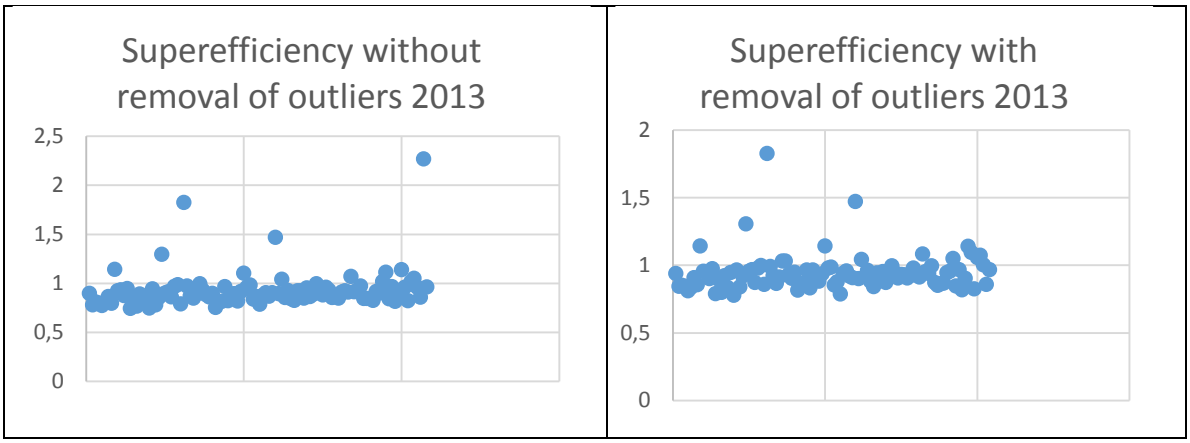

Figure 14: Super-efficiency with and without removal of outliers in 2013.

In Figure 14, it is clear that at least one bank will be excluded based on this criterion. In this case the bank with a score over 2 is Cultura Sparebank. This bank has a very high efficiency score due to irregularities in the interest expenses variable, as previously explained.

When all the previously proposed outliers in 2013 are removed, the mean efficiency score increases from 0.89 to 0.92, and the standard deviation for the scores are reduced from 0.19 to 0.13. In the figure, it is evident that there still exist some banks that have relatively high efficiency compared to the others. These banks are Jernbanepersonalets Sparebnak, Fornebu sparebank and Spareskillingsbanken. However, these banks have high efficiency scores for more than one year, and have relatively high efficiency scores for all the years in the analysis, they also fall under the pre-set criteria of a super-efficiency of over 2, and are categorized as homogenous to the other banks. This is opposed to Cultura Sparebank which had an extremely high efficiency score for only one year if this bank was not excluded from the analysis. In most of the cases, the removal of the outliers caused very small changes. In Appendix 20, some key result of the sensitivity analysis without removal of outlies are presented.

On the basis of the analysis and discussions in this section, the following changes were made to the data for each year. The banks that are identified with abnormal credit losses in Table 6 are removed from the analysis that year. Also banks that have super-efficiency scores of over 2 are removed that year. Since Cultura sparebank diverges from the other banks in its concept, and have outlier values in several years of the analysis, this bank will be categorized as an outlier for all the years. Table 8 present the banks that have been removed from the analysis for each year.

2007	2008	2009	2010	2011	2012	2013
CULTURA SPAREBANK	CULTURA SPAREBANK	BIRKENES SPAREBANK	BIRKENES SPAREBANK	CULTURA SPAREBANK	CULTURA SPAREBANK	CULTURA SPAREBANK
ETNEDAL SPREBANK	ETNEDAL SPAREBANK	CULTURA SPAREBANK	CULTURA SPAREBANK	KVINSEDAL SPAREBANK	KVINSEDAL SPAREBANK	KVINSEDAL SPAREBANK
SPARESKILLINGSBANKEN	HJELMELAND SPAREBANK	HJELMELAND SPAREBANK	STRØMMEN SPAREBANK		VANG SPAREBANK	
	SPARESKILLINGSBANKEN	STRØMMEN SPAREBANK				
	STRØMMEN SPAREBANK					
					Labor cost changed to 37,165 for BAMLE SPAREBANK	

Table 8: Removal of outliers.

6.0 Results and analysis

These following sections presents some key results obtained from the analysis of 131 Norwegian savings banks in the period from 2007 to 2013. The complete results can be found in appendices. The DMUs for each year are made out of all active savings banks in the period that are not categorized as outliers, from 106 to 119 banks. The sample in the study are the observed input and output values of these banks. The analysis was performed with Excel and Visual Basic (VB), using code developed by the author.

6.1 Efficiency analysis

6.1.1 Technical efficiency

		2007	2008	2009	2010	2011	2012	2013
VRS	AVERAGE VRS	0,9317	0,9561	0,9317	0,9385	0,9345	0,9357	0,9508
	ST.DEV	0,0705	0,0441	0,0580	0,0590	0,0585	0,0539	0,0528
	MIN	0,7491	0,8329	0,8047	0,7783	0,7959	0,7930	0,8052
	# of banks with score 1	41	40	30	33	33	25	36
	% of banks with score 1 VRS	35 %	35 %	26 %	30 %	31 %	24 %	35 %
CRS	AVERAGE CRS	0,8856	0,9318	0,8960	0,9085	0,8990	0,9031	0,9196
	ST.DEV	0,0784	0,0503	0,0577	0,0623	0,0619	0,0587	0,0609
	MIN	0,7455	0,7937	0,7809	0,7486	0,7807	0,7593	0,7790
	# of banks with score 1	23	23	13	18	14	12	15
	% of banks with score 1 CRS	20 %	20 %	11 %	16 %	13 %	11 %	14 %

Table 9: TE with CRS and VRS, results

In Table 9 some descriptive statistics of the findings of the analysis of TE are presented. The first rows in the table represent the results with VRS assumption, and the bottom rows represent the results with a CRS assumption. It is clear that the average score for both assumptions have been stable for all the years in the period. For VRS, this have varied from 0.93 to 0.95. For CRS the scores the average have been a little lower, varying from 0.88 to 0.93. The minimum TE scores have varied a little bit more, but have also had a generally stable level. For the CRS assumption, the minimum TE scores have varied from 0.74 to 0.79, and from 0.75 to 0.83 with VRS assumption. From this it seems that the Norwegian savings banks are quite similar in the efficient use of resources, and that the deviations from the most efficient banks each year are quite small. The number of efficient banks in the period have been more variable in the period. The complete results for the efficiency analysis with CRS and VRS assumptions are presented in Appendix 1 and Appendix 2 respectively.

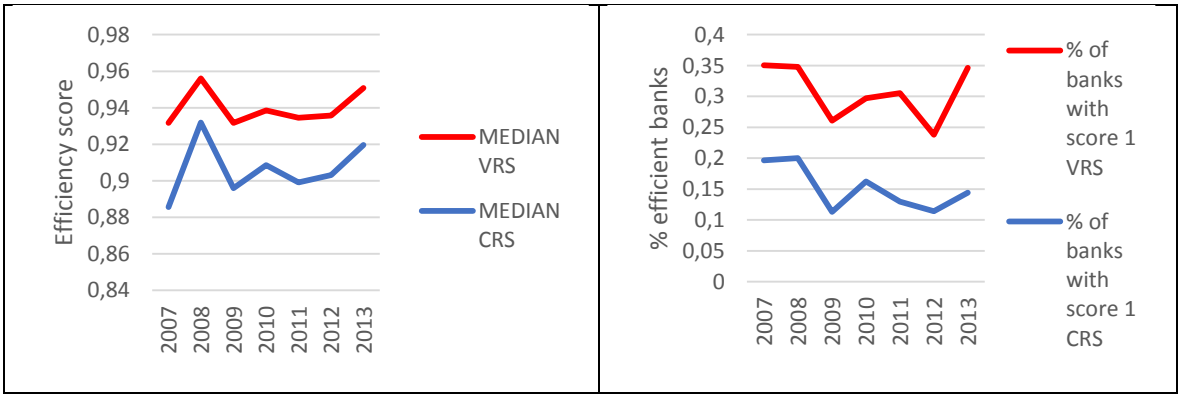

Figure 15: Median efficiency score and % of efficient banks.

From Table 9 and Figure 15, it is clear that the VRS assumption results in a larger number of efficient banks, which is in line with what could be assumed. This is also the case for the mean efficiency scores, which are larger with the VRS assumption. The maximum number of efficient banks with the VRS assumption was in 2007, with 41 efficient banks, equal to 35% of the production units. After this, the number decreased in 2008 and 2009, before increasing to about 30% in 2010 and 2011. The relative number of efficient banks with a VRS assumption reached a minimum level in 2012 with only 25 efficient banks (equal to under 25%). The median TE scores related to the CRS assumption follow the same form as for the VRS assumption, but as can be seen in Figure 15, it fluctuates more. For the relative number of efficient banks, the opposite is the case, when the graph fluctuates less with the CRS assumption. It is also evident that this patterns support the findings in [50], with an increase in efficiency just before the crisis and a drop during the crisis.

	Bottom 3 scores per year						
	CRS						
	2007	2008	2009	2010	2011	2012	2013
FJALER SPAREBANK	0,765	0,833	0,881				
HALDEN SPAREBANK	0,772	0,794	0,781	0,749			
HEGRA SPAREBANK	0,746	0,879	0,865	0,917	0,903	0,931	0,996
INDRE SOGN SPAREBANK	0,787	0,885	0,833	0,792	0,834	0,879	0,883
JERNBANEPERSONALETS SPAREBANK	0,869	0,997	0,793	1,000	1,000	1,000	1,000
KRAGERØ SPAREBANK	0,867	0,922	0,861	0,899	0,837	0,834	0,788
KVINNHERAD SPAREBANK	0,790	0,812	0,813				
Sparebank 1 Buskerud-Vestfold		0,870	0,834	0,813	0,784	0,789	0,791
SpareBank 1 Nordvest	0,759	0,862	0,829	0,811	0,781	0,759	0,779
Sparebank 1 Nøtterøy-Tønsberg				0,830	0,787	0,799	0,873
Bien sparebank	0,908	0,910	0,802	0,777	0,860	0,872	0,877
Sparebank 1 Østfold Akershus					0,872	0,784	0,799
	VRS						
	2007	2008	2009	2010	2011	2012	2013
AASEN SPAREBANK	0,822	0,859	0,900	0,962	0,913	0,910	0,920
BAMBLE OG LANGESUND SPAREBANK	0,824	0,876	0,835	0,847	0,862	0,841	0,819
FJALER SPAREBANK	0,766	0,833	0,899				
GJERSTAD SPAREBANK	1,000	0,935	0,918	0,863	0,819	0,839	0,819
HALDEN SPAREBANK	0,890	0,872	0,829	0,798			
HEGRA SPAREBANK	0,749	0,886	0,958	0,938	0,907	0,938	0,997
INDRE SOGN SPAREBANK	0,826	0,893	0,834	0,795	0,848	0,884	0,894
KLEPP SPAREBANK	1,000	0,874	0,851	0,950	0,840	0,793	0,868
KLÆBU SPAREBANK	0,784	0,848	0,847	0,832	0,864	0,899	0,999
KRAGERØ SPAREBANK	0,897	0,925	0,872	0,901	0,862	0,841	0,805
LARVIKBANKEN BRUNLANES SPAREBANK	0,920	0,901	0,822	0,883	0,853	0,833	0,879
NESSET SPAREBANK	0,802	0,886	0,919	0,818	0,796	0,839	0,874
SANDNES SPAREBANK		1,000	1,000	1,000	0,906	0,818	0,985
SOKNEDAL SPAREBANK	0,787	0,895	0,926	0,888	0,808	0,868	0,860
Sparebank 1 Nøtterøy-Tønsberg				0,843	0,820	0,829	0,878
Bien sparebank	0,964	0,910	0,805	0,778	0,866	0,881	0,878
SPYDEBERG SPAREBANK	1,000	0,990	0,825	0,851	0,866	0,901	0,957

Table 10: Bottom 3 banks according to efficiency scores each year.

In Table 10, the banks that have an efficiency score among the bottom three banks are listed for each year. The scores highlighted with red is the bottom score for that year, while the scores marked with yellow is the other values in the bottom three. With the CRS assumption, twelve different banks are in this category, whereas 17 banks have bottom three values with VRS assumption. Many of the banks that have a value in this category one year have high scores other years. For instance Hegra Sparebank, who has an efficiency score of 0.74 (0.75 for VRS) in 2007, is almost fully efficient in 2013, with a score of 0.99. Halden Sparebank had efficiency scores below 0.8 for all of the years in the analysis until it merged with other banks to form Sparebank 1 Østfold og Akershus in 2011. One bank that has been active all years stands out with bottom scores for three years with CRS, and relatively low scores for the other years: Sparebank 1 Nordvest.

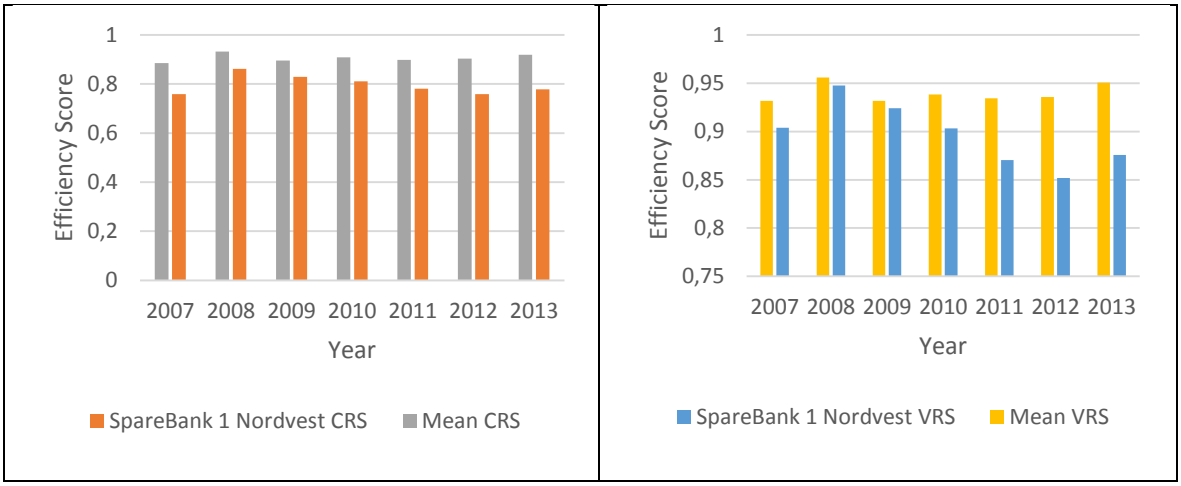

Figure 16: Efficiency scores for Sparebank 1 Nordvest.

In Figure 16, the efficiency scores of Sparebank 1 Nordvest is compared to the mean efficiency scores for VRS and CRS assumptions. From this it is clear that this bank is performing below average every year.

Only four banks were efficient for each year with CRS assumption. For VRS assumption this number increases to twelve banks. In Table 11 these banks are listed.

CRS	VRS
BJUGN SPAREBANK	BJUGN SPAREBANK
SPAREBANKEN PLUSS	DNB NOR BANK ASA
VESTRE SLIDRE SPAREBANK	FORNEBU SPAREBANK
VOSS SPAREBANK	HAUGESUND SPAREBANK
	SPAREBANK 1 SR-BANK
	SPAREBANKEN HEDMARK
	SPAREBANKEN MØRE
	SPAREBANKEN PLUSS
	SPAREBANKEN VEST
	VANG SPAREBANK
	VESTRE SLIDRE SPAREBANK
	VOSS SPAREBANK

Table 11: Efficient banks with CRS and VRS.

From Table 11, it is clear that all of the banks that are efficient under CRS also are efficient under VRS. This imply that these banks are scale efficient for all years as well. The banks that are fully efficient with only VRS assumption could be characterized as efficient in the short term, but could reduce its waste of resources compared to the other banks if they changed their scale of operations. Scale efficiencies will be further analyzed in the next section.

6.1.2 Scale efficiency

	2007	2008	2009	2010	2011	2012	2013
Total number of active banks	117	115	115	111	108	105	104
AVERAGE	0,9513	0,9749	0,9628	0,9689	0,9628	0,9661	0,9675
ST.DEV	0,0552	0,0343	0,0463	0,0468	0,0467	0,0497	0,0418
MIN	0,8076	0,8430	0,8352	0,7960	0,8061	0,8078	0,8103
Scale efficient banks	23	23	13	18	14	12	15
% Scale efficient banks	20 %	20 %	11 %	16 %	13 %	11 %	14 %

Table 12: Scale efficiency, results.

In Table 12, some information about the results obtained from analysis of scale efficiency are presented. Here it seems that the average bank have relatively low scale inefficiency, since the average SE varies from 0.95 to 0.97. Also the minimum level of scale efficiency is relatively stable with an exception in the years 2009 and 2010, when the minimum score decreases from 0.83 to 0.79. The relative number of efficient banks varies to a certain degree. It is on its maximum of 20% in 2007 and 2008, then decreases to only 11% in 2009. In 2010 it increases to 16% and then decreases in 2011 to 13% and in 2012 to 11% again. In 2013 the number increase to 14%. In Appendix 3, the obtained SE for all the savings banks are listed.

	2007	2008	2009	2010	2011	2012	2013
Number of banks with decreasing return to scale	98	82	66	71	89	76	85
Number of banks with increasing return to scale	17	31	48	40	19	27	19
% of banks with decreasing return to scale	84 %	71 %	57 %	64 %	82 %	72 %	82 %
% of banks with increasing return to scale	15 %	27 %	42 %	36 %	18 %	26 %	18 %

Table 13: Banks with decreasing and increasing return to scale

Table 13 presents the distribution of banks that operate with increasing or decreasing returns to scale. The most significant element in this table is that the relative number of banks with increasing returns to scale seem to increase very much from 15% in 2007 to 42% in 2009. The opposite is the case for the decreasing return to scale, where the number has decreased from 84% in 2007 to 57% in 2009. Since the size of the banks have not changed drastically over the period of analysis, this can suggest that something has happened with the scale properties of the industry during the period. In Appendix 4, the sums of weights of all the banks in the analysis are presented.

In Figure 17 below, the SE and sum of weights of the largest bank based on total assets, DNB Nor, and one of the smallest banks, Gildeskål Sparebank, are compared. As evident form the figure, both banks are relatively scale efficient in 2007 and 2013. In the middle of the period of analysis, the SE scores for both banks are relatively low. From the sum of weights it is clear that Gildeskål Sparebank are operating at increasing return to scale and could benefit from increasing its size, especially in the years 2008, 2009, 2010 and 2011. For DNB Nor, the sum of weights have been extremely high for all the years in the period except for in 2007. In 2009 and 2010 the sum of weighs has decreased, before increasing very much the following years. Having sum of weights at such high levels (up to over 800) could indicate that this bank have to decrease its size very much in order to operate on an optimal scale. However, since the scale efficiency scores have not been very low, the proposed saving of resources would be limited.

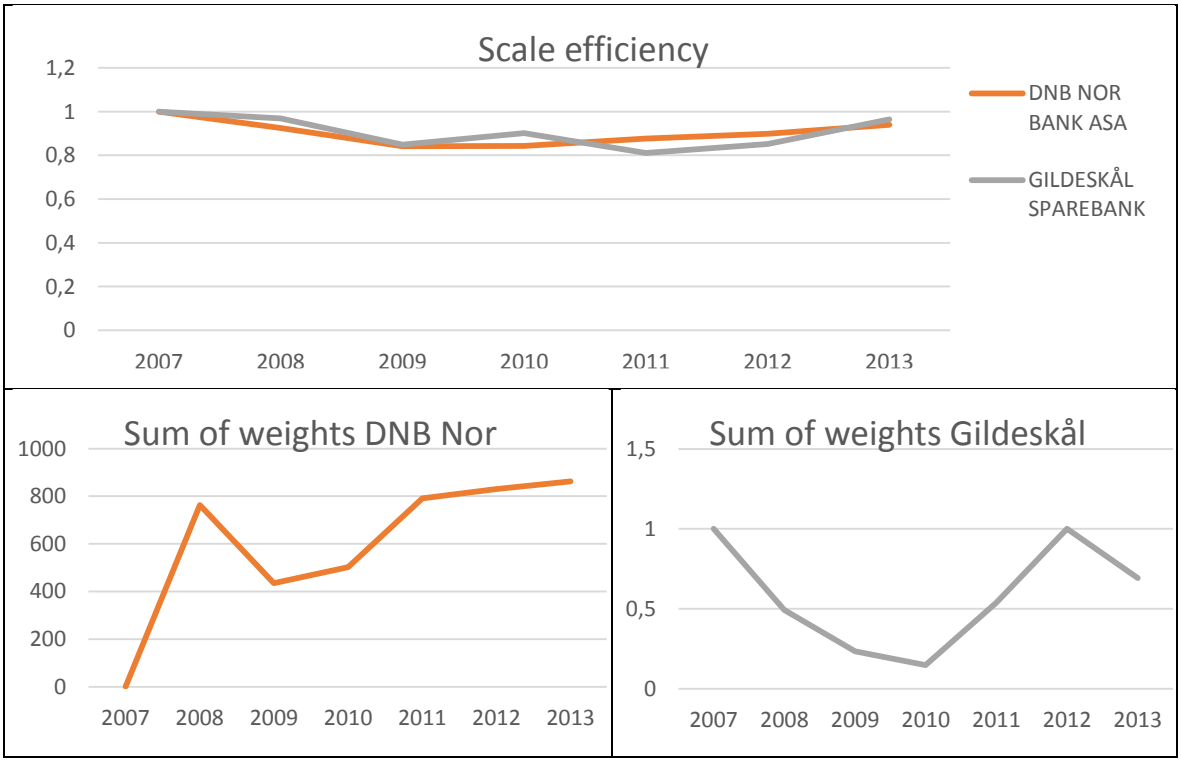

Figure 17: Scale efficiency DNB Nor and Gildeskål Sparebank

6.1.3 Super-efficiency analysis

	2007	2008	2009	2010	2011	2012	2013
MEDIAN	0,9009	0,9492	0,9072	0,9372	0,9244	0,9258	0,9435
ST.DEV	0,1226	0,0979	0,0895	0,1409	0,1439	0,1153	0,1325
MAX	1,4746	1,5135	1,3314	1,8028	1,8105	1,5162	1,8260
MIN	0,7012	0,7673	0,7809	0,7486	0,7807	0,7593	0,7790
# of banks with score over 1	22	22	13	18	14	13	15
% of banks with score over 1	19 %	19 %	11 %	16 %	13 %	12 %	14 %

Table 14: Descriptive statistics for super-efficiency analysis.

In Table 14, some descriptive statistics form the super-efficiency analysis (under CRS assumption) are presented. Here it is clear that the average super-efficiency scores are at a high level each year, indicating that most of the banks have a good management of their inputs and outputs. The best performing banks for each year have scores that varies from 1.33 to 1.82. The lowest maximal super efficiency score appears in 2009. The percentage of banks that are super-efficient also reach its lowest level in 2009, with 11%. This is a decrease from 19% in the two previous years. In 2010 the percentage increase to 16%, and have a stable value of 13, 12 and 14 per cent the next three years respectively. The complete results from the super-efficiency analysis are presented in Appendix 5.

Superefficiency	2007	2008	2009	2010	2011	2012	2013
0-0,4	0	0	0	0	0	0	0
0,4-0,79	16	1	2	5	4	5	4
0,8-1,19	101	114	113	106	104	100	100
1,2-1,59	0	0	0	0	0	0	0
1,6-2	0	0	0	0	0	0	0
SUM	117	115	115	111	108	105	104
In %							
0-0,4	0 %	0 %	0 %	0 %	0 %	0 %	0 %
0,4-0,79	14 %	1 %	2 %	5 %	4 %	5 %	4 %
0,8-1,19	86 %	99 %	98 %	95 %	96 %	95 %	96 %
1,2-1,59	0 %	0 %	0 %	0 %	0 %	0 %	0 %
1,6-2	0 %	0 %	0 %	0 %	0 %	0 %	0 %
SUM	100 %	100 %	100 %	100 %	100 %	100 %	100 %

Table 15: Frequency distribution of super-efficiency.

In Table 15, the frequencies of the efficiency scores based on super-efficiency are presented. The main part of banks have scores that lie between 0.8 and 1,19. Each year except from in 2007 over 90% of the banks have scores in this category. In 2007 a larger part of banks receive a score between 0.4 and 0.79. The category with scores from 1,6 to 2 only include banks the years 2010, 2011 and 2013. It could seem that 2010 have a larger degree of super-efficient banks, as the banks with a score over 1,2 include 6% of the banks. It seems clear from Table 15 that the distribution of the efficiency scores are strongly centered on the

category from 0.8 to 1.19, indicating that the banks operations are quite similar. Only a few banks have very high or very low efficiency scores.

	2013		2012		2011	
	Name	Score	Name	Score	Name	Score
Bank 1	Jernbanepersonalets Sparebank	1,826	SPARESKILLINGSBANKEN	1,516	SPARESKILLINGSBANKEN	1,811
Bank 2	Fornebu Sparebank	1,470	JERNBANEPERSONALETS SPAREBANK	1,382	JERNBANEPERSONALETS SPAREBANK	1,682
Bank 3	Spareskillingsbanken	1,305	Fornebu Sparebank	1,285	Fornebu Sparebank	1,251
Bank 4	Voss Sparebank	1,142	VESTRE SLIDRE SPAREBANK	1,241	SPAREBANKEN PLUSS	1,201
Bank 5	SPAREBANKEN PLUSS	1,142	HALTDALEN SPAREBANK	1,164	ØYSTRE SLIDRE SPAREBANK	1,191
	2010		2009		2008	
	Name	Score	Name	Score	Name	Score
Bank 1	Spareskillingsbanken	1,803	SPARESKILLINGSBANKEN	1,331	Fornebu Sparebank	1,514
Bank 2	Hønefoss Sparebank	1,438	SANDNES SPAREBANK	1,290	SPAREBANKEN PLUSS	1,251
Bank 3	Sparebanken Pluss	1,320	SPAREBANKEN PLUSS	1,213	SKUDENES & AAKRA SPAREBANK	1,219
Bank 4	Vestre Slidre Sparebank	1,314	SPAREBANK 1 GRAN	1,120	SANDNES SPAREBANK	1,194
Bank 5	Jernbanepersonalets Sparebank	1,274	BJUGN SPAREBANK	1,114	TINGVOLL SPAREBANK	1,185
	2007					
	Name	Score				
Bank 1	SPYDEBERG SPAREBANK	1,475				
Bank 2	FLEKKEFJORD SPAREBANK	1,345				
Bank 3	Fornebu Sparebank	1,286				
Bank 4	BJUGN SPAREBANK	1,202				
Bank 5	SPAREBANKEN PLUSS	1,198				

Table 16: Most efficient banks according to super-efficiency

Table 16 show the five most efficient banks according to super efficiency for each year. From this table it is clear the same banks tend to be among the most efficient several years. This could be used as an argument for supporting these banks as the most efficient in the period. Spareskillingsbanken is the most efficient in four years. (In 2008 and 2007 this bank is categorized as an outlier.) If the banks listed in Table 16 are compared to the banks listed in Table 11, it is also clear that the banks that are fully efficient for all years with the CRS assumption are among the most super-efficient banks. Sparebanken Pluss is among the five most super-efficient banks in six of the years in the analysis. The other banks listed in Table 11 appears in Table 16 one or two of the years. Based on this, Sparebanken Pluss and Spareskillingsbanken seem to be good candidates to be the banks that have been the best in practice during this period.

From Table 16, it is also clear that the efficiency scores have varied from year to year. For instance did the score for Spareskillingsbanken increase from 1,33 in 2009 to 1,8 in 2010. Also, Jernbanepersonalets sparebank was among the least efficient banks in 2009, and became among the most efficient in 2010. By looking at the accounts for these years, it is clear that this bank has had a very good year in 2010, with an increase of 763 new customers and an increase of 20% in customers having all their banks products in this bank (total customers) [67]. The variation of the scores does not necessarily reflect an increase or a decrease of the banks efficiency, but could also be a result of an increase or decrease of the

efficiency of the other DMUs. This can be investigated through the productivity change analysis.

6.2 Productivity change analysis

Tables 17 and 18 present some results obtained from the MPI analysis of productivity change. In Table 17, 2007 is used as base year, (t), for each of the other years. This way, the productivity change for each of the other years is analyzed based on the same terms. Table 18 use the previous year to measure the productivity change for each year. The results in Table 17 suggest that there has been little change in productivity for the average bank compared to 2007. However, there has been a decrease in the productivity for some of the banks, and a relatively large productivity increase for others. This is also the case with varying base year. The largest average decrease in productivity in Table 18 is for the years 2010/2011 with an average MPI of 0.94, and the largest increase between the years 2009/2010 with MPI of 1,074.

t+1=	2008	2009	2010	2011	2012	2013
Number of banks	113	109	103	100	97	93
Avrage	0,9776	0,9992	1,0740	1,0205	1,0493	1,0679
Min	0,6183	0,4523	0,5790	0,4362	0,5755	0,5976
Max	1,2902	1,3199	1,5618	1,6047	1,8635	1,7924
Stdev	0,1298	0,1618	0,1967	0,1872	0,2036	0,2106

Table 17: Malmquist index base year 2007.

t +1	2008	2009	2010	2011	2012	2013
NUMBER OF BANKS	113	111	108	107	105	100
AVREAGE	0,9776	1,0473	1,0758	0,9495	1,0058	1,0279
MIN	0,6183	0,7331	0,7521	0,7011	0,7757	0,7917
MAX	1,2902	1,5093	1,5973	1,2890	1,2064	1,3339
St.dev	0,1298	0,1275	0,1245	0,0985	0,0810	0,0942

Table 18: Malmquist index: varying base year.

In Figure 18, the development of the average MPI is illustrated. The productivity is also decomposed into PEC and TC

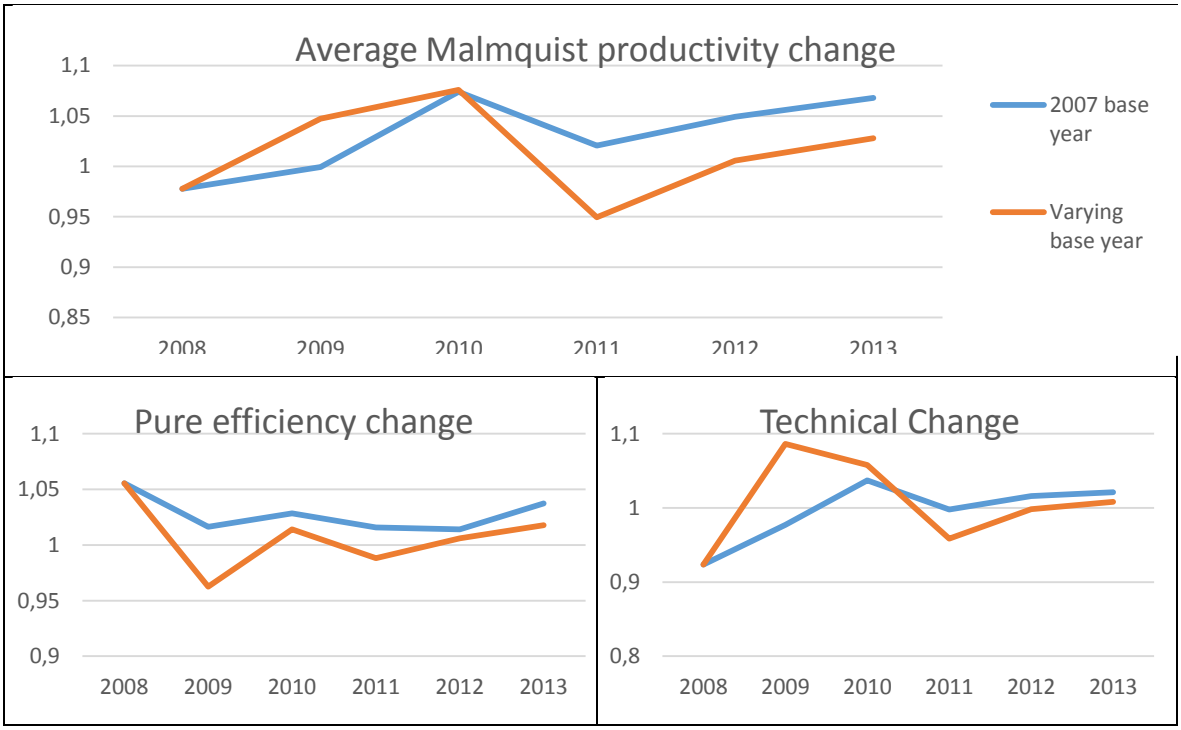

Figure 18: Malmquist productivity change decomposed.

In Figure 18, the productivity change for all the years (t+1) are presented. From this it seems that the productivity for the Norwegian savings banks have increased for most of the years in the period. Compared to 2007 as a base year, the productivity have increased every year except in 2008. The largest change in productivity was between 2009/2010 and 2010/2011 when the productivity went from increasing to decreasing. This could indicate that the finance crisis had an impact these years. The technical change seem to have increased up until 2008/2009 and 2009/2010, after this, the technical change decreased, before stabilizing after 2010/2011. This indicates that the technological progress (frontier shift) increased the first years of the study, before decreasing and stabilizing at that level. The pure efficiency change have had index numbers over 1 for most of the years after 2007. The exception is a slight decrease from 2008 to 2009 and from 2010 to 2011. Overall, the banks have increased in relative efficiency after 2007 with 2007 as the year of comparison.

The complete results for the MPI, PEC and TC with 2007 as base year can be found in Appendix 6, Appendix 8 and Appendix 10 respectively. The respective results with varying base year are presented in Appendix 7, Appendix 9 and Appendix 11.

6.3 Stage two analysis

The next sections will be devoted to evaluate whether the efficiency and productivity changes of Norwegian banks are related to size of the banks, the membership in alliances, and if it has been affected by the finance crisis.

6.3.1 Size

	Correlation	P-value
2013	-0,02754634	0,79662
2012	-0,05685293	0,594556
2011	-0,05714782	0,592642
2010	-0,10718594	0,314636
2009	-0,1138336	0,285384
2008	-0,0445866	0,676473
2007	0,171897323	0,105222

Table 19 Correlation and significance of correlation between efficiency and size.

Table 19 presents the result of a correlation analysis between the super-efficiency scores and the size of the banks measured in total assets. This analysis is made based on balanced panel data (i.e. just including the banks that were operative for all the years in the analysis). As presented, there cannot be assumed to be a correlation between size and super efficiency score for either of the years, even with a significance level of 0,1.

(t+1)	Correlation	P-value
2013	0,0906	0,3929
2012	-0,0119	0,9111
2011	0,0791	0,4562
2010	-0,0885	0,4042
2009	-0,2867	0,0059
2008	0,1266	0,2319

Table 20 Correlation and significance of correlation between MPI and size.

Table 20 presents the results of a correlation analysis between total assets and MPI. It cannot be concluded that there is a correlation between the size and productivity change either, except for between the years 2008 and 2009. In this period, there is a negative correlation, indicating that smaller banks are more likely to have high productivity in this period.

In Figure 19, the SE for the DMU's in 2009 and 2013 are presented with increasing size of the DMUs.

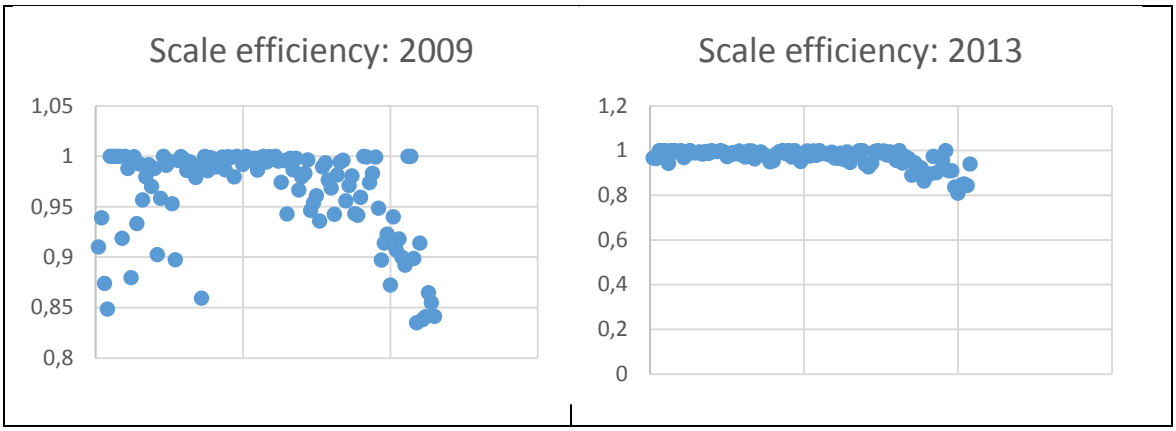

Figure 19 Scale efficiency in 2009 and 2013, sorted with increasing size.

From Figure 19, there seems to be more of a connection between the size and the efficiency score. From the figure it is clear that large banks are less scale efficient compared to medium sized or small banks in 2013. In 2009 only the banks with medium size are scale efficient. In appendix – similar figures for all the years are presented. Here it is clear that the small and medium sized banks have higher scale efficiency except in the years 2008 and 2009, when the small banks also have a relative high proportion of scale inefficient banks. This can suggest that the medium sized banks have larger robustness in the scale efficiency scores, and that the optimal scale of the bank operations have had a shift in some of the years in the period. This finding is consistent with the findings in [52], which concluded that small banks were more likely to be scale inefficient during the crisis.

6.3.2 Alliances

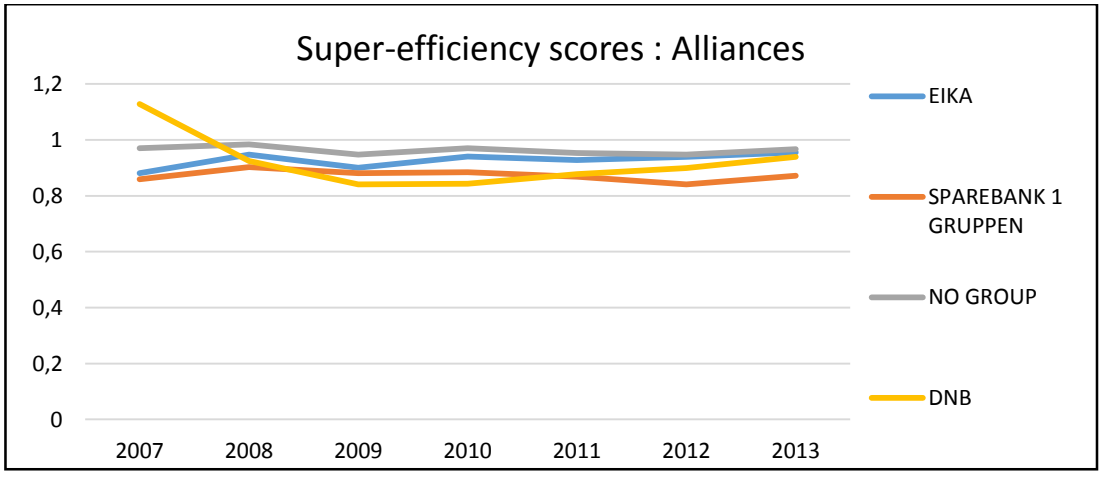

Figure 20: Super-efficiency scores: Alliances

Figure 20 illustrates the average super-efficiency scores of the banks in different alliances, and DNB Nor. Based on the figure, there seem to be some small differences between the average efficiency scores between some of the groups of banks. For instance are the average scores for the banks that are not part of an alliance larger than for the banks in Sparebank 1 group. It also appears that all of the groups except the Sparebank 1 group have merged towards the same average efficiency in 2013. In Table 21, the relative numbers of efficient banks are presented for each of the groupings.

	2013	2012	2011	2010	2009	2008	2007
EIKA	16 %	14 %	15 %	16 %	10 %	13 %	13 %
SPAREBANK 1 GRUPPEN	0 %	0 %	6 %	16 %	10 %	14 %	4 %
NO GROUP	23 %	17 %	12 %	16 %	15 %	33 %	42 %

Table 21: Relative number of efficient banks in bank alliances.

Also in Table 21, the Sparbank 1 group seem to be the worst performer. The banks that are not in an alliance have the highest relative number of efficient banks for all years except from 2010 and 2011. In 2010 all of the groups have the same relative number.

These results could indicate that not being in an alliance can be associated with higher efficiency scores, and a higher probability of being efficient. It also seems that the Sparebank 1 group on average contains the least efficient banks. By testing hypothesis about the mean efficiency scores for the different groupings, the results revealed that it can be concluded with a significance level of 0.05 that the banks which are not in an alliance have the largest mean scores in 2009 and 2007. Also, the Sparebank 1 group has had the lowest average efficiency scores in all the years except in 2009 and 2007, when it was equal to the Eika group. These result are presented in Table 22. Here, the respective means of the groupings are indicated as μ, with the index (n) representing independent banks, (SB1) indicating the Sparebank 1 group and (E) indicating the Eika group.

		2007	2008	2009	2010	2011	2012	2013
Ind vs SB1	P value	0,0027	0,0017	0,0203	0,0412	0,0360	0,0015	0,0011
	Conclusion	μ(n) > μ(SB1)	μ(n) > μ(SB1)	μ(n) > μ(SB1)	μ(n) > μ(SB1)	μ(n) > μ(SB1)	μ(n) > μ(SB1)	μ(n) > μ(SB1)
SB1 vs Eika	P value	0,1156	0,0060	0,1749	0,0358	0,0212	0,0000	0,0004
	Conclusion	μ(E) = μ(SB1)	μ(E) > μ(SB1)	μ(E) = μ(SB1)	μ(E) > μ(SB1)	μ(E) > μ(SB1)	μ(E) > μ(SB1)	μ(E) > μ(SB1)
Eika vs Ind	P value	0,0102	0,0810	0,0413	0,2421	0,2769	0,3982	0,3562
	Conclusion	μ(n) > μ(E)	μ(n) = μ(E)	μ(n) > μ(E)	μ(n) = μ(E)	μ(n) = μ(E)	μ(n) = μ(E)	μ(n) = μ(E)

Table 22: Testing for differences in mean, super-efficiency, alliances.

The same indicators as in Table 22 are used in Table 23, where the differences in productivity between the groups are analyzed. From this it cannot be concluded that there have been a difference in the productivity change for the banks in the different groups for most of the years in the period. From 2008 to 2009, the banks in the Sparebank 1 group has had the largest increase in productivity. This group also has had a larger productivity change than the Eika group from 2012 to 2013, but it cannot be concluded that this was larger than the productivity change for the independent banks.

	(t+1)	2008	2009	2010	2011	2012	2013
	P-value	0,358	0,014	0,276	0,205	0,159	0,063
Ind vs SB1	Conclusion	μ(n) = μ(SB1)	μ(n) < μ(SB1)	μ(n)= μ(SB1)	μ(n) = μ(SB1)	μ(n) = μ(SB1)	μ(n) = μ(SB1)
	P value	0,063	0,006	0,078	0,071	0,061	0,012
SB1 vs Eika	Conclusion	μ(E) = μ(SB1)	μ(E) < μ(SB1)	μ(E) = μ(SB1)	μ(E) = μ(SB1)	μ(E) = μ(SB1)	μ(E) < μ(SB1)
	P value	0,136	0,485	0,022	0,219	0,281	0,478
Eika vs Ind	Conclusion	μ(n) = μ(E)	μ(n) = μ(E)	μ(n) < μ(E)	μ(n) = μ(E)	μ(n) = μ(E)	μ(n) = μ(E)

Table 23: Testing for differences in mean, MPI, alliances.

A list of the banks that are members in the respective alliances, based on information from Sparebankforeningen [59], is presented in Appendix 12.

6.3.3 Financial crisis

As evident in the sections 6.1 through 6.3, there has been a significant decrease in the mean efficiency scores in 2009 and in 2011. This implies that the most efficient banks have become more efficient compared to the others, or that the inefficient banks have become less efficient. From Figure 19 it is clear that the PEC have dropped between 2008 and 2009 and between 2010 and 2011, at the same time as TC have increased from 2008 to 2009 and dropped from 2010 to 2011. This reveals that the decline in efficiency in 2009 is a result of a combination of a decline of pure efficiency and a positive shift in the technical frontier. In 2011, the decline is due to a combination of a drop in pure efficiency simultaneous with a negative shift in the technology. As a conclusion it seems safe to say that the efficiency of the Norwegian savings banks were affected by the finance crisis in 2009. Since the decline in efficiency in 2011 is a result of both an efficiency drop for the average bank as well as the technology, it could be assumed that this is a result of the adaption of the new international regulations, Basel III [68], which were implemented in 2011 as a consequence of the crisis.

Looking at the effect of the crisis on the banks grouped in the alliances it can be suggested that the banks that are not members in any alliances are performing the best just after the crisis (in 2009). Also, the relative number of efficient banks seems to be most affected for this group of banks. However, this is probably due to the fact that there are few banks that are independent, making the relative numbers more reliant on the individual banks. It cannot be concluded if these banks would have performed different if they were in alliances, and the effect of the alliances in relation to the finance crisis can therefore not be determined even though the data analyzed in this study reveal that the banks that were not in alliances had higher efficiencies.

From Table 20, it is also evident that the productivity change from 2008 to 2009 can be related to the size of the banks, where the smaller banks are more likely to have a higher productivity increase, This could of course be a coincidence, or it could be that the banks that are small are more adaptable to the crisis, increasing their efficiencies faster than the large ones.

6.3.3.1 Effect of government support

As mentioned in section 1, 26 banks received government funding after the crisis. In Appendix 13, these banks are listed. This section will present some of the results found when analyzing the effect of the finance crisis on these banks.

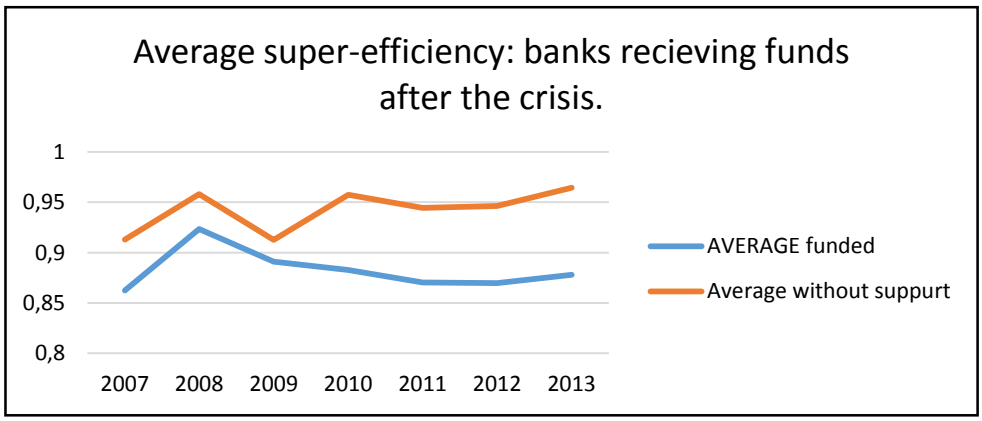

Figure 21: Average super-efficeincy for banks recieving funding after the crisis.

Figure 21 reveals an interesting development of the average super-efficiency of the banks that received funding from the government after the finance crisis. In the figure it appears that the average efficiency decreased relatively less for these banks from 2008 to 2009. The other banks increased their average efficiency to the 2008 level in 2010, but the banks which

received funds continued to have a negative efficiency development also in 2010, 2011 and 2012. These banks only had a slight increase in efficiency in 2013.

When comparing the productivity change for these banks the following can be presented:

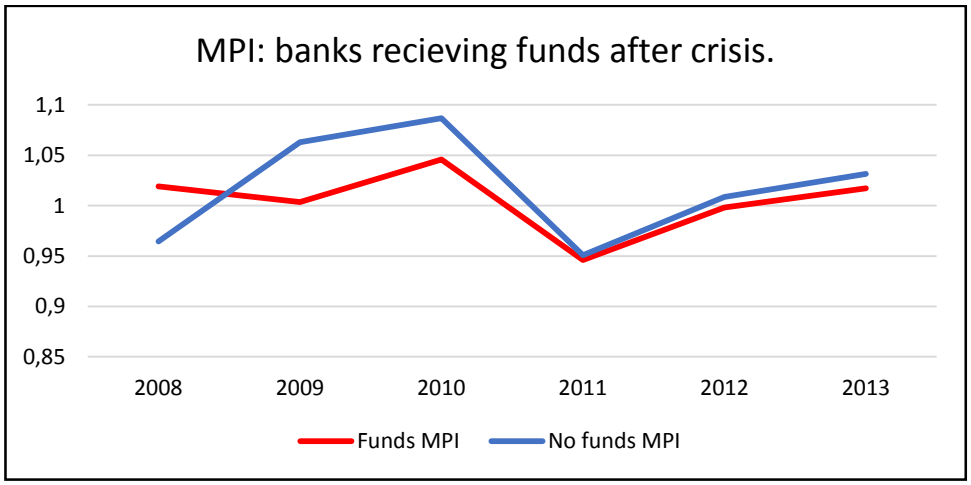

Figure 22: MPI: banks receiving funds after the crisis.

From Figure 22, it is clear that there is a difference between the productivity changes for the banks that received funding compared to the other banks. These banks were on average more productive from 2007 to 2008, but had a lower increase in productivity from 2008 to 2009. The figure also suggests that the productivity increases less for the banks that received funding between the years 2009 and 2010, even if the relative increase compared to previous periods are larger for these banks. After 2010 the productivity changes for these groups of banks have been the same, but perhaps a little bit lower for the funded banks. The effects on the MPI come from a combined result of lower pure efficiency change and technical change.

By combining the observations from Figures 21 and 22, it seems that the banks that received funding were banks that performed below average for the whole period. The differences in the mean efficiency scores for the funded banks have increased after 2009, indicating that these banks waste more resources compared to the other banks after the funds were granted. However, the productivity development have changed from a performance below the other banks before the funds were received, to a development similar to the other banks. It cannot be concluded based on this data, whether the banks that received funding performed worse because of the funding, or if these banks would perform even worse without the government support.

6.3.3.2 The effects on DNB Nor

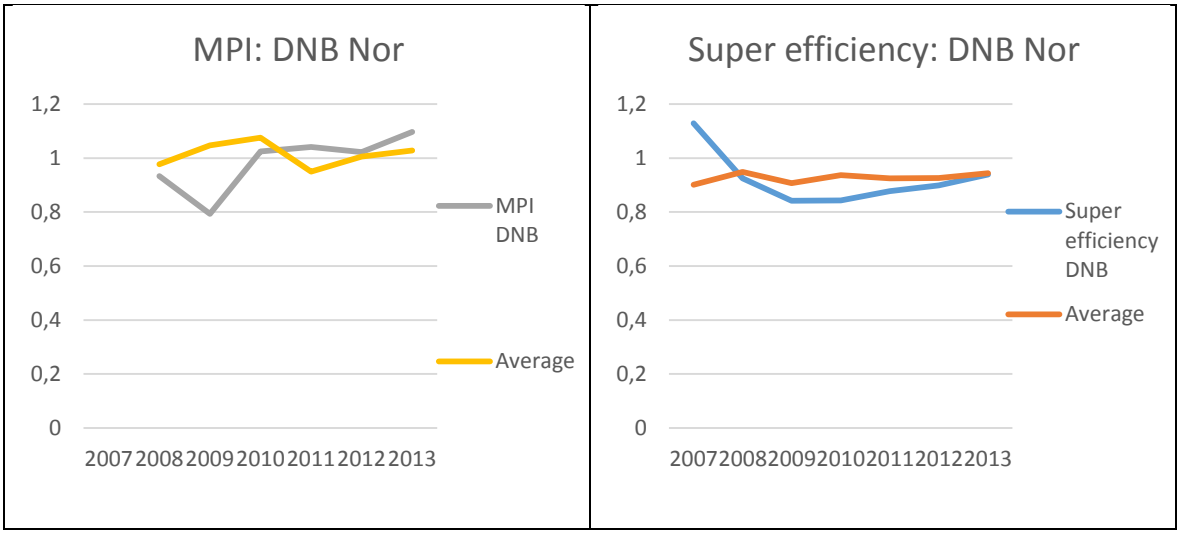

Figure 23: Malmquist productivity index and super-efficiency for DNB Nor.

Figure 23 presents the development of the productivity and efficiency of DNB Nor compared to the average levels. From the figure it seems that DNB Nor has been affected by the crisis to a larger extent than the average. In the years after 2008 it has had a lover efficiency score compared to the rest of the banks. Also, the MPI decreased significantly from 2008 to 2009. However, it appears that this large bank have increased its productivity more than the average after 2010. This is also reflected in the efficiency score, where DNB Nor's efficiency have moved towards the average after this year. Based on this, one might argue that the claims that DNB Nor is resting on the fact that it could be too big to fail as suggested in [6], might not be the case. Even though the bank was affected by the crisis more than average, it has a good ability to recover, by increasing its productivity after the crisis.

7.0 Validation and verification

Validation refers to the process of making sure that the model describes the phenomena that it is intended to describe, in a way that is sufficient in order to aid in decision making [69]. Verification is the process of making sure that the model built is actually the one that was intended. In the next sections, some concerns regarding the validity and verification of the results will be assessed.

7.1 Additional concerns about data

7.1.1 Adjustment for inflation

Since the intention of this study is both to identify efficiency of banks in one year and evaluate productivity change over several years, the question of inflation should be addressed. The nomination of all the variables is in NOK, making the efficiency analysis possibly sensitive to the value of money from one year to another. The issue with inflation could be solved by adjusting the prices relative to the consumer price index (CPI). The problem with this is that not all prices follow the CPI. As a result, the deflated values could also involve errors, and may not be more valid that the original results. Also, some of the variables used in this study are gathered form the balance sheet of the banks accounts. These are numbers that are aggregated from the year that bank started, and would therefore not be affected by the inflation problem to the same extent. At the same time it could be argued that since efficiency analysis is based on ratios of outputs over inputs, the effect of inflation would be limited if it affects both the value of inputs and the value of outputs with the same rates. Based on this, it seems safe to assume that the analysis is valid despite not adjusting for inflation.

7.1.2 The use of balance sheet variables

Another issue of validation of results comes with the use of balance sheet numbers. A consequence of this could be that a bank who gets a high efficiency score might only be benefitting from having been efficient in past time periods. To compensate for this, it is necessary to use many years and compare the results [26]. If a bank is efficient year after year, a more definite conclusion could be made. Since this study includes seven time periods, the effects of this could most likely be dealt with.

7.1.3 IFRS rules

International financial reporting standards (IFRS) represent a set of accounting regulations that in some cases can be used as an alternative to the standard accounting techniques in Norway. From 2005, all Norwegian companies registered on the stock exchange were forced to use these rules. Since then, also smaller companies has been allowed to use IFRS [70].

Some of the banks in the study use IFRS rules when producing their annual reports. This could result in deviations between the valuations of some of the elements in the accounts. According to [71], some of the differences in the measuring are in the valuation of credit losses. Possible effects of this could be that some of the banks that use IFRS could be deemed

more or less efficient due to accounting principles alone. However, based on the results of the preliminary data analysis, this will not cause many outliers. Also, there exist many possibilities for differences in accounting techniques even with the same accounting standard. It should also be stated that since the Norwegian companies were allowed to use the IFRS rules in 2005, also the regular accounting rules used in Norway has become more similar to the international standards [70]. Based on this, it does not seem that the banks that banks operating with the IFRS standard represent a large cause of error in the study. However, this could affect the results for individual banks.

7.2 Efficiency and productivity analysis

7.2.1 VRS concerns

A TE of 1 with a VRS assumption could as previously mentioned occur because there does not exist banks that perform in the approximate same scale. In the literature, there exist studies where conclusions about scale have been made despite using a relatively small sample of observations. To mention two, [54] and [47] used a selection of 27 and 25 banks respectively. In these studies, VRS was assumed and suggestions about the SE levels were made.

In this study some of the banks are of significantly different size than other banks. For instance is DNB Nor over 10 times larger in terms of total assets compared to the second largest bank. On the other hand, even though many more banks became efficient with the VRS assumption, the efficient firms still only consist of an average of maximum 35% of the total banks.

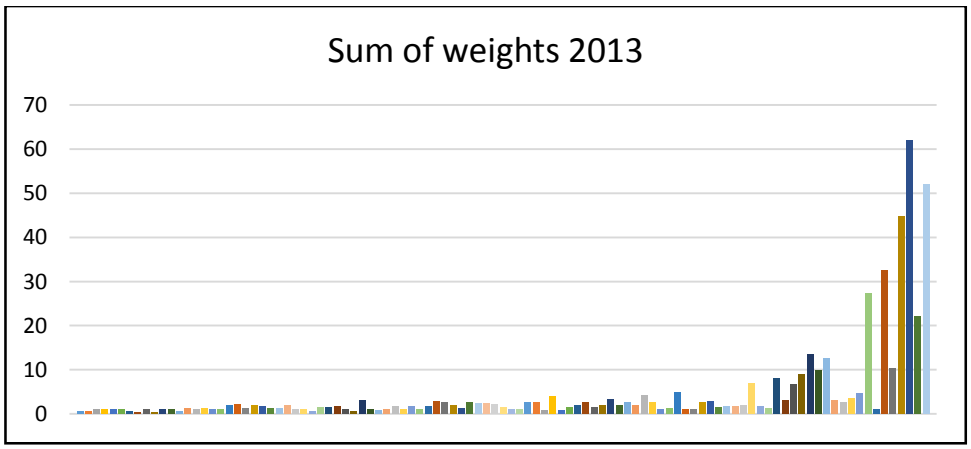

Figure 24: Sum of weights arranged with increasing size of inputs.

In Figure 24, the sums of weights with a CRS assumption are ranged according to the sums of all inputs in 2013. If there existed enough DMUs to allow for conclusions based on a VRS assumption, one could expect the weights to increase in a smooth manner with the increasing sum of inputs. From Figure 24 it seems that this is the case for most of the instances, but that some of the banks have lower weights than what could be expected. (DNB Nor is excluded from Figure 24, because it has much larger values than the others.)

Based on this, it seems that some of the banks in the sample are made more scale efficient than they actually are. However, it seems that for the most part, there is a clear trend that the larger banks have larger sums of weights, and that smaller banks have smaller sums of weights. There should not be made any conclusion of the individual banks' performance based on the VRS assumption, but the conclusion about the average levels seem to be valid to a large degree.

7.2.2 Input slacks and input congestion

Some topics that have not been addressed in this thesis so far are input congestion and slacks. This occurs when some sections of the pricewise linear frontier is parallel to the axes [11]. For these DMUs one could reduce the amount of inputs and still produce the same outputs. This is known as an input slack. These are equal to zero if $\theta x_{i0} - \sum_{j=1}^{n} x_{ij}\lambda_j = 0$, for the optimal values of θ and λ. However, it is important to notice that the slacks measured by this does not necessarily identify all the slacks that could occur [11]. According to [11], additional LPs have to be performed in order to identify all input slacks.

[11] strongly suggest that the importance of slack measurement is overrated. In fact, slacks can be viewed as a part of the DEA method's way to construct the efficient frontier, and is a consequence of using a finite sample of observations. [11] states, through Ferrier and Lovell (1990), that slacks actually are AE measures for inefficiency, and that the DEA method without including slacks is sufficient for determining TE.

In this study, strong disposability of inputs have been assumed. This implies that a firm should be able to dispose of excess inputs. In some cases, this assumption could be violated due to for instance labors unions, government control and so on. [11] introduces some methods for solving a DEA if this is the case. However, using these methods may lead to the discovery of congestion that are due only to insufficient data points. Therefore, it is

advised against using these methods if there are not very strong arguments for the presence of congestions, since they also will affect the values for TE and SE in the analysis.

7.2.3 Sensitivity of the results

In order to verify the results, a sensitivity analysis can be performed. There could for instance be expected that a correlation between the efficiency scores between each of the years exist.

	Super 2013	*Super 2012*	*Super 2011*	*Super 2010*	*Super 2009*	*Super 2008*	*Super 2007*
Super 2013	1						
Super 2012	0,81326514	1					
Super 2011	0,81326514	1	1				
Super 2010	0,57166462	0,668918387	0,668918387	1			
Super 2009	0,237149569	0,385193877	0,385193877	0,463654838	1		
Super 2008	0,520291165	0,6081403	0,6081403	0,330732907	0,538601624	1	
Super 2007	0,303249523	0,332830943	0,332830943	0,234624406	0,39164378	0,601306773	1

Table 24 Correlation between super-efficiency scores each year

In Table 24, the correlation between the super-efficiency scores for the banks that are active each year are presented. From this, it is clear that there is a strong positive relation between the scores for each bank. This means that a high score in one year is related to a high score another year. From the Table 24 is also evident that this relation is stronger in the last years of the period (from 2011). The relation is least strong in the years around the crisis, as could be expected due to the shift in efficiency these years.

[23] also perform a sensitivity analysis on the results when removing one after another of the super-efficient units from the analysis, and investigating what this does to the results. When doing this for the years 2013 and 2009, the following results are obtained:

Removed 2013	P-value
JERNBANEPERSONALETS SPAREBANK	0.4
FORNEBU SPAREBANK	0.7
SPARESKILLINGSBANKEN	0.8
VOSS SPAREBANK and SPAREBANKEN PLUSS	0.8
Removed 2009	P-value
SPARESKILLINGSBANKEN	0.03
SANDNES SPAREBANK	0.03
SPAREBANKEN PLUSS	0.0004

Table 25: Removal of the most super-efficient banks 2013 and 2009

Table 25 presents the results of a Students-t test about the mean of the super-efficiency scores with and without the removal of the most efficient banks. From this it is clear that the

results are much more sensitive to the most efficient banks in 2009 than in 2013. The mean efficiency scores would change in 2009 even if only the most efficient bank is removed. When testing for a difference in the mean scores for all the years in the analysis, it was revealed that the results are sensitive to the following banks: Spareskillingsbanken, Spydeberg Sparebank, Fornebu Sparebank and Flekkefjord Sparebank. This implies that it is crucial that these banks do not have errors in the data.

Based on this, a thorough investigation considering these banks' accounts was conducted. Comparing the values in the annual reports, there is no reason to suspect that there exist any errors in the data for these banks. Spydeberg Sparebank has a large growth in the total assets from 2007 to 2008, but this is explained by a restructuring of the balance to more long term funds [72]. Also Flekkefjord Sparebank had a relatively large increase of total assets in 2008, due to a very good year for this bank [73]. Spareskillingsbanken was categorized as an outlier in 2008 and 2007 (see section 5.2), however, there does not seem to be any reason for this bank to be placed in this category after 2008 [64].

Some studies use this kind of sensitivity analysis to automatically categorize DMUs as outliers which should be excluded from the analysis [63] . It seems important to address the reason why this is not done in this study. In fact, the exclusion of important banks could also corrupt the result. According to [62], the mechanical application of a test like this one could often lead to a detection of observations that do not contain errors, but just happen to be "extreme" compared to the other DMUs. The purpose of checking if there are influential observations is that these must be checked for errors, and for improving the quality of the research by noting these observations. If a bank that is performing well is taken out of the analysis, a false picture of efficiency for the other banks could occur, because an important benchmark for many others is removed. However, it is very important to notice that the DEA method is extremely sensitive to the data that is being analyzed, and that further analysis using other techniques should be made before making definite conclusions.

The DEA method could, as previously mentioned, also be very sensitive to which variables who are included in the analysis. To find how the results would change without some of the variables, super-efficiency analysis excluding one variable at the time was performed for all of the years in the analysis. The results from this is presented in Table 26.

Variable removed	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*
Labour cost	0,750	0,725	0,480	0,620	0,740	0,741	0,777
Total assets - deposits	0,932	0,869	0,968	0,936	0,879	0,820	0,847
Interest expences	0,933	0,868	0,796	0,911	0,934	0,881	0,885
Credit losses	0,687	0,584	0,971	0,679	0,751	0,879	0,646
Deposits	0,988	0,986	0,946	0,848	0,733	0,866	0,995
Net loans to customers	0,980	0,971	0,984	0,917	0,708	0,861	0,983
Interest income	0,929	0,861	0,703	0,886	0,669	0,796	0,939

Table 26: Correlation of super-efficiency scores with removal of variables.

From Table 26, it is clear that the efficiency scores is not extremely sensitive to the removal of the variables in most of the cases. The largest difference in the results would occur if the labor cost variable is removed in 2009 or if the credit losses variable is removed in 2008. This is also consistent with what could be expected, as these variables are varying more from bank to bank. It is also evident from the table that the results are less sensitive to the removal of the output variables. An exception of this is for 2011, when the result also depend on these. 2011 is the year in the analysis where the result depend the most on which variables are included.

Other ways to verify the results would be to include a larger selection and/or to include more years in the analysis. This could for instance be done by including banks from other countries that can be compared to the Norwegian banks. This will not be done in this study, but will be encouraged as a point for further research in order to confirm the findings of this study.

7.3 Cost efficiency

It is important to remember that the efficiency scores that are presented in this study do not reveal which banks are the most able to minimize their cost or to maximize their profits. A correlation analysis investigating the relationship between the operating profits adjusted for the size of the bank and the super-efficiency scores for 2013 revealed that there was no correlation between these, with a significance level as high as 0,1. (The obtained P-value was 0,12). Therefore it cannot be concluded if the efficiencies of the banks have changed in correlation to price or profit changes in the service products. If the prices have changed differently for banks according to for instance location or size, a bank that is less efficient in terms of TE might still be more cost or profit efficient than other banks.

8.0 Conclusions and suggestions for further research

This study has analyzed the efficiencies and the productivity changes of Norwegian savings banks in the period from 2007 to 2013. The analysis has been made through the use of a DEA model, where both CRS and VRS assumptions have been compared. In addition, the most efficient banks under CRS have been ranged through a super-efficiency analysis. For the productivity analysis a MPI approach assuming CRS has been used.

The study reveals that the average efficiency level has been high for most of the banks throughout the period. The most efficient banks seem to be Spareskillingsbanken and Sparebanken Pluss. These banks make up the efficient front in most of the years in the analysis, and could be considered as important benchmarks, as they also have super-efficiency scores among the top 5 banks in many of the years.

The least efficient banks have varied much between the years, indicating that there is no clear conclusion of which banks are the worst performers in the period. However, some of the banks have had low scores for several periods, such as Sparebank 1 Nordvest. However, it is important to notice that even if this bank received low efficiency scores in this study, it might be among the best performers if other variables have been used. To investigate this, further research is needed.

The average levels of productivity have also been relatively constant in the period. Productivity only decreased from 2010 to 2011, due to a negative shift in the efficient frontier. Further research should be made in order to reveal the causes of this decline.

From this data it cannot be claimed that the size of a bank in terms of total assets have any effect on the efficiency. However, small and medium sized banks are more scale efficient than large banks. In 2008 and 2009, medium sized banks were the most likely to be scale efficient.

The average efficiency of independent banks and banks in the Eika alliance have been similar in all of the years except in 2007 and 2009 when the independent banks had a higher score. Banks in the Sparebank 1 group had the lowest average efficiency scores for all of the years except in 2007 and 2009, when they had equal scores to banks in the Eika group.

It cannot be concluded that being a member of the Sparebank 1 group results in a lower efficiency, as it is not known if these banks would increase their scores if not being in this alliance. Further research should investigate the relations between being an independent bank and the ability to be technical efficient, both during crisis and in regular market terms.

Norwegian banks seem to have been affected by the finance crisis in 2009 with decreased efficiency levels. In the years that followed, the average increase in productivity has also been lower than in 2008 and 2007. An important reservation to this finding is that the observed data in some of the most efficient banks does not contain errors.

The data also reveal that the banks that received funding from the finance fund in 2009 have had decreasing efficiencies in the following years. Further research should be performed in order to verify these findings. It should also be investigated weather government "bail outs" causes more inefficient banks, or if this helps these banks improve the efficiency compared to the case if no funding was granted.

The development of DNB Nor in terms of efficiency suggests that it must reduce its size tremendously in order to become scale efficient. However, the efficiency gain by doing this is relatively small. The study also reveals that even though it was affected more than average by the finance crisis, DNB Nor had a larger increase in productivity in the years that followed, resulting in an increase in the relative efficiency to the average level in 2013. Based on this, it cannot be claimed that DNB Nor is wasting resources due to its size and special place among the Norwegian banks.

From the sensitivity analysis it is clear that the results obtained in this study are to a large degree dependent on the correctness of the data that has been used. The selected input variables also seem to have some impact of the results, especially credit losses and cost of labor. More studies should therefore be conducted to verify the results of this thesis. Also, the allocative efficiency and cost efficiency should be research further before concluding about the performance of the banks in more general terms.

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Appendices

Appendix 1. CRS Scores

Bank Name	2007	2008	2009	2010	2011	2012	2013
AASEN SPAREBANK	0,821	0,858	0,895	0,956	0,910	0,908	0,907
ANDEBU SPAREBANK	0,929	0,931	0,889	0,917	0,877	0,902	0,996
ARENDAL OG OMEGNS SPAREKASSE	1,000	0,997	1,000	1,000	0,995	0,952	0,943
ASKIM SPAREBANK	0,875	0,894	0,867	0,873	0,870	0,895	0,966
AURLAND SPAREBANK	0,915	0,894	1,000	1,000	1,000	0,917	1,000
AURSKOG SPAREBANK	0,916	0,965	0,956	0,992	1,000	0,953	0,967
BAMBLE OG LANGESUND SPAREBANK	0,778	0,871	0,832	0,840	0,850	0,836	0,816
BERG SPAREBANK	0,812	0,969	0,892	0,886	0,849	0,914	0,933
BIRKENES SPAREBANK	0,886	0,933			0,898	0,903	0,918
BJUGN SPAREBANK	1,000	1,000	1,000	1,000	1,000	1,000	1,000
BLAKER SPAREBANK	0,802	0,913	0,879	0,903	0,954	0,952	0,944
BUD FRÆNA OG HUSTAD SPAREBANK	0,825	0,911	0,842	0,836	0,831	0,862	0,881
BØ SPAREBANK	0,811	0,931	0,923	0,938	0,862	0,876	
CULTURA SPAREBANK							
DNB NOR BANK ASA	1,000	0,925	0,841	0,843	0,877	0,899	0,940
DRANGEDAL OG TØRDAL SPAREBANK	0,848	1,000	0,929	0,915	0,943	0,979	0,926
EIDSBERG SPAREBANK	0,887	0,958	0,848	0,930	0,901	0,923	0,986
ETNE SPAREBANK	0,830	0,940	0,845	0,871	0,864	0,879	0,862
ETNEDAL SPAREBANK			0,864	0,937	0,996	1,000	1,000
EVJE OG HORNNES SPAREBANK	0,876	0,934	0,950	0,914	0,957	0,935	0,947
FANA SPAREBANK	0,972	0,945	0,885	0,850	0,845	0,844	0,836
FJALER SPAREBANK	0,765	0,833	0,881				
FLEKKEFJORD SPAREBANK	1,000	1,000	0,953	1,000	0,969	0,973	1,000
Fornebu Sparebank	1,000	1,000	0,898	1,000	1,000	1,000	1,000
GILDESKÅL SPAREBANK	1,000	0,970	0,849	0,902	0,811	0,852	0,860
GJERSTAD SPAREBANK	1,000	0,934	0,880	0,861	0,815	0,836	0,819
GRONG SPAREBANK	0,881	1,000	0,917	0,884	0,862	0,926	0,942
GRUE SPAREBANK	0,888	0,982	0,886	0,878	0,912	0,904	0,852
HALDEN SPAREBANK	0,772	0,794	0,781	0,749			
HALTDALEN SPAREBANK	0,848	0,943	0,853	1,000	1,000	1,000	0,968
HARSTAD SPAREBANK	0,856	0,927	0,898	0,949	0,957	0,936	0,908
HAUGESUND SPAREBANK	0,989	1,000	0,999	0,905	0,930	0,922	0,964
HEGRA SPAREBANK	0,746	0,879	0,865	0,917	0,903	0,931	0,996
HELGELAND SPAREBANK	0,821	0,925	0,880	0,934	0,917	0,886	0,974
HJARTDAL OG GRANSHERAD SPAREBANK	0,891	0,964	0,959	0,909	0,904	0,953	0,874

HJELMELAND SPAREBANK	0,827			0,835	0,847	0,893	0,927
HOL SPAREBANK	0,828	0,936	0,828	0,834	0,850	0,871	
HOLLA OG LUNDE SPAREBANK	0,843	0,927	0,914	0,861	0,810		
Høland & Setskog Sparebank	0,812	0,857	0,818	0,830	0,872	0,912	0,930
HØNEFOSS SPAREBANK	1,000	1,000	0,824	1,000	0,837	0,908	0,953
INDRE SOGN SPAREBANK	0,787	0,885	0,833	0,792	0,834	0,879	0,883
JERNBANEPERSONALETS SPAREBANK	0,869	0,997	0,793	1,000	1,000	1,000	1,000
KLEPP SPAREBANK	1,000	0,873	0,850	0,947	0,822	0,791	0,859
KLÆBU SPAREBANK	0,775	0,847	0,843	0,825	0,846	0,870	0,979
KRAGERØ SPAREBANK	0,867	0,922	0,861	0,899	0,837	0,834	0,788
KVINESDAL SPAREBANK	0,817	0,898	0,827	0,903			
KVINNHERAD SPAREBANK	0,790	0,812	0,813				
LARVIKBANKEN BRUNLANES SPAREBANK	0,904	0,894	0,819	0,872	0,832	0,831	0,870
LILLESANDS SPAREBANK	1,000	1,000	0,964	0,958	0,986	0,954	0,921
LILLESTRØMBANKEN LILLESTRØM SPAREBANK	0,879	0,887	0,864	0,883	0,840	0,843	0,867
LOFOTEN SPAREBANK	1,000	1,000	1,000	0,986	1,000	1,000	1,000
LOM OG SKJÅK SPAREBANK	0,826	0,926	0,886	0,949	0,897	0,886	
LUSTER SPAREBANK	0,962	1,000	0,998	0,954	0,945	0,968	0,959
MARKER SPAREBANK	0,867	0,962	0,975	0,980	0,925	0,973	0,979
MELDAL SPAREBANK	0,951	0,957	0,881	0,923	0,933	0,954	1,000
MELHUS SPAREBANK	0,922	0,940	0,915	0,898	0,881	0,852	0,990
MODUM SPAREBANK	0,808	0,901	0,884	0,905	0,831	0,868	0,924
NES PRESTEGJELDS SPAREBANK	0,845	0,871	0,876	0,873	0,883	0,850	
NESSET SPAREBANK	0,798	0,884	0,919	0,812	0,791	0,833	0,869
NØTTERØ SPAREBANK	0,836	0,894	0,830				
ODAL SPAREBANK	0,868	1,000	0,919	0,924	0,890	0,935	0,948
OFOTEN SPAREBANK	0,894	0,947	0,932	0,893	0,910	0,935	0,873
OPDALS SPAREBANK	0,891	0,982	0,941	0,902	0,911	0,907	0,916
ORKDAL SPAREBANK	0,957	1,000	0,965	0,955	0,907	0,944	0,965
RINDAL SPAREBANK	0,866	0,920	0,928	0,965	0,925	0,942	0,956
Ringerikes Sparebank	0,948	1,000	0,949				
Rygge-Vaaler Sparebank			0,841	0,809			
RØROSBANKEN RØROS SPAREBANK	0,789	0,909	0,838	0,867	1,000	0,875	0,852
SANDNES SPAREBANK		1,000	1,000	0,922	0,845	0,800	0,953
SAUDA SPAREBANK	0,978	1,000					
SELBU SPAREBANK	0,802	0,882	0,868	0,902	0,870	0,882	0,854
SELJORD SPAREBANK	0,800	0,888	0,928	0,851	0,882	0,850	
SETSKOG SPAREBANK	0,775	0,882	0,831				
SKUDENES & AAKRA SPAREBANK	1,000	1,000	0,901	0,929	0,934	0,943	0,980
Skue sparebank							0,921
SOKNEDAL SPAREBANK	0,786	0,885	0,886	0,877	0,806	0,858	0,847

SPAREBANK 1 GRAN	0,921	1,000	1,000				
Sparebank 1 Buskerud-Vestfold		0,870	0,834	0,813	0,784	0,789	0,791
SPAREBANK 1 GUDBRANDSDAL FRON SPAREBANK	0,851	0,914	0,904	0,889	0,825	0,843	0,914
SPAREBANK 1 HALLINGDAL	0,895	0,865	0,839	0,861	0,847	0,903	0,956
Sparebank 1 Lom og Skjåk							0,903
SPAREBANK 1 JEVNAKER LUNNER	0,791	0,877	0,807				
SpareBank 1 Kongsberg	0,797						
SpareBank 1 Moss	0,887	0,877					
SPAREBANK 1 NORD-NORGE	0,817	0,907	0,838	0,799	0,806	0,804	0,810
SpareBank 1 Nordvest	0,759	0,862	0,829	0,811	0,781	0,759	0,779
Sparebank 1 Nøtterøy-Tønsberg				0,830	0,787	0,799	0,873
Sparebank 1 Ringerike Hadeland				1,000	0,923	0,910	0,923
SpareBank 1 SMN	0,794	0,882	0,818	0,860	0,844	0,833	0,851
SPAREBANK 1 SR-BANK	0,992	0,886	0,855	0,854	0,897	0,808	0,845
Bien sparebank	0,908	0,910	0,802	0,777	0,860	0,872	0,877
Sparebank 1 Telemark	0,852	0,843	0,872	0,845	0,853	0,827	0,896
Sparebank 1 Søre Sunnmøre			0,886	0,835	0,848	0,838	0,839
Sparebank 1 Østfold Akershus					0,872	0,784	0,799
Sparebanken DIN							0,833
SPAREBANKEN GRENLAND	0,917						
SPAREBANKEN HARDANGER	0,850	0,913	0,864	0,900			
SPAREBANKEN HEDMARK	0,811	0,889	0,835	0,796	0,813	0,851	0,837
SPAREBANKEN HEMNE	0,930	0,936	0,939	0,902	0,881	0,946	0,940
SPAREBANKEN MØRE	0,808	0,952	0,914	0,903	0,930	1,000	0,910
Sparebanken Narvik	0,800	0,937	0,889	0,884	0,901	0,961	1,000
SPAREBANKEN PLUSS	1,000	1,000	1,000	1,000	1,000	1,000	1,000
SPAREBANKEN SOGN OG FJORDANE	0,823	0,929	0,892	0,965	0,916	0,911	0,955
SPAREBANKEN SØR	0,873	0,938	0,899	0,943	0,894	0,845	0,856
SPAREBANKEN VEST	1,000	0,906	0,865	0,836	0,843	0,865	0,845
Sparebanken Øst	1,000	0,936	0,900	0,887	0,912	0,887	0,901
SPARESKILLINGSBANKEN			1,000	1,000	1,000	1,000	1,000
SPYDEBERG SPAREBANK	1,000	0,980	0,818	0,848	0,865	0,901	0,953
STADSBYGD SPAREBANK	0,867	0,861	0,881	0,918	0,911	0,922	0,902
STRØMMEN SPAREBANK	0,916				0,935	0,929	0,938
SUNNDAL SPAREBANK	0,832	0,926	0,880	1,000	0,893	0,923	0,921
Surnadal Sparebank	0,814	0,901	0,851	0,864	0,842	0,906	0,902
SØGNE OG GREIPSTAD SPAREBANK	1,000	0,956	0,889	0,925	0,966	0,933	0,938
TIME SPAREBANK	1,000	0,915	0,910	1,000	0,963	0,945	0,998
TINGVOLL SPAREBANK	1,000	1,000					
TINN SPAREBANK	0,817	0,917	0,876	0,914	0,842	0,885	0,843
TOLGA-OS SPAREBANK	0,815	0,950	0,956	0,927	0,874	0,911	0,930
TOTENS SPAREBANK	0,869	0,945	0,914	0,943	0,907	0,882	0,947

TRØGSTAD SPAREBANK	0,823	0,913	0,880	0,896	0,903	0,912	0,905
TYSNES SPAREBANK	1,000	1,000	1,000	0,975	0,954	1,000	1,000
VALLE SPAREBANK	0,956	0,910	0,942	0,921	0,960	0,950	1,000
VANG SPAREBANK	1,000	0,990	0,910	1,000	0,926		0,968
VEGÅRSHEI SPAREBANK	0,836	0,910	0,915	0,923	0,895	0,877	0,825
Vestfold Sparebank	0,840						
VESTRE SLIDRE SPAREBANK	1,000	1,000	1,000	1,000	1,000	1,000	1,000
VIK SPAREBANK	0,974	0,929	0,926	1,000	0,950	0,865	0,904
VOLDA OG ØRSTA SPAREBANK	0,836	0,881					
VOSS SPAREBANK	1,000	1,000	1,000	1,000	1,000	1,000	1,000
ØRLAND SPAREBANK	0,960	0,972	0,945	0,958	0,962	0,953	0,963
ØRSKOG SPAREBANK	0,959	1,000	1,000	0,986	1,000	0,896	0,922
ØYSTRE SLIDRE SPAREBANK	0,953	1,000	1,000	1,000	1,000		
ÅFJORD SPAREBANK	0,873	0,925	0,885	0,855	0,921	0,952	0,913
Total number of active banks	119	116	115	111	110	107	106

Appendix 2. VRS Scores

Bank Name	2007	2008	2009	2010	2011	2012	2013
AASEN SPAREBANK	0,822	0,859	0,900	0,962	0,913	0,910	0,920
ANDEBU SPAREBANK	0,966	0,933	0,899	0,921	0,880	0,910	0,997
ARENDAL OG OMEGNS SPAREKASSE	1,000	1,000	1,000	1,000	1,000	0,985	0,944
ASKIM SPAREBANK	0,984	0,940	0,885	0,907	0,902	0,940	1,000
AURLAND SPAREBANK	0,917	0,918	1,000	1,000	1,000	0,921	1,000
AURSKOG SPAREBANK	0,929	0,970	0,972	1,000	1,000	0,953	0,975
BAMBLE OG LANGESUND SPAREBANK	0,824	0,876	0,835	0,847	0,862	0,841	0,819
BERG SPAREBANK	0,820	0,974	0,893	0,888	0,884	0,921	0,953
BIRKENES SPAREBANK	0,934	0,938			0,935	0,937	0,951
BJUGN SPAREBANK	1,000	1,000	1,000	1,000	1,000	1,000	1,000
BLAKER SPAREBANK	0,803	0,913	0,884	0,909	0,970	0,957	0,971
BUD FRÆNA OG HUSTAD SPAREBANK	0,864	0,929	0,842	0,836	0,846	0,870	0,922
BØ SPAREBANK	0,815	0,931	0,936	0,938	0,878	0,876	
CULTURA SPAREBANK							
DNB NOR BANK ASA	1,000	1,000	1,000	1,000	1,000	1,000	1,000
DRANGEDAL OG TØRDAL SPAREBANK	0,849	1,000	0,929	0,992	1,000	0,986	0,952
EIDSBERG SPAREBANK	0,972	0,964	0,871	0,954	0,927	0,936	0,987
ETNE SPAREBANK	0,839	0,954	0,886	0,880	0,867	0,883	0,876
ETNEDAL SPAREBANK			0,920	0,944	1,000	1,000	1,000
EVJE OG HORNNES SPAREBANK	0,895	0,941	0,980	0,923	0,957	0,937	0,956
FANA SPAREBANK	1,000	1,000	0,959	1,000	1,000	1,000	0,935
FJALER SPAREBANK	0,766	0,833	0,899				
FLEKKEFJORD SPAREBANK	1,000	1,000	0,959	1,000	0,977	0,976	1,000

Fornebu Sparebank	1,000	1,000	1,000	1,000	1,000	1,000	1,000
GILDESKÅL SPAREBANK	1,000	1,000	1,000	1,000	1,000	1,000	0,891
GJERSTAD SPAREBANK	1,000	0,935	0,918	0,863	0,819	0,839	0,819
GRONG SPAREBANK	0,953	1,000	0,930	0,914	0,897	0,969	0,991
GRUE SPAREBANK	0,917	0,988	0,890	0,885	0,933	0,908	0,855
HALDEN SPAREBANK	0,890	0,872	0,829	0,798			
HALTDALEN SPAREBANK	0,953	0,993	0,969	1,000	1,000	1,000	1,000
HARSTAD SPAREBANK	0,891	0,927	0,899	0,952	0,974	0,936	0,935
HAUGESUND SPAREBANK	1,000	1,000	1,000	1,000	1,000	1,000	1,000
HEGRA SPAREBANK	0,749	0,886	0,958	0,938	0,907	0,938	0,997
HELGELAND SPAREBANK	1,000	0,993	0,970	0,985	0,966	0,986	1,000
HJARTDAL OG GRANSHERAD SPAREBANK	0,894	0,973	0,970	0,932	0,926	1,000	0,891
HJELMELAND SPAREBANK	0,833			0,844	0,853	0,893	0,942
HOL SPAREBANK	0,837	0,937	0,831	0,834	0,864	0,878	
HOLLA OG LUNDE SPAREBANK	0,900	0,930	0,943	0,877	0,847		
Høland & Setskog Sparebank	0,883	0,879	0,832	0,852	0,904	0,917	0,945
HØNEFOSS SPAREBANK	1,000	1,000	0,959	1,000	0,840	0,913	0,957
INDRE SOGN SPAREBANK	0,826	0,893	0,834	0,795	0,848	0,884	0,894
JERNBANEPERSONALETS SPAREBANK	1,000	1,000	0,827	1,000	1,000	1,000	1,000
KLEPP SPAREBANK	1,000	0,874	0,851	0,950	0,840	0,793	0,868
KLÆBU SPAREBANK	0,784	0,848	0,847	0,832	0,864	0,899	0,999
KRAGERØ SPAREBANK	0,897	0,925	0,872	0,901	0,862	0,841	0,805
KVINESDAL SPAREBANK	0,830	0,921	0,832	0,911			
KVINNHERAD SPAREBANK	0,881	0,869	0,859				
LARVIKBANKEN BRUNLANES SPAREBANK	0,920	0,901	0,822	0,883	0,853	0,833	0,879
LILLESANDS SPAREBANK	1,000	1,000	0,983	0,964	0,987	0,957	0,921
LILLESTRØMBANKEN LILLESTRØM SPAREBANK	1,000	0,934	0,918	0,967	0,919	0,896	0,935
LOFOTEN SPAREBANK	1,000	1,000	1,000	0,989	1,000	1,000	1,000
LOM OG SKJÅK SPAREBANK	0,874	0,926	0,916	0,963	0,939	0,898	
LUSTER SPAREBANK	0,989	1,000	1,000	0,960	0,962	0,974	0,980
MARKER SPAREBANK	0,908	0,963	0,980	0,981	0,953	0,989	1,000
MELDAL SPAREBANK	0,963	0,957	0,882	0,927	0,952	0,955	1,000
MELHUS SPAREBANK	0,989	0,992	0,937	0,925	0,900	0,885	0,994
MODUM SPAREBANK	0,931	0,952	0,910	0,922	0,882	0,929	0,978
NES PRESTEGJELDS SPAREBANK	0,952	0,903	0,880	0,878	0,889	0,862	
NESSET SPAREBANK	0,802	0,886	0,919	0,818	0,796	0,839	0,874
NØTTERØ SPAREBANK	0,897	0,944	0,847				
ODAL SPAREBANK	1,000	1,000	0,974	0,998	0,944	0,986	1,000
OFOTEN SPAREBANK	0,945	0,956	0,939	0,893	0,924	0,943	0,884
OPDALS SPAREBANK	0,891	0,983	0,942	0,906	0,925	0,913	0,920
ORKDAL SPAREBANK	1,000	1,000	0,967	0,955	0,922	0,947	0,972
RINDAL SPAREBANK	0,876	0,941	0,994	0,991	0,925	0,960	0,966

Ringerikes Sparebank	1,000	1,000	1,000				
Rygge-Vaaler Sparebank			0,894	0,890			
RØROSBANKEN RØROS SPAREBANK	0,849	0,924	0,847	0,880	1,000	0,903	0,888
SANDNES SPAREBANK		1,000	1,000	1,000	0,906	0,818	0,985
SAUDA SPAREBANK	1,000	1,000					
SELBU SPAREBANK	0,845	0,915	0,880	0,902	0,890	0,891	0,875
SELJORD SPAREBANK	0,806	0,891	0,930	0,854	0,892	0,859	
SETSKOG SPAREBANK	0,883	1,000	0,951				
SKUDENES & AAKRA SPAREBANK	1,000	1,000	0,918	0,956	0,952	0,965	1,000
Skue sparebank							0,975
SOKNEDAL SPAREBANK	0,787	0,895	0,926	0,888	0,808	0,868	0,860
SPAREBANK 1 GRAN	1,000	1,000	1,000				
Sparebank 1 Buskerud-Vestfold		0,945	0,908	0,906	0,906	0,897	0,884
SPAREBANK 1 GUDBRANDSDAL FRON SPAREBANK	0,951	0,949	0,948	0,943	0,895	0,890	0,974
SPAREBANK 1 HALLINGDAL	0,960	0,944	0,889	0,940	0,907	1,000	1,000
Sparebank 1 Lom og Skjåk							0,925
SPAREBANK 1 JEVNAKER LUNNER	0,910	0,942	0,862				
SpareBank 1 Kongsberg	0,903						
SpareBank 1 Moss	0,974	0,936					
SPAREBANK 1 NORD-NORGE	1,000	1,000	1,000	1,000	1,000	0,992	1,000
SpareBank 1 Nordvest	0,904	0,948	0,924	0,903	0,870	0,852	0,876
Sparebank 1 Nøtterøy-Tønsberg				0,843	0,820	0,829	0,878
Sparebank 1 Ringerike Hadeland				1,000	1,000	1,000	1,000
SpareBank 1 SMN	0,967	1,000	0,972	1,000	1,000	1,000	1,000
SPAREBANK 1 SR-BANK	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Bien sparebank	0,964	0,910	0,805	0,778	0,866	0,881	0,878
Sparebank 1 Telemark	0,952	1,000	1,000	0,985	1,000	1,000	1,000
Sparebank 1 Søre Sunnmøre			0,910	0,876	0,900	0,873	0,863
Sparebank 1 Østfold Akershus					1,000	0,928	0,924
Sparebanken DIN							0,861
SPAREBANKEN GRENLAND	1,000						
SPAREBANKEN HARDANGER	0,939	0,970	0,899	0,969			
SPAREBANKEN HEDMARK	1,000	1,000	1,000	1,000	1,000	1,000	1,000
SPAREBANKEN HEMNE	0,936	0,940	0,950	0,909	0,887	0,946	0,944
SPAREBANKEN MØRE	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Sparebanken Narvik	0,957	1,000	0,930	0,912	0,948	0,967	1,000
SPAREBANKEN PLUSS	1,000	1,000	1,000	1,000	1,000	1,000	1,000
SPAREBANKEN SOGN OG FJORDANE	1,000	1,000	1,000	1,000	1,000	0,934	1,000
SPAREBANKEN SØR	1,000	1,000	1,000	1,000	0,953	0,901	0,940
SPAREBANKEN VEST	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Sparebanken Øst	1,000	0,974	1,000	0,951	0,987	0,998	1,000
SPARESKILLINGSBANKEN			1,000	1,000	1,000	1,000	1,000

SPYDEBERG SPAREBANK	1,000	0,990	0,825	0,851	0,866	0,901	0,957
STADSBYGD SPAREBANK	0,870	0,866	0,883	0,922	0,914	0,922	0,913
STRØMMEN SPAREBANK	0,942				0,952	0,946	0,955
SUNNDAL SPAREBANK	0,832	0,927	0,899	1,000	0,900	0,925	0,956
Surnadal Sparebank	0,853	0,917	0,851	0,868	0,861	0,915	0,918
SØGNE OG GREIPSTAD SPAREBANK	1,000	0,971	0,891	0,927	0,985	0,945	0,949
TIME SPAREBANK	1,000	0,933	0,915	1,000	0,989	0,951	0,999
TINGVOLL SPAREBANK	1,000	1,000					
TINN SPAREBANK	0,870	0,936	0,877	0,918	0,875	0,910	0,888
TOLGA-OS SPAREBANK	0,819	0,950	0,969	0,930	0,892	0,912	0,931
TOTENS SPAREBANK	0,937	0,999	1,000	0,994	0,954	0,932	1,000
TRØGSTAD SPAREBANK	0,829	0,915	0,881	0,900	0,904	0,913	0,932
TYSNES SPAREBANK	1,000	1,000	1,000	1,000	0,959	1,000	1,000
VALLE SPAREBANK	0,959	0,914	0,949	0,922	0,963	0,952	1,000
VANG SPAREBANK	1,000	1,000	1,000	1,000	1,000		1,000
VEGÅRSHEI SPAREBANK	0,982	0,964	0,996	0,948	0,896	0,927	0,874
Vestfold Sparebank	0,927						
VESTRE SLIDRE SPAREBANK	1,000	1,000	1,000	1,000	1,000	1,000	1,000
VIK SPAREBANK	0,985	0,934	0,937	1,000	1,000	0,869	0,910
VOLDA OG ØRSTA SPAREBANK	0,920	0,932					
VOSS SPAREBANK	1,000	1,000	1,000	1,000	1,000	1,000	1,000
ØRLAND SPAREBANK	0,970	0,973	0,953	0,966	0,986	0,967	0,978
ØRSKOG SPAREBANK	1,000	1,000	1,000	1,000	1,000	1,000	0,929
ØYSTRE SLIDRE SPAREBANK	0,969	1,000	1,000	1,000	1,000		
ÅFJORD SPAREBANK	0,881	0,928	0,893	0,858	0,921	0,957	0,918

Appendix 3. SE Scores

Bank Name	2007	2008	2009	2010	2011	2012	2013
AASEN SPAREBANK	0,999	0,999	0,995	0,993	0,997	0,998	0,986
ANDEBU SPAREBANK	0,961	0,998	0,989	0,995	0,997	0,991	0,999
ARENDAL OG OMEGNS SPAREKASSE	1,000	0,997	1,000	1,000	0,995	0,967	0,999
ASKIM SPAREBANK	0,889	0,951	0,980	0,962	0,965	0,953	0,966
AURLAND SPAREBANK	0,997	0,973	1,000	1,000	1,000	0,996	1,000
AURSKOG SPAREBANK	0,987	0,995	0,983	0,992	1,000	1,000	0,991
BAMBLE OG LANGESUND SPAREBANK	0,944	0,994	0,996	0,992	0,985	0,995	0,995
BERG SPAREBANK	0,991	0,995	0,999	0,998	0,960	0,992	0,979
BIRKENES SPAREBANK	0,950	0,956			0,961	0,965	0,966
BJUGN SPAREBANK	1,000	1,000	1,000	1,000	1,000	1,000	1,000
BLAKER SPAREBANK	0,999	1,000	0,995	0,994	0,983	0,995	0,972

BUD FRÆNA OG HUSTAD SPAREBANK	0,955	0,981	1,000	1,000	0,982	0,990	0,955
BØ SPAREBANK	0,995	1,000	0,986	1,000	0,982	0,999	
CULTURA SPAREBANK							
DNB NOR BANK ASA	1,000	0,925	0,841	0,843	0,877	0,899	0,940
DRANGEDAL OG TØRDAL SPAREBANK	0,998	1,000	1,000	0,922	0,943	0,993	0,973
EIDSBERG SPAREBANK	0,912	0,993	0,974	0,975	0,972	0,987	0,998
ETNE SPAREBANK	0,989	0,986	0,953	0,990	0,997	0,996	0,985
ETNEDAL SPAREBANK			0,939	0,993	0,996	1,000	1,000
EVJE OG HORNNES SPAREBANK	0,978	0,992	0,970	0,990	1,000	0,998	0,991
FANA SPAREBANK	0,972	0,945	0,923	0,850	0,845	0,844	0,894
FJALER SPAREBANK	0,999	1,000	0,980				
FLEKKEFJORD SPAREBANK	1,000	1,000	0,994	1,000	0,992	0,997	1,000
Fornebu Sparebank	1,000	1,000	0,898	1,000	1,000	1,000	1,000
GILDESKÅL SPAREBANK	1,000	0,970	0,849	0,902	0,811	0,852	0,965
GJERSTAD SPAREBANK	1,000	0,998	0,959	0,997	0,995	0,996	1,000
GRONG SPAREBANK	0,925	1,000	0,986	0,967	0,961	0,955	0,951
GRUE SPAREBANK	0,969	0,994	0,996	0,992	0,977	0,996	0,996
HALDEN SPAREBANK	0,867	0,910	0,943	0,938			
HALTDALEN SPAREBANK	0,890	0,950	0,880	1,000	1,000	1,000	0,968
HARSTAD SPAREBANK	0,961	1,000	0,998	0,997	0,983	0,999	0,972
HAUGESUND SPAREBANK	0,989	1,000	0,999	0,905	0,930	0,922	0,964
HEGRA SPAREBANK	0,995	0,992	0,903	0,978	0,996	0,993	1,000
HELGELAND SPAREBANK	0,821	0,932	0,907	0,948	0,950	0,899	0,974
HJARTDAL OG GRANSHERAD SPAREBANK	0,996	0,991	0,989	0,975	0,977	0,953	0,981
HJELMELAND SPAREBANK	0,993			0,990	0,994	1,000	0,984
HOL SPAREBANK	0,989	0,998	0,996	1,000	0,984	0,992	
HOLLA OG LUNDE SPAREBANK	0,936	0,997	0,969	0,982	0,956		
Høland & Setskog Sparebank	0,920	0,974	0,983	0,974	0,964	0,995	0,984
HØNEFOSS SPAREBANK	1,000	1,000	0,859	1,000	0,996	0,994	0,996
INDRE SOGN SPAREBANK	0,953	0,991	0,998	0,996	0,983	0,994	0,988
JERNBANEPERSONALETS SPAREBANK	0,869	0,997	0,959	1,000	1,000	1,000	1,000
KLEPP SPAREBANK	1,000	0,998	0,999	0,997	0,979	0,997	0,990
KLÆBU SPAREBANK	0,989	0,999	0,995	0,991	0,979	0,967	0,980
KRAGERØ SPAREBANK	0,967	0,997	0,987	0,997	0,971	0,992	0,979
KVINESDAL SPAREBANK	0,985	0,976	0,994	0,992			
KVINNHERAD SPAREBANK	0,897	0,934	0,946				

LARVIKBANKEN BRUNLANES SPAREBANK	0,982	0,992	0,996	0,988	0,975	0,997	0,989
LILLESANDS SPAREBANK	1,000	1,000	0,980	0,993	0,999	0,997	1,000
LILLESTRØMBANKEN LILLESTRØM SPAREBANK	0,879	0,950	0,942	0,913	0,913	0,941	0,927
LOFOTEN SPAREBANK	1,000	1,000	1,000	0,997	1,000	1,000	1,000
LOM OG SKJÅK SPAREBANK	0,945	1,000	0,967	0,985	0,955	0,986	
LUSTER SPAREBANK	0,973	1,000	0,998	0,994	0,983	0,994	0,979
MARKER SPAREBANK	0,955	0,999	0,995	0,998	0,971	0,984	0,979
MELDAL SPAREBANK	0,987	1,000	1,000	0,996	0,981	1,000	1,000
MELHUS SPAREBANK	0,933	0,947	0,977	0,971	0,979	0,962	0,996
MODUM SPAREBANK	0,868	0,946	0,971	0,982	0,942	0,934	0,944
NES PRESTEGJELDS SPAREBANK	0,888	0,965	0,996	0,994	0,993	0,987	
NESSET SPAREBANK	0,995	0,997	1,000	0,994	0,994	0,992	0,994
NØTTERØ SPAREBANK	0,931	0,948	0,981				
ODAL SPAREBANK	0,868	1,000	0,943	0,926	0,943	0,948	0,948
OFOTEN SPAREBANK	0,946	0,990	0,992	1,000	0,985	0,991	0,988
OPDALS SPAREBANK	0,999	1,000	0,999	0,996	0,985	0,994	0,996
ORKDAL SPAREBANK	0,957	1,000	0,997	1,000	0,984	0,996	0,993
RINDAL SPAREBANK	0,988	0,978	0,933	0,974	1,000	0,981	0,990
Ringerikes Sparebank	0,948	1,000	0,949				
Rygge-Vaaler Sparebank			0,940	0,909			
RØROSBANKEN RØROS SPAREBANK	0,929	0,983	0,990	0,986	1,000	0,968	0,960
SANDNES SPAREBANK		1,000	1,000	0,922	0,933	0,977	0,967
SAUDA SPAREBANK	0,978	1,000					
SELBU SPAREBANK	0,949	0,965	0,986	1,000	0,978	0,991	0,975
SELJORD SPAREBANK	0,993	0,996	0,997	0,996	0,988	0,989	
SETSKOG SPAREBANK	0,878	0,882	0,874				
SKUDENES & AAKRA SPAREBANK	1,000	1,000	0,982	0,972	0,980	0,977	0,980
Skue sparebank							0,945
SOKNEDAL SPAREBANK	0,999	0,989	0,957	0,988	0,999	0,989	0,985
SPAREBANK 1 GRAN	0,921	1,000	1,000				
Sparebank 1 Buskerud-Vestfold		0,921	0,918	0,898	0,866	0,880	0,895
SPAREBANK 1 GUDBRANDSDAL FRON SPAREBANK	0,895	0,963	0,954	0,943	0,922	0,946	0,939
SPAREBANK 1 HALLINGDAL	0,933	0,917	0,943	0,915	0,934	0,903	0,956
Sparebank 1 Lom og Skjåk							0,976

SPAREBANK 1 JEVNAKER LUNNER	0,869	0,931	0,936				
SpareBank 1 Kongsberg	0,882						
SpareBank 1 Moss	0,910	0,937					
SPAREBANK 1 NORD-NORGE	0,817	0,907	0,838	0,799	0,806	0,811	0,810
SpareBank 1 Nordvest	0,840	0,909	0,897	0,898	0,897	0,891	0,890
Sparebank 1 Nøtterøy-Tønsberg				0,985	0,960	0,964	0,995
Sparebank 1 Ringerike Hadeland				1,000	0,923	0,910	0,923
SpareBank 1 SMN	0,821	0,882	0,841	0,860	0,844	0,833	0,851
SPAREBANK 1 SR-BANK	0,992	0,886	0,855	0,854	0,897	0,808	0,845
Bien sparebank	0,942	0,999	0,996	0,998	0,994	0,990	0,999
Sparebank 1 Telemark	0,895	0,843	0,872	0,857	0,853	0,827	0,896
Sparebank 1 Søre Sunnmøre			0,974	0,953	0,943	0,960	0,973
Sparebank 1 Østfold Akershus					0,872	0,845	0,864
Sparebanken DIN							0,967
SPAREBANKEN GRENLAND	0,917						
SPAREBANKEN HARDANGER	0,906	0,942	0,961	0,929			
SPAREBANKEN HEDMARK	0,811	0,889	0,835	0,796	0,813	0,851	0,837
SPAREBANKEN HEMNE	0,993	0,995	0,988	0,992	0,993	1,000	0,996
SPAREBANKEN MØRE	0,808	0,952	0,914	0,903	0,930	1,000	0,910
Sparebanken Narvik	0,836	0,937	0,956	0,970	0,950	0,994	1,000
SPAREBANKEN PLUSS	1,000	1,000	1,000	1,000	1,000	1,000	1,000
SPAREBANKEN SOGN OG FJORDANE	0,823	0,929	0,892	0,965	0,916	0,975	0,955
SPAREBANKEN SØR	0,873	0,938	0,899	0,943	0,938	0,938	0,911
SPAREBANKEN VEST	1,000	0,906	0,865	0,836	0,843	0,865	0,845
Sparebanken Øst	1,000	0,961	0,900	0,934	0,924	0,888	0,901
SPARESKILLINGSBANKEN			1,000	1,000	1,000	1,000	1,000
SPYDEBERG SPAREBANK	1,000	0,991	0,992	0,996	0,999	1,000	0,995
STADSBYGD SPAREBANK	0,996	0,995	0,998	0,995	0,997	1,000	0,988
STRØMMEN SPAREBANK	0,972				0,982	0,982	0,982
SUNNDAL SPAREBANK	1,000	1,000	0,979	1,000	0,993	0,997	0,964
Surnadal Sparebank	0,954	0,983	1,000	0,996	0,977	0,990	0,982
SØGNE OG GREIPSTAD SPAREBANK	1,000	0,984	0,998	0,998	0,980	0,987	0,988
TIME SPAREBANK	1,000	0,980	0,994	1,000	0,973	0,993	0,998
TINGVOLL SPAREBANK	1,000	1,000					
TINN SPAREBANK	0,940	0,980	0,999	0,996	0,962	0,972	0,950
TOLGA-OS SPAREBANK	0,995	1,000	0,987	0,996	0,980	0,999	0,999

TOTENS SPAREBANK	0,927	0,946	0,914	0,949	0,951	0,947	0,947
TRØGSTAD SPAREBANK	0,993	0,998	0,999	0,996	0,999	0,999	0,971
TYSNES SPAREBANK	1,000	1,000	1,000	0,975	0,995	1,000	1,000
VALLE SPAREBANK	0,997	0,996	0,992	0,999	0,996	0,998	1,000
VANG SPAREBANK	1,000	0,990	0,910	1,000	0,926		0,968
VEGÅRSHEI SPAREBANK	0,852	0,944	0,919	0,974	0,999	0,946	0,943
Vestfold Sparebank	0,906						
VESTRE SLIDRE SPAREBANK	1,000	1,000	1,000	1,000	1,000	1,000	1,000
VIK SPAREBANK	0,989	0,994	0,988	1,000	0,950	0,996	0,993
VOLDA OG ØRSTA SPAREBANK	0,909	0,946					
VOSS SPAREBANK	1,000	1,000	1,000	1,000	1,000	1,000	1,000
ØRLAND SPAREBANK	0,989	1,000	0,992	0,992	0,977	0,985	0,984
ØRSKOG SPAREBANK	0,959	1,000	1,000	0,986	1,000	0,896	0,992
ØYSTRE SLIDRE SPAREBANK	0,983	1,000	1,000	1,000	1,000		
ÅFJORD SPAREBANK	0,991	0,997	0,991	0,997	0,999	0,994	0,995
Total number of active banks	119	116	115	110	110	107	106

Appendix 4. Sums of weights in CRS

Bank Name	2007	2008	2009	2010	2011	2012	2013
AASEN SPAREBANK	1,082	0,857	0,703	0,610	1,149	2,740	1,650
ANDEBU SPAREBANK	1,580	1,373	1,228	0,641	1,132	1,667	0,934
ARENDAL OG OMEGNS SPAREKASSE	1,000	1,142	1,000	1,000	1,447	9,743	1,085
ASKIM SPAREBANK	3,032	2,528	1,634	1,456	3,091	3,031	3,136
AURLAND SPAREBANK	1,361	0,298	1,000	1,000	1,000	1,391	1,000
AURSKOG SPAREBANK	1,115	1,621	2,539	1,536	1,000	0,982	1,225
BAMBLE OG LANGESUND SPAREBANK	1,657	1,247	1,184	1,629	2,359	0,933	1,833
BERG SPAREBANK	1,618	1,702	0,887	1,130	2,406	0,965	2,150
BIRKENES SPAREBANK	3,361	8,343			13,189	12,415	13,602
BJUGN SPAREBANK	1,000	1,000	1,000	1,000	1,000	1,000	1,000
BLAKER SPAREBANK	1,164	1,023	1,163	1,339	2,055	1,369	2,115
BUD FRÆNA OG HUSTAD SPAREBANK	1,770	1,504	0,998	0,876	1,597	1,000	2,630
BØ SPAREBANK	0,821	0,800	0,706	1,012	1,601	1,000	
CULTURA SPAREBANK							
DNB NOR BANK ASA	1,000	762,704	434,397	501,852	790,832	829,593	862,832
DRANGEDAL OG TØRDAL SPAREBANK	1,170	1,000	1,003	2,382	2,054	0,671	2,011
EIDSBERG SPAREBANK	2,825	2,159	1,820	2,026	1,794	27,175	1,469
ETNE SPAREBANK	0,899	0,511	0,532	0,502	0,887	0,502	1,649
ETNEDAL SPAREBANK			0,331	0,655	0,645	3,345	1,000

EVJE OG HORNNES SPAREBANK	0,806	0,707	0,670	0,651	0,989	1,099	1,188
FANA SPAREBANK	3,925	7,777	5,583	4,034	3,848	4,726	6,685
FJALER SPAREBANK	1,099	1,033	0,494				
FLEKKEFJORD SPAREBANK	1,000	1,000	0,697	1,000	2,602	3,320	1,000
Fornebu Sparebank	1,000	1,000	0,340	1,000	1,000	4,360	1,000
GILDESKÅL SPAREBANK	1,000	0,492	0,233	0,148	0,539	1,000	0,692
GJERSTAD SPAREBANK	1,000	0,945	0,478	0,720	1,277	1,000	1,007
GRONG SPAREBANK	1,762	1,000	1,418	1,527	2,121	3,853	2,537
GRUE SPAREBANK	2,249	1,253	0,726	0,674	1,621	0,824	1,099
HALDEN SPAREBANK	4,965	2,529	1,764	1,940			
HALTDALEN SPAREBANK	0,494	0,612	0,214	1,000	1,000	4,427	0,310
HARSTAD SPAREBANK	3,780	0,972	0,774	0,776	1,636	10,376	1,984
HAUGESUND SPAREBANK	5,153	1,000	1,740	2,866	4,419	6,765	2,757
HEGRA SPAREBANK	1,095	0,649	0,534	0,624	0,869	0,651	1,018
HELGELAND SPAREBANK	12,906	5,572	7,637	5,931	6,971	1,255	3,003
HJARTDAL OG GRANSHERAD SPAREBANK	1,461	1,692	1,294	2,524	1,983	2,739	1,788
HJELMELAND SPAREBANK	0,884			0,733	1,351	11,905	0,874
HOL SPAREBANK	1,599	1,209	0,845	0,984	1,754	1,580	
HOLLA OG LUNDE SPAREBANK	1,667	1,089	2,209	2,233	3,197		
Høland & Setskog Sparebank	2,324	1,384	1,593	2,263	3,069	1,828	2,574
HØNEFOSS SPAREBANK	1,000	1,000	0,462	1,000	0,763	1,736	0,785
INDRE SOGN SPAREBANK	1,401	1,356	1,062	0,715	1,683	9,257	1,970
JERNBANEPERSONALETS SPAREBANK	2,434	2,966	1,861	1,000	1,000	2,555	1,000
KLEPP SPAREBANK	1,000	1,170	0,825	1,298	2,946	1,117	2,056
KLÆBU SPAREBANK	2,139	1,384	0,719	1,471	1,614	1,784	1,587
KRAGERØ SPAREBANK	1,525	1,366	1,309	0,762	2,698	1,868	1,889
KVINESDAL SPAREBANK	1,218	1,952	1,212	0,764			
KVINNHERAD SPAREBANK	2,860	2,184	1,723				
LARVIKBANKEN BRUNLANES SPAREBANK	1,646	1,287	1,177	1,832	2,734	2,269	1,497
LILLESANDS SPAREBANK	1,000	1,000	0,511	0,623	1,282	1,675	0,975
LILLESTRØMBANKEN LILLESTRØM SPAREBANK	2,169	4,264	3,085	3,049	5,586	13,674	4,230
LOFOTEN SPAREBANK	1,000	1,000	1,000	0,602	1,000	0,744	1,000
LOM OG SKJÅK SPAREBANK	3,465	1,058	1,686	1,818	3,251	0,961	
LUSTER SPAREBANK	1,858	1,000	0,633	0,675	2,434	0,764	1,599
MARKER SPAREBANK	1,955	1,612	1,084	1,036	2,466	0,897	2,640

MELDAL SPAREBANK	1,602	1,051	1,006	1,248	1,919	0,632	1,000
MELHUS SPAREBANK	2,076	2,939	1,838	1,669	2,238	0,809	1,503
MODUM SPAREBANK	3,402	2,683	1,938	1,227	4,178	1,000	4,963
NES PRESTEGJELDS SPAREBANK	2,649	1,728	1,322	1,547	1,394	1,136	
NESSET SPAREBANK	0,965	1,178	0,964	1,114	1,180	1,000	1,112
NØTTERØ SPAREBANK	3,446	4,065	2,128				
ODAL SPAREBANK	4,217	1,000	2,673	3,688	3,401	1,529	3,907
OFOTEN SPAREBANK	2,744	0,909	1,224	1,037	1,691	33,909	1,451
OPDALS SPAREBANK	1,076	0,603	0,981	1,230	1,841	5,405	1,470
ORKDAL SPAREBANK	1,486	1,148	1,199	0,834	2,078	5,779	1,791
RINDAL SPAREBANK	0,646	0,746	0,507	0,511	1,018	2,189	0,661
Ringerikes Sparebank	5,491	1,000	2,293				
Rygge-Vaaler Sparebank			7,034	6,535			
RØROSBANKEN RØROS SPAREBANK	1,867	1,463	1,514	2,009	1,000	1,963	2,547
SANDNES SPAREBANK		1,000	1,000	10,910	7,854	1,057	2,685
SAUDA SPAREBANK	0,511	1,000					
SELBU SPAREBANK	2,555	1,655	1,230	0,968	2,374	1,811	2,331
SELJORD SPAREBANK	1,811	0,623	0,789	0,836	1,447	5,019	
SETSKOG SPAREBANK	0,718	0,296	0,242				
SKUDENES & AAKRA SPAREBANK	1,000	1,000	1,252	1,275	2,054	1,000	2,641
Skue sparebank							1,781
SOKNEDAL SPAREBANK	1,069	0,739	0,604	0,718	1,044	1,000	1,281
SPAREBANK 1 GRAN	3,414	1,000	1,000				
Sparebank 1 Buskerud-Vestfold		7,318	10,703	11,609	16,846	1,549	12,556
SPAREBANK 1 GUDBRANDSDAL FRON SPAREBANK	3,902	1,523	2,002	1,827	4,881	41,998	2,583
SPAREBANK 1 HALLINGDAL	3,130	3,835	2,059	4,214	5,985	1,619	6,816
Sparebank 1 Lom og Skjåk							3,225
SPAREBANK 1 JEVNAKER LUNNER	3,045	2,235	2,372				
SpareBank 1 Kongsberg	4,300						
SpareBank 1 Moss	5,510	5,720					
SPAREBANK 1 NORD-NORGE	32,553	29,743	29,397	29,214	45,233	1,118	44,773
SpareBank 1 Nordvest	6,058	5,099	4,246	5,387	6,661	0,683	8,025
Sparebank 1 Nøtterøy-Tønsberg				1,559	2,702	1,098	1,613
Sparebank 1 Ringerike Hadeland				1,000	9,422	5,668	9,815

SpareBank 1 SMN	34,432	33,405	33,335	19,461	43,739	1,000	22,214
SPAREBANK 1 SR-BANK	13,765	47,712	36,092	26,127	40,667	7,442	52,051
Bien sparebank	2,133	1,032	0,908	0,829	0,732	1,866	0,869
Sparebank 1 Telemark	5,022	7,271	3,673	5,127	13,171	0,610	8,889
Sparebank 1 Søre Sunnmøre			1,980	2,062	3,589	3,087	1,621
Sparebank 1 Østfold Akershus					8,751	1,720	13,525
Sparebanken DIN							2,545
SPAREBANKEN GRENLAND	2,464						
SPAREBANKEN HARDANGER	3,788	1,967	1,523	4,303			
SPAREBANKEN HEDMARK	23,704	25,645	21,092	21,070	38,692	0,414	32,524
SPAREBANKEN HEMNE	0,829	0,717	0,577	0,731	1,268	1,886	1,145
SPAREBANKEN MØRE	17,729	9,268	19,241	24,556	33,929	1,475	27,186
Sparebanken Narvik	6,936	1,897	2,409	2,927	4,099	0,931	1,000
SPAREBANKEN PLUSS	1,000	1,000	1,000	1,000	1,000	28,840	1,000
SPAREBANKEN SOGN OG FJORDANE	13,199	7,828	11,292	11,871	15,222	2,171	4,622
SPAREBANKEN SØR	15,747	16,956	13,136	16,430	19,336	1,531	10,382
SPAREBANKEN VEST	1,000	53,753	38,407	40,541	66,840	1,452	61,972
Sparebanken Øst	1,000	9,342	8,263	7,498	5,815	1,866	3,545
SPARESKILLINGSBANKEN			1,000	1,000	1,000	2,739	1,000
SPYDEBERG SPAREBANK	1,000	0,637	0,890	0,794	1,026	1,942	1,225
STADSBYGD SPAREBANK	1,103	1,098	1,112	0,843	1,316	2,093	1,343
STRØMMEN SPAREBANK	1,570				1,563	3,778	1,301
SUNNDAL SPAREBANK	1,031	1,127	0,526	1,000	1,308	1,000	0,516
Surnadal Sparebank	1,696	1,446	0,931	1,102	2,034	1,010	1,974
SØGNE OG GREIPSTAD SPAREBANK	1,000	1,479	0,764	0,799	1,809	1,302	1,467
TIME SPAREBANK	1,000	2,021	1,095	1,000	1,685	0,997	1,201
TINGVOLL SPAREBANK	1,000	1,000					
TINN SPAREBANK	2,007	1,659	0,887	1,109	2,369	1,292	2,869
TOLGA-OS SPAREBANK	1,789	0,700	1,173	1,179	1,828	1,000	1,069
TOTENS SPAREBANK	4,713	7,860	4,651	3,410	5,993	1,614	2,994
TRØGSTAD SPAREBANK	1,098	1,252	0,877	0,813	1,064	2,342	1,721
TYSNES SPAREBANK	1,000	1,000	1,000	0,505	0,597	0,886	1,000
VALLE SPAREBANK	0,685	0,684	0,511	1,081	1,103	1,103	1,000
VANG SPAREBANK	1,000	0,191	0,267	1,000	0,752		0,615
VEGÅRSHEI SPAREBANK	0,426	0,469	0,290	0,320	1,078	2,294	0,314
Vestfold Sparebank	5,364						
VESTRE SLIDRE SPAREBANK	1,000	1,000	1,000	1,000	1,000	2,578	1,000
VIK SPAREBANK	1,411	0,813	0,971	1,000	1,320	1,000	0,650
VOLDA OG ØRSTA SPAREBANK	2,697	2,506					

VOSS SPAREBANK	1,000	1,000	1,000	1,000	1,000	1,577	1,000
ØRLAND SPAREBANK	1,247	0,886	1,221	1,494	1,937	0,668	2,313
ØRSKOG SPAREBANK	0,481	1,000	1,000	0,375	1,000	42,651	0,551
ØYSTRE SLIDRE SPAREBANK	1,162	1,000	1,000	1,000	1,000		
ÅFJORD SPAREBANK	1,737	0,878	0,752	0,866	0,826	0,903	1,165
Total number of active banks	119	115	115	112	110	107	106

Appendix 5. Super-efficiency scores

Bank Name	2007	2008	2009	2010	2011	2012	2013
AASEN SPAREBANK	0,821	0,858	0,895	0,956	0,910	0,908	0,907
ANDEBU SPAREBANK	0,929	0,931	0,889	0,917	0,877	0,902	0,996
ARENDAL OG OMEGNS SPAREKASSE	1,024	0,997	1,021	1,026	0,995	0,952	0,943
ASKIM SPAREBANK	0,875	0,894	0,867	0,873	0,870	0,895	0,966
AURLAND SPAREBANK	0,915	0,894	1,000	1,020	1,070	0,917	1,095
AURSKOG SPAREBANK	0,916	0,965	0,956	0,992	1,003	0,953	0,967
BAMBLE OG LANGESUND SPAREBANK	0,778	0,871	0,832	0,840	0,850	0,836	0,816
BERG SPAREBANK	0,812	0,969	0,892	0,886	0,849	0,914	0,933
BIRKENES SPAREBANK	0,886	0,933			0,898	0,903	0,918
BJUGN SPAREBANK	1,202	1,084	1,114	1,132	1,077	1,081	1,085
BLAKER SPAREBANK	0,802	0,913	0,879	0,903	0,954	0,952	0,944
BUD FRÆNA OG HUSTAD SPAREBANK	0,825	0,911	0,842	0,836	0,831	0,862	0,881
BØ SPAREBANK	0,811	0,931	0,923	0,938	0,862	0,876	
CULTURA SPAREBANK							
DNB NOR BANK ASA	1,129	0,925	0,841	0,843	0,877	0,899	0,940
DRANGEDAL OG TØRDAL SPAREBANK	0,848	1,108	0,929	0,915	0,943	0,979	0,926
EIDSBERG SPAREBANK	0,887	0,958	0,848	0,930	0,901	0,923	0,986
ETNE SPAREBANK	0,830	0,940	0,845	0,871	0,864	0,879	0,862
ETNEDAL SPAREBANK			0,868	0,937	0,996	1,077	1,002
EVJE OG HORNNES SPAREBANK	0,876	0,934	0,950	0,914	0,957	0,935	0,947
FANA SPAREBANK	0,972	0,945	0,885	0,850	0,845	0,844	0,836
FJALER SPAREBANK	0,765	0,833	0,881				
FLEKKEFJORD SPAREBANK	1,345	1,051	0,953	1,068	0,969	0,973	1,031
Fornebu Sparebank	1,286	1,514	0,898	1,050	1,251	1,285	1,470
GILDESKÅL SPAREBANK	1,000	0,970	0,849	0,902	0,811	1,077	0,860
GJERSTAD SPAREBANK	1,056	0,934	0,880	0,861	0,815	0,836	0,819
GRONG SPAREBANK	0,881	1,055	0,917	0,884	0,862	0,926	0,942
GRUE SPAREBANK	0,888	0,982	0,886	0,878	0,912	0,904	0,852
HALDEN SPAREBANK	0,772	0,794	0,781	0,749			
HALTDALEN SPAREBANK	0,848	0,943	0,853	1,180	1,129	1,164	0,968
HARSTAD SPAREBANK	0,856	0,927	0,898	0,949	0,957	0,936	0,908
HAUGESUND SPAREBANK	0,989	1,028	0,999	0,905	0,930	0,922	0,964
HEGRA SPAREBANK	0,746	0,879	0,865	0,917	0,903	0,931	0,996

HELGELAND SPAREBANK	0,821	0,925	0,880	0,934	0,917	0,886	0,974
HJARTDAL OG GRANSHERAD SPAREBANK	0,891	0,964	0,959	0,909	0,904	0,953	0,874
HJELMELAND SPAREBANK	0,827			0,835	0,847	0,893	0,927
HOL SPAREBANK	0,828	0,936	0,828	0,834	0,850	0,871	
HOLLA OG LUNDE SPAREBANK	0,843	0,927	0,914	0,861	0,810		
Høland & Setskog Sparebank	0,812	0,857	0,818	0,830	0,872	0,912	0,930
HØNEFOSS SPAREBANK	0,701	0,767	0,824	1,438	0,837	0,908	0,953
INDRE SOGN SPAREBANK	0,787	0,885	0,833	0,792	0,834	0,879	0,883
JERNBANEPERSONALETS SPAREBANK	0,869	0,997	0,793	1,274	1,682	1,382	1,826
KLEPP SPAREBANK	1,002	0,873	0,850	0,947	0,822	0,791	0,859
KLÆBU SPAREBANK	0,775	0,847	0,843	0,825	0,846	0,870	0,979
KRAGERØ SPAREBANK	0,867	0,922	0,861	0,899	0,837	0,834	0,788
KVINESDAL SPAREBANK	0,817	0,898	0,827	0,903			
KVINNHERAD SPAREBANK	0,790	0,812	0,813				
LARVIKBANKEN BRUNLANES SPAREBANK	0,904	0,894	0,819	0,872	0,832	0,831	0,870
LILLESANDS SPAREBANK	1,157	1,011	0,964	0,958	0,986	0,954	0,921
LILLESTRØMBANKEN LILLESTRØM SPAREBANK	0,879	0,887	0,864	0,883	0,840	0,843	0,867
LOFOTEN SPAREBANK	1,000	1,000	1,000	0,986	1,087	1,041	1,057
LOM OG SKJÅK SPAREBANK	0,826	0,926	0,886	0,949	0,897	0,886	
LUSTER SPAREBANK	0,962	1,039	0,998	0,954	0,945	0,968	0,959
MARKER SPAREBANK	0,867	0,962	0,975	0,980	0,925	0,973	0,979
MELDAL SPAREBANK	0,951	0,957	0,881	0,923	0,933	0,954	1,043
MELHUS SPAREBANK	0,922	0,940	0,915	0,898	0,881	0,852	0,990
MODUM SPAREBANK	0,808	0,901	0,884	0,905	0,831	0,868	0,924
NES PRESTEGJELDS SPAREBANK	0,845	0,871	0,876	0,873	0,883	0,850	
NESSET SPAREBANK	0,798	0,884	0,919	0,812	0,791	0,833	0,869
NØTTERØ SPAREBANK	0,836	0,894	0,830				
ODAL SPAREBANK	0,868	1,062	0,919	0,924	0,890	0,935	0,948
OFOTEN SPAREBANK	0,894	0,947	0,932	0,893	0,910	0,935	0,873
OPDALS SPAREBANK	0,891	0,982	0,941	0,902	0,911	0,907	0,916
ORKDAL SPAREBANK	0,957	1,000	0,965	0,955	0,907	0,944	0,965
RINDAL SPAREBANK	0,866	0,920	0,928	0,965	0,925	0,942	0,956
Ringerikes Sparebank	0,948	1,021	0,949				
Rygge-Vaaler Sparebank			0,841	0,809			
RØROSBANKEN RØROS SPAREBANK	0,789	0,909	0,838	0,867	1,017	0,875	0,852
SANDNES SPAREBANK		1,194	1,290	0,922	0,845	0,800	0,953
SAUDA SPAREBANK	0,978	1,072					
SELBU SPAREBANK	0,802	0,882	0,868	0,902	0,870	0,882	0,854
SELJORD SPAREBANK	0,800	0,888	0,928	0,851	0,882	0,850	
SETSKOG SPAREBANK	0,775	0,882	0,831				
SKUDENES & AAKRA SPAREBANK	1,088	1,219	0,901	0,929	0,934	0,943	0,980
Skue sparebank							0,921
SOKNEDAL SPAREBANK	0,786	0,885	0,886	0,877	0,806	0,858	0,847
SPAREBANK 1 GRAN	0,921	1,050	1,120				

Sparebank 1 Buskerud-Vestfold		0,870	0,834	0,813	0,784	0,789	0,791
SPAREBANK 1 GUDBRANDSDAL FRON SPAREBANK	0,851	0,914	0,904	0,889	0,825	0,843	0,914
SPAREBANK 1 HALLINGDAL	0,895	0,865	0,839	0,861	0,847	0,903	0,956
Sparebank 1 Lom og Skjåk							0,903
SPAREBANK 1 JEVNAKER LUNNER	0,791	0,877	0,807				
SpareBank 1 Kongsberg	0,797						
SpareBank 1 Moss	0,887	0,877					
SPAREBANK 1 NORD-NORGE	0,817	0,907	0,838	0,799	0,806	0,804	0,810
SpareBank 1 Nordvest	0,759	0,862	0,829	0,811	0,781	0,759	0,779
Sparebank 1 Nøtterøy-Tønsberg				0,830	0,787	0,799	0,873
Sparebank 1 Ringerike Hadeland				1,254	0,923	0,910	0,923
SpareBank 1 SMN	0,794	0,882	0,818	0,860	0,844	0,833	0,851
SPAREBANK 1 SR-BANK	0,992	0,886	0,855	0,854	0,897	0,808	0,845
Bien sparebank	0,908	0,910	0,802	0,777	0,860	0,872	0,877
Sparebank 1 Telemark	0,852	0,843	0,872	0,845	0,853	0,827	0,896
Sparebank 1 Søre Sunnmøre			0,886	0,835	0,848	0,838	0,839
Sparebank 1 Østfold Akershus					0,872	0,784	0,799
Sparebanken DIN							0,833
SPAREBANKEN GRENLAND	0,917						
SPAREBANKEN HARDANGER	0,850	0,913	0,864	0,900			
SPAREBANKEN HEDMARK	0,811	0,889	0,835	0,796	0,813	0,851	0,837
SPAREBANKEN HEMNE	0,930	0,936	0,939	0,902	0,881	0,946	0,940
SPAREBANKEN MØRE	0,808	0,952	0,914	0,903	0,930	1,063	0,910
Sparebanken Narvik	0,800	0,937	0,889	0,884	0,901	0,961	1,031
SPAREBANKEN PLUSS	1,198	1,251	1,213	1,320	1,201	1,136	1,142
SPAREBANKEN SOGN OG FJORDANE	0,823	0,929	0,892	0,965	0,916	0,911	0,955
SPAREBANKEN SØR	0,873	0,938	0,899	0,943	0,894	0,845	0,856
SPAREBANKEN VEST	1,035	0,906	0,865	0,836	0,843	0,865	0,845
Sparebanken Øst	1,025	0,936	0,900	0,887	0,912	0,887	0,901
SPARESKILLINGSBANKEN			1,331	1,803	1,811	1,516	1,305
SPYDEBERG SPAREBANK	1,475	0,980	0,818	0,848	0,865	0,901	0,953
STADSBYGD SPAREBANK	0,867	0,861	0,881	0,918	0,911	0,922	0,902
STRØMMEN SPAREBANK	0,916				0,935	0,929	0,938
SUNNDAL SPAREBANK	0,832	0,926	0,880	1,014	0,893	0,923	0,921
Surnadal Sparebank	0,814	0,901	0,851	0,864	0,842	0,906	0,902
SØGNE OG GREIPSTAD SPAREBANK	1,025	0,956	0,889	0,925	0,966	0,933	0,938
TIME SPAREBANK	1,002	0,915	0,910	1,017	0,963	0,945	0,998
TINGVOLL SPAREBANK	1,019	1,185					
TINN SPAREBANK	0,817	0,917	0,876	0,914	0,842	0,885	0,843
TOLGA-OS SPAREBANK	0,815	0,950	0,956	0,927	0,874	0,911	0,930
TOTENS SPAREBANK	0,869	0,945	0,914	0,943	0,907	0,882	0,947
TRØGSTAD SPAREBANK	0,823	0,913	0,880	0,896	0,903	0,912	0,905
TYSNES SPAREBANK	1,000	1,082	1,036	0,975	0,954	1,053	1,139
VALLE SPAREBANK	0,956	0,910	0,942	0,921	0,960	0,950	1,050

VANG SPAREBANK	1,000	0,990	0,910	1,000	0,926		0,968
VEGÅRSHEI SPAREBANK	0,836	0,910	0,915	0,923	0,895	0,877	0,825
Vestfold Sparebank	0,840						
VESTRE SLIDRE SPAREBANK	1,000	1,000	1,000	1,314	1,131	1,241	1,074
VIK SPAREBANK	0,974	0,929	0,926	1,114	0,950	0,865	0,904
VOLDA OG ØRSTA SPAREBANK	0,836	0,881					
VOSS SPAREBANK	1,014	1,094	1,046	1,124	1,083	1,119	1,142
ØRLAND SPAREBANK	0,960	0,972	0,945	0,958	0,962	0,953	0,963
ØRSKOG SPAREBANK	0,959	1,108	1,002	0,986	1,012	0,896	0,922
ØYSTRE SLIDRE SPAREBANK	0,953	1,000	1,109	1,028	1,191		
ÅFJORD SPAREBANK	0,873	0,925	0,885	0,855	0,921	0,952	0,913
Total number of active banks	119	116	115	111	110	107	106

Appendix 6. MPI – 2007 base year

Bank name	2008	2009	2010	2011	2012	2013
AASEN SPAREBANK	0,950	1,139	1,309	1,202	1,173	1,205
ANDEBU SPAREBANK	0,820	0,830	0,990	0,951	1,017	1,143
ARENDAL OG OMEGNS SPAREKASSE	1,035	0,892	0,912	0,895	0,842	0,811
ASKIM SPAREBANK	0,889	0,939	1,028	1,021	1,080	1,231
AURLAND SPAREBANK	0,811	1,308	1,488	1,447	1,152	1,360
AURSKOG SPAREBANK	1,104	0,957	1,045	1,037	0,960	0,937
BAMBLE OG LANGESUND SPAREBANK	1,082	1,077	1,168	1,096	1,099	1,059
BERG SPAREBANK	1,290	1,149	1,226	1,074	1,205	1,310
BIRKENES SPAREBANK	0,976			0,997	1,069	1,062
BJUGN SPAREBANK	0,835	0,845	0,908	0,924	0,927	0,874
BLAKER SPAREBANK	1,142	1,104	1,195	1,289	1,299	1,318
BUD FRÆNA OG HUSTAD SPAREBANK	1,024	1,040	1,026	1,013	1,086	1,182
BØ SPAREBANK	1,201	1,213	1,300	1,066	1,150	
CULTURA SPAREBANK						
DNB NOR BANK ASA	0,933	0,640	0,608	0,651	0,680	0,823
DRANGEDAL OG TØRDAL SPAREBANK	1,233	1,139	1,191	1,285	1,304	1,158
EIDSBERG SPAREBANK	0,970	0,903	1,158	1,084	1,130	1,251
ETNE SPAREBANK	1,095	0,984	1,095	1,091	1,149	1,082
ETNEDAL SPAREBANK						
EVJE OG HORNNES SPAREBANK	0,994	1,098	1,092	1,120	1,102	1,149
FANA SPAREBANK	0,936	0,778	0,811	0,793	0,796	0,747
FJALER SPAREBANK	1,014	1,300				
FLEKKEFJORD SPAREBANK	0,828	0,847	0,964	0,869	0,919	0,914
Fornebu Sparebank	0,816	0,701	0,786	0,824	0,962	0,917
GILDESKÅL SPAREBANK	0,618	0,568	0,723	0,660	0,745	0,752
GJERSTAD SPAREBANK	0,804	0,701	0,658	0,611	0,675	0,648
GRONG SPAREBANK	1,006	0,984	0,974	0,925	1,062	1,101
GRUE SPAREBANK	0,998	1,042	1,088	1,106	1,070	0,984

HALDEN SPAREBANK	0,875	1,062	1,061			
HALTDALEN SPAREBANK	1,125	0,979	1,562	1,454	1,558	1,270
HARSTAD SPAREBANK	0,999	1,048	1,265	1,287	1,234	1,173
HAUGESUND SPAREBANK	0,955	0,944	0,866	0,900	0,899	0,904
HEGRA SPAREBANK	1,164	1,320	1,516	1,469	1,519	1,792
HELGELAND SPAREBANK	1,109	1,051	1,185	1,116	1,086	1,276
HJARTDAL OG GRANSHERAD SPAREBANK	1,031	1,135	1,104	1,083	1,229	0,923
HJELMELAND SPAREBANK			0,887	0,917	1,123	1,155
HOL SPAREBANK	1,172	0,940	1,043	1,049	1,149	
HOLLA OG LUNDE SPAREBANK	1,083	1,042	0,963	0,844		
Høland & Setskog Sparebank	0,907	0,942	1,033	1,057	1,163	1,238
HØNEFOSS SPAREBANK	0,731	0,452	0,579	0,436	0,576	0,598
INDRE SOGN SPAREBANK	1,080	1,062	1,095	1,111	1,211	1,234
JERNBANEPERSONALETS SPAREBANK	1,114	0,918	1,517	1,605	1,863	1,701
KLEPP SPAREBANK	0,695	0,708	0,835	0,623	0,594	0,729
KLÆBU SPAREBANK	1,035	1,128	1,188	1,209	1,243	1,585
KRAGERØ SPAREBANK	1,071	0,914	1,066	0,924	0,919	0,830
KVINESDAL SPAREBANK	1,058	0,953	1,165			
KVINNHERAD SPAREBANK	0,884	1,085				
LARVIKBANKEN BRUNLANES SPAREBANK	0,830	0,780	0,975	0,866	0,848	0,943
LILLESANDS SPAREBANK	0,954	0,949	0,974	0,990	0,924	0,823
LILLESTRØMBANKEN LILLESTRØM SPAREBANK	0,977	0,850	0,821	0,749	0,771	0,948
LOFOTEN SPAREBANK	0,785	1,034	1,133	1,136	1,071	1,050
LOM OG SKJÅK SPAREBANK	1,063	1,060	1,344	1,102	1,119	
LUSTER SPAREBANK	0,972	1,100	1,120	1,032	1,087	1,010
MARKER SPAREBANK	1,075	1,212	1,302	1,101	1,242	1,263
MELDAL SPAREBANK	0,840	0,835	0,942	0,934	1,002	1,108
MELHUS SPAREBANK	0,983	0,947	0,966	0,920	0,833	1,126
MODUM SPAREBANK	1,050	1,167	1,342	1,074	1,169	1,344
NES PRESTEGJELDS SPAREBANK	0,988	0,967	1,009	1,028	0,996	
NESSET SPAREBANK	1,093	1,140	1,027	0,986	1,100	1,113
NØTTERØ SPAREBANK	1,041	0,952				
ODAL SPAREBANK	1,120	1,019	1,141	1,058	1,179	1,186
OFOTEN SPAREBANK	0,828	1,057	1,038	1,083	1,074	0,968
OPDALS SPAREBANK	1,035	1,018	1,001	0,957	0,974	1,023
ORKDAL SPAREBANK	0,942	0,976	1,007	0,866	0,967	0,975
RINDAL SPAREBANK	0,981	1,142	1,242	1,131	1,212	1,273
Ringerikes Sparebank	0,915	1,101				
Rygge-Vaaler Sparebank						
RØROSBANKEN RØROS SPAREBANK	1,150	1,011	1,167	1,474	1,215	1,144
SANDNES SPAREBANK						
SAUDA SPAREBANK	0,981					
SELBU SPAREBANK	1,027	1,136	1,285	1,194	1,255	1,158
SELJORD SPAREBANK	1,080	1,298	1,198	1,168	1,117	
SETSKOG SPAREBANK	1,096	1,100				

SKUDENES & AAKRA SPAREBANK	0,907	0,899	0,888	0,878	0,866	0,968
Skue sparebank						
SOKNEDAL SPAREBANK	1,086	1,198	1,244	1,038	1,197	1,204
SPAREBANK 1 GRAN	0,848	1,303				
Sparebank 1 Buskerud-Vestfold						
SPAREBANK 1 GUDBRANDSDAL FRON SPAREBANK	0,953	1,087	1,192	0,961	1,011	1,213
SPAREBANK 1 HALLINGDAL	0,780	0,939	1,043	0,991	1,133	1,229
Sparebank 1 Lom og Skjåk						
SPAREBANK 1 JEVNAKER LUNNER	1,005	1,068				
SpareBank 1 Kongsberg						
SpareBank 1 Moss	0,853					
SPAREBANK 1 NORD-NORGE	1,110	1,002	0,975	0,921	0,939	0,961
SpareBank 1 Nordvest	1,046	1,151	1,135	1,009	0,970	1,051
Sparebank 1 Nøtterøy-Tønsberg						
Sparebank 1 Ringerike Hadeland						
SpareBank 1 SMN	1,055	1,004	1,164	1,068	1,069	1,106
SPAREBANK 1 SR-BANK	0,803	0,702	0,747	0,755	0,620	0,688
Bien sparebank	0,808	0,770	0,787	0,981	0,987	0,978
Sparebank 1 Telemark	0,830	1,103	1,063	1,044	0,999	1,145
Sparebank 1 Søre Sunnmøre						
Sparebank 1 Østfold Akershus						
Sparebanken DIN						
SPAREBANKEN GRENLAND						
SPAREBANKEN HARDANGER	0,923	1,070	1,286			
SPAREBANKEN HEDMARK	1,093	1,003	0,992	0,980	1,047	1,028
SPAREBANKEN HEMNE	0,926	1,008	1,013	0,925	1,021	0,979
SPAREBANKEN MØRE	1,258	1,118	1,112	1,149	1,373	1,143
Sparebanken Narvik	1,102	1,183	1,196	1,213	1,325	1,458
SPAREBANKEN PLUSS	1,062	0,947	0,950	0,889	0,924	0,888
SPAREBANKEN SOGN OG FJORDANE	1,020	1,072	1,299	1,090	1,118	1,213
SPAREBANKEN SØR	1,048	0,981	1,100	0,952	0,884	0,893
SPAREBANKEN VEST	0,791	0,727	0,677	0,707	0,701	0,687
Sparebanken Øst	0,926	0,735	0,658	0,697	0,643	0,700
SPARESKILLINGSBANKEN						
SPYDEBERG SPAREBANK	0,754	0,613	0,723	0,761	0,843	0,883
STADSBYGD SPAREBANK	0,870	0,987	1,092	1,059	1,056	1,067
STRØMMEN SPAREBANK				0,966	1,028	1,136
SUNNDAL SPAREBANK	1,086	1,102	1,490	1,143	1,252	1,276
Surnadal Sparebank	1,050	1,074	1,158	1,034	1,236	1,224
SØGNE OG GREIPSTAD SPAREBANK	0,817	0,861	0,966	1,005	0,936	0,902
TIME SPAREBANK	0,778	0,906	1,015	0,931	0,898	1,039
TINGVOLL SPAREBANK	0,949					
TINN SPAREBANK	1,087	1,174	1,307	1,076	1,210	1,116
TOLGA-OS SPAREBANK	1,178	1,279	1,279	1,045	1,154	1,180
TOTENS SPAREBANK	1,123	1,073	1,165	1,004	0,980	1,085

TRØGSTAD SPAREBANK	1,087	1,110	1,216	1,168	1,203	1,182
TYSNES SPAREBANK	0,937	1,024	1,042	0,921	1,029	1,017
VALLE SPAREBANK	0,774	0,964	1,013	1,060	1,017	1,156
VANG SPAREBANK	0,800	0,842	1,097	0,947		0,968
VEGÅRSHEI SPAREBANK	1,048	1,088	1,153	1,072	1,029	0,872
Vestfold Sparebank						
VESTRE SLIDRE SPAREBANK	0,991	0,966	1,059	1,050	1,074	1,024
VIK SPAREBANK	0,767	0,963	1,265	1,145	0,908	0,953
VOLDA OG ØRSTA SPAREBANK	0,981					
VOSS SPAREBANK	0,876	1,051	1,203	1,154	1,095	1,072
ØRLAND SPAREBANK	0,922	0,912	0,962	0,943	0,952	0,981
ØRSKOG SPAREBANK	1,064	1,045	1,014	1,016	0,845	0,890
ØYSTRE SLIDRE SPAREBANK	0,997	1,121	1,214	1,164		
ÅFJORD SPAREBANK	0,973	0,981	0,958	1,140	1,138	1,083
Total number of active banks	115	111	105	100	97	94

Appendix 7. MPI – varying base year

Bank name	2008	2009	2010	2011	2012	2013
AASEN SPAREBANK	0,950	1,220	1,162	0,875	0,982	1,016
ANDEBU SPAREBANK	0,820	1,071	1,109	0,912	1,032	1,146
ARENDAL OG OMEGNS SPAREKASSE	1,035	1,036	1,040	0,938	0,934	0,964
ASKIM SPAREBANK	0,889	1,038	1,060	0,984	1,045	1,134
AURLAND SPAREBANK	0,811	1,509	1,167	0,940	0,813	1,213
AURSKOG SPAREBANK	1,104	0,993	1,102	0,983	0,938	0,993
BAMBLE OG LANGESUND SPAREBANK	1,082	1,034	1,065	0,982	0,984	0,947
BERG SPAREBANK	1,290	0,918	1,044	0,895	1,122	1,037
BIRKENES SPAREBANK	0,976				1,008	1,025
BJUGN SPAREBANK	0,835	1,117	0,996	0,998	0,961	1,006
BLAKER SPAREBANK	1,142	0,936	1,072	1,075	0,981	1,002
BUD FRÆNA OG HUSTAD SPAREBANK	1,024	1,043	1,012	0,951	1,061	1,065
BØ SPAREBANK	1,201	1,066	1,080	0,817	1,013	
CULTURA SPAREBANK						
DNB NOR BANK ASA	0,933	0,793	1,025	1,041	1,022	1,096
DRANGEDAL OG TØRDAL SPAREBANK	1,233	0,910	1,018	1,095	1,055	0,886
EIDSBERG SPAREBANK	0,970	0,913	1,239	0,928	1,018	1,118
ETNE SPAREBANK	1,095	0,892	1,091	0,969	1,003	0,976
ETNEDAL SPAREBANK			1,267	1,095	0,977	0,974
EVJE OG HORNNES SPAREBANK	0,994	1,129	0,956	1,058	0,946	1,044
FANA SPAREBANK	0,936	0,920	0,959	0,951	0,986	0,980
FJALER SPAREBANK	1,014	1,334				
FLEKKEFJORD SPAREBANK	0,828	1,043	1,213	0,841	1,038	1,041
Fornebu Sparebank	0,816	1,033	1,211	1,065	0,963	1,071
GILDESKÅL SPAREBANK	0,618	0,891	1,165	0,786	1,065	1,019

GJERSTAD SPAREBANK	0,804	0,880	0,976	0,917	1,035	0,954
GRONG SPAREBANK	1,006	0,906	0,970	0,966	1,110	1,036
GRUE SPAREBANK	0,998	0,992	1,067	1,035	0,967	0,885
HALDEN SPAREBANK	0,875	1,174	0,999			
HALTDALEN SPAREBANK	1,125	0,854	1,451	1,066	1,052	0,817
HARSTAD SPAREBANK	0,999	1,071	1,173	1,009	0,953	0,938
HAUGESUND SPAREBANK	0,955	1,066	0,851	1,031	0,972	1,080
HEGRA SPAREBANK	1,164	1,058	1,145	0,946	1,043	1,165
HELGELAND SPAREBANK	1,109	1,033	1,155	0,928	0,965	1,162
HJARTDAL OG GRANSHERAD SPAREBANK	1,031	1,130	0,974	0,942	1,084	0,834
HJELMELAND SPAREBANK				1,007	1,112	1,067
HOL SPAREBANK	1,172	0,839	1,075	0,994	1,051	
HOLLA OG LUNDE SPAREBANK	1,083	1,017	0,918	0,853		
Høland & Setskog Sparebank	0,907	1,050	1,064	1,062	1,107	1,029
HØNEFOSS SPAREBANK	0,731	0,733	1,306	0,701	1,129	1,096
INDRE SOGN SPAREBANK	1,080	1,041	0,978	1,025	1,115	1,009
JERNBANEPERSONALETS SPAREBANK	1,114	0,849	1,597	1,121	1,201	0,945
KLEPP SPAREBANK	0,695	1,075	1,303	0,705	0,943	1,171
KLÆBU SPAREBANK	1,035	1,107	1,024	1,019	1,026	1,243
KRAGERØ SPAREBANK	1,071	0,901	1,122	0,859	0,965	0,900
KVINESDAL SPAREBANK	1,058	0,906	1,216			
KVINNHERAD SPAREBANK	0,884	1,192				
LARVIKBANKEN BRUNLANES SPAREBANK	0,830	0,898	1,188	0,866	0,997	1,081
LILLESANDS SPAREBANK	0,954	1,061	1,044	0,973	0,963	0,915
LILLESTRØMBANKEN LILLESTRØM SPAREBANK	0,977	0,992	1,062	0,873	0,982	1,067
LOFOTEN SPAREBANK	0,785	1,214	1,053	1,005	0,948	0,992
LOM OG SKJÅK SPAREBANK	1,063	1,005	1,200	0,866	0,961	
LUSTER SPAREBANK	0,972	1,116	1,040	0,895	1,046	0,974
MARKER SPAREBANK	1,075	1,170	1,068	0,856	1,087	1,034
MELDAL SPAREBANK	0,840	0,965	1,133	0,984	1,030	1,078
MELHUS SPAREBANK	0,983	1,031	0,988	0,929	0,938	1,330
MODUM SPAREBANK	1,050	1,183	1,108	0,788	1,077	1,118
NES PRESTEGJELDS SPAREBANK	0,988	0,968	1,028	1,013	0,947	
NESSET SPAREBANK	1,093	1,135	0,845	0,919	1,076	1,095
NØTTERØ SPAREBANK	1,041	0,947				
ODAL SPAREBANK	1,120	0,919	1,094	0,888	1,077	1,023
OFOTEN SPAREBANK	0,828	1,201	0,971	1,005	1,010	0,883
OPDALS SPAREBANK	1,035	1,003	0,956	0,980	0,998	1,017
ORKDAL SPAREBANK	0,942	1,090	1,008	0,872	1,080	1,043
RINDAL SPAREBANK	0,981	1,190	1,110	0,885	1,018	1,019
Ringerikes Sparebank	0,915	1,199				
Rygge-Vaaler Sparebank			0,952			
RØROSBANKEN RØROS SPAREBANK	1,150	0,896	1,111	1,289	0,776	0,965
SANDNES SPAREBANK		0,777	0,752	0,806	0,933	1,334
SAUDA SPAREBANK	0,981					

SELBU SPAREBANK	1,027	1,104	1,128	0,915	1,009	0,939
SELJORD SPAREBANK	1,080	1,257	0,900	1,051	0,907	
SETSKOG SPAREBANK	1,096	1,011				
SKUDENES & AAKRA SPAREBANK	0,907	1,035	1,064	0,976	1,010	1,069
Skue sparebank						
SOKNEDAL SPAREBANK	1,086	1,100	1,010	0,816	1,091	0,969
SPAREBANK 1 GRAN	0,848	1,475				
Sparebank 1 Buskerud-Vestfold		1,026	0,984	0,896	1,007	1,010
SPAREBANK 1 GUDBRANDSDAL FRON SPAREBANK	0,953	1,134	1,034	0,847	0,996	1,170
SPAREBANK 1 HALLINGDAL	0,780	1,177	1,124	0,907	1,154	1,046
Sparebank 1 Lom og Skjåk						
SPAREBANK 1 JEVNAKER LUNNER	1,005	1,090				
SpareBank 1 Kongsberg						
SpareBank 1 Moss	0,853					
SPAREBANK 1 NORD-NORGE	1,110	0,986	0,949	0,979	0,978	1,032
SpareBank 1 Nordvest	1,046	1,119	1,000	0,892	0,930	1,079
Sparebank 1 Nøtterøy-Tønsberg				0,857	1,031	1,167
Sparebank 1 Ringerike Hadeland				0,732	0,975	1,002
SpareBank 1 SMN	1,055	1,003	1,140	0,929	0,983	1,044
SPAREBANK 1 SR-BANK	0,803	1,000	1,033	1,055	0,840	1,080
Bien sparebank	0,808	0,920	0,970	1,195	1,006	0,998
Sparebank 1 Telemark	0,830	1,293	1,015	0,981	0,933	1,141
Sparebank 1 Søre Sunnmøre			0,939	0,979	0,976	1,002
Sparebank 1 Østfold Akershus					0,819	1,064
Sparebanken DIN						
SPAREBANKEN GRENLAND						
SPAREBANKEN HARDANGER	0,923	1,136	1,181			
SPAREBANKEN HEDMARK	1,093	0,998	0,952	0,996	1,049	0,985
SPAREBANKEN HEMNE	0,926	1,162	0,985	0,922	1,133	1,005
SPAREBANKEN MØRE	1,258	0,984	1,002	1,019	1,206	0,792
Sparebanken Narvik	1,102	1,032	1,024	1,001	1,151	1,075
SPAREBANKEN PLUSS	1,062	0,948	1,005	0,947	0,998	0,951
SPAREBANKEN SOGN OG FJORDANE	1,020	1,073	1,223	0,860	1,035	1,044
SPAREBANKEN SØR	1,048	0,968	1,124	0,862	0,922	1,012
SPAREBANKEN VEST	0,791	0,975	0,959	0,980	1,051	0,951
Sparebanken Øst	0,926	0,872	0,986	1,016	0,970	1,018
SPARESKILLINGSBANKEN			0,906	1,011	0,969	0,884
SPYDEBERG SPAREBANK	0,754	0,866	1,080	1,011	1,057	1,091
STADSBYGD SPAREBANK	0,870	1,136	1,108	0,953	1,013	0,971
STRØMMEN SPAREBANK					0,983	1,010
SUNNDAL SPAREBANK	1,086	1,037	1,369	0,761	1,067	0,961
Surnadal Sparebank	1,050	1,065	1,091	0,915	1,149	1,003
SØGNE OG GREIPSTAD SPAREBANK	0,817	1,075	1,117	1,033	0,929	1,001
TIME SPAREBANK	0,778	1,236	1,238	0,882	0,937	1,073

TINGVOLL SPAREBANK	0,949					
TINN SPAREBANK	1,087	1,079	1,159	0,824	1,075	0,914
TOLGA-OS SPAREBANK	1,178	1,132	0,983	0,860	1,099	1,030
TOTENS SPAREBANK	1,123	1,020	1,094	0,892	0,953	1,155
TRØGSTAD SPAREBANK	1,087	1,053	1,058	0,989	0,992	0,990
TYSNES SPAREBANK	0,937	1,119	1,053	0,899	1,111	1,048
VALLE SPAREBANK	0,774	1,172	1,016	1,079	0,930	1,120
VANG SPAREBANK	0,800	1,044	1,348	0,819		
VEGÅRSHEI SPAREBANK	1,048	1,068	1,046	0,937	0,940	0,882
Vestfold Sparebank						
VESTRE SLIDRE SPAREBANK	0,991	1,032	1,034	1,046	0,946	0,981
VIK SPAREBANK	0,767	1,163	1,348	0,887	0,784	1,063
VOLDA OG ØRSTA SPAREBANK	0,981					
VOSS SPAREBANK	0,876	1,170	1,167	0,905	0,958	0,988
ØRLAND SPAREBANK	0,922	1,005	1,043	0,977	0,964	1,027
ØRSKOG SPAREBANK	1,064	1,061	0,999	0,993	0,831	1,024
ØYSTRE SLIDRE SPAREBANK	0,997	1,158	1,108	1,101		
ÅFJORD SPAREBANK	0,973	1,011	0,967	1,154	1,039	0,910

Appendix 8. PEC – 2007 base year

Bank name	2008	2009	2010	2011	2012	2013
AASEN SPAREBANK	1,045	1,090	1,163	1,108	1,106	1,104
ANDEBU SPAREBANK	1,003	0,957	0,987	0,945	0,971	1,072
ARENDAL OG OMEGNS SPAREKASSE	0,997	1,000	1,000	0,995	0,952	0,943
ASKIM SPAREBANK	1,022	0,992	0,998	0,995	1,023	1,104
AURLAND SPAREBANK	0,977	1,093	1,093	1,093	1,003	1,093
AURSKOG SPAREBANK	1,053	1,043	1,083	1,091	1,040	1,055
BAMBLE OG LANGESUND SPAREBANK	1,120	1,070	1,080	1,092	1,075	1,048
BERG SPAREBANK	1,194	1,099	1,091	1,046	1,126	1,149
BIRKENES SPAREBANK	1,055			1,013	1,012	1,034
BJUGN SPAREBANK	1,000	1,000	1,000	1,000	1,000	1,000
BLAKER SPAREBANK	1,138	1,096	1,126	1,190	1,187	1,178
BUD FRÆNA OG HUSTAD SPAREBANK	1,104	1,021	1,014	1,007	1,045	1,068
BØ SPAREBANK	1,148	1,139	1,157	1,064	1,080	
CULTURA SPAREBANK						
DNB NOR BANK ASA	0,925	0,841	0,843	0,877	0,899	0,940
DRANGEDAL OG TØRDAL SPAREBANK	1,180	1,096	1,079	1,113	1,155	1,093
EIDSBERG SPAREBANK	1,080	0,957	1,049	1,016	1,041	1,112
ETNE SPAREBANK	1,134	1,018	1,050	1,042	1,059	1,040
ETNEDAL SPAREBANK						
EVJE OG HORNNES SPAREBANK	1,066	1,085	1,043	1,093	1,067	1,081
FANA SPAREBANK	0,972	0,910	0,874	0,870	0,868	0,859
FJALER SPAREBANK	1,088	1,151				

FLEKKEFJORD SPAREBANK	1,000	0,953	1,000	0,969	0,973	1,000
Fornebu Sparebank	1,000	0,898	1,000	1,000	1,000	1,000
GILDESKÅL SPAREBANK	0,970	0,849	0,902	0,811	0,852	0,860
GJERSTAD SPAREBANK	0,934	0,880	0,861	0,815	0,836	0,819
GRONG SPAREBANK	1,135	1,040	1,003	0,978	1,051	1,069
GRUE SPAREBANK	1,105	0,998	0,989	1,026	1,017	0,959
HALDEN SPAREBANK	1,028	1,012	0,970			
HALTDALEN SPAREBANK	1,112	1,005	1,179	1,179	1,179	1,141
HARSTAD SPAREBANK	1,082	1,048	1,109	1,118	1,093	1,061
HAUGESUND SPAREBANK	1,011	1,011	0,915	0,941	0,933	0,975
HEGRA SPAREBANK	1,179	1,160	1,231	1,212	1,249	1,337
HELGELAND SPAREBANK	1,128	1,072	1,138	1,118	1,080	1,187
HJARTDAL OG GRANSHERAD SPAREBANK	1,082	1,077	1,020	1,015	1,070	0,980
HJELMELAND SPAREBANK			1,010	1,025	1,080	1,121
HOL SPAREBANK	1,130	1,000	1,007	1,026	1,052	
HOLLA OG LUNDE SPAREBANK	1,099	1,084	1,022	0,961		
Høland & Setskog Sparebank	1,055	1,008	1,023	1,074	1,124	1,146
HØNEFOSS SPAREBANK	1,000	0,824	1,000	0,837	0,908	0,953
INDRE SOGN SPAREBANK	1,124	1,058	1,006	1,059	1,116	1,121
JERNBANEPERSONALETS SPAREBANK	1,148	0,913	1,151	1,151	1,151	1,151
KLEPP SPAREBANK	0,873	0,850	0,947	0,822	0,791	0,859
KLÆBU SPAREBANK	1,092	1,087	1,064	1,091	1,122	1,263
KRAGERØ SPAREBANK	1,063	0,992	1,036	0,965	0,962	0,909
KVINESDAL SPAREBANK	1,099	1,012	1,105			
KVINNHERAD SPAREBANK	1,029	1,030				
LARVIKBANKEN BRUNLANES SPAREBANK	0,989	0,907	0,965	0,920	0,919	0,963
LILLESANDS SPAREBANK	1,000	0,964	0,958	0,986	0,954	0,921
LILLESTRØMBANKEN LILLESTRØM SPAREBANK	1,010	0,983	1,005	0,955	0,960	0,986
LOFOTEN SPAREBANK	1,000	1,000	0,986	1,000	1,000	1,000
LOM OG SKJÅK SPAREBANK	1,121	1,072	1,149	1,086	1,072	
LUSTER SPAREBANK	1,039	1,037	0,992	0,982	1,006	0,997
MARKER SPAREBANK	1,110	1,125	1,130	1,067	1,122	1,129
MELDAL SPAREBANK	1,007	0,927	0,971	0,982	1,004	1,052
MELHUS SPAREBANK	1,018	0,991	0,973	0,956	0,924	1,073
MODUM SPAREBANK	1,115	1,094	1,121	1,029	1,074	1,143
NES PRESTEGJELDS SPAREBANK	1,031	1,037	1,033	1,045	1,006	
NESSET SPAREBANK	1,108	1,152	1,019	0,992	1,044	1,090
NØTTERØ SPAREBANK	1,070	0,994				
ODAL SPAREBANK	1,153	1,059	1,065	1,026	1,078	1,092
OFOTEN SPAREBANK	1,059	1,042	0,999	1,019	1,046	0,977
OPDALS SPAREBANK	1,103	1,056	1,013	1,023	1,019	1,028
ORKDAL SPAREBANK	1,045	1,008	0,998	0,948	0,986	1,009
RINDAL SPAREBANK	1,063	1,072	1,115	1,068	1,088	1,104
Ringerikes Sparebank	1,055	1,001				
Rygge-Vaaler Sparebank						

RØROSBANKEN RØROS SPAREBANK	1,151	1,062	1,099	1,267	1,108	1,080
SANDNES SPAREBANK						
SAUDA SPAREBANK	1,022					
SELBU SPAREBANK	1,101	1,083	1,125	1,085	1,100	1,065
SELJORD SPAREBANK	1,109	1,159	1,063	1,102	1,062	
SETSKOG SPAREBANK	1,137	1,072				
SKUDENES & AAKRA SPAREBANK	1,000	0,901	0,929	0,934	0,943	0,980
Skue sparebank						
SOKNEDAL SPAREBANK	1,126	1,127	1,116	1,026	1,092	1,078
SPAREBANK 1 GRAN	1,086	1,086				
Sparebank 1 Buskerud-Vestfold						
SPAREBANK 1 GUDBRANDSDAL FRON SPAREBANK	1,073	1,062	1,044	0,969	0,990	1,074
SPAREBANK 1 HALLINGDAL	0,966	0,937	0,961	0,946	1,008	1,068
Sparebank 1 Lom og Skjåk						
SPAREBANK 1 JEVNAKER LUNNER	1,108	1,020				
SpareBank 1 Kongsberg						
SpareBank 1 Moss	0,989					
SPAREBANK 1 NORD-NORGE	1,110	1,026	0,978	0,986	0,984	0,992
SpareBank 1 Nordvest	1,135	1,092	1,068	1,029	1,000	1,026
Sparebank 1 Nøtterøy-Tønsberg						
Sparebank 1 Ringerike Hadeland						
SpareBank 1 SMN	1,112	1,030	1,083	1,064	1,050	1,073
SPAREBANK 1 SR-BANK	0,892	0,862	0,861	0,904	0,814	0,851
Bien sparebank	1,002	0,883	0,856	0,948	0,961	0,966
Sparebank 1 Telemark	0,989	1,023	0,991	1,001	0,970	1,051
Sparebank 1 Søre Sunnmøre						
Sparebank 1 Østfold Akershus						
Sparebanken DIN						
SPAREBANKEN GRENLAND						
SPAREBANKEN HARDANGER	1,074	1,017	1,058			
SPAREBANKEN HEDMARK	1,097	1,030	0,982	1,002	1,050	1,032
SPAREBANKEN HEMNE	1,006	1,010	0,970	0,947	1,017	1,011
SPAREBANKEN MØRE	1,178	1,132	1,118	1,152	1,238	1,126
Sparebanken Narvik	1,171	1,112	1,106	1,127	1,202	1,251
SPAREBANKEN PLUSS	1,000	1,000	1,000	1,000	1,000	1,000
SPAREBANKEN SOGN OG FJORDANE	1,128	1,084	1,172	1,113	1,107	1,161
SPAREBANKEN SØR	1,075	1,029	1,080	1,023	0,968	0,981
SPAREBANKEN VEST	0,906	0,865	0,836	0,843	0,865	0,845
Sparebanken Øst	0,936	0,900	0,887	0,912	0,887	0,901
SPARESKILLINGSBANKEN						
SPYDEBERG SPAREBANK	0,980	0,818	0,848	0,865	0,901	0,953
STADSBYGD SPAREBANK	0,993	1,016	1,059	1,051	1,064	1,040
STRØMMEN SPAREBANK	1,037				0,965	1,025
SUNNDAL SPAREBANK	1,113	1,058	1,202	1,074	1,109	1,107
Surnadal Sparebank	1,107	1,045	1,062	1,034	1,112	1,108

SØGNE OG GREIPSTAD SPAREBANK	0,956	0,889	0,925	0,966	0,933	0,938
TIME SPAREBANK	0,915	0,910	1,000	0,963	0,945	0,998
TINGVOLL SPAREBANK	1,000					
TINN SPAREBANK	1,122	1,072	1,119	1,030	1,083	1,032
TOLGA-OS SPAREBANK	1,165	1,173	1,137	1,071	1,117	1,141
TOTENS SPAREBANK	1,088	1,052	1,085	1,044	1,015	1,089
TRØGSTAD SPAREBANK	1,110	1,070	1,089	1,097	1,108	1,100
TYSNES SPAREBANK	1,000	1,000	0,975	0,954	1,000	1,000
VALLE SPAREBANK	0,952	0,985	0,963	1,004	0,994	1,046
VANG SPAREBANK	0,990	0,910	1,000	0,926	0,000	0,968
VEGÅRSHEI SPAREBANK	1,089	1,095	1,104	1,071	1,049	0,986
Vestfold Sparebank						
VESTRE SLIDRE SPAREBANK	1,000	1,000	1,000	1,000	1,000	1,000
VIK SPAREBANK	0,953	0,950	1,027	0,975	0,888	0,928
VOLDA OG ØRSTA SPAREBANK	1,054					
VOSS SPAREBANK	1,000	1,000	1,000	1,000	1,000	1,000
ØRLAND SPAREBANK	1,013	0,984	0,997	1,002	0,992	1,003
ØRSKOG SPAREBANK	1,043	1,043	1,028	1,043	0,934	0,961
ØYSTRE SLIDRE SPAREBANK	1,050	1,050	1,050	1,050		
ÅFJORD SPAREBANK	1,059	1,014	0,979	1,054	1,090	1,045
Total number of active banks	115	109	103	101	100	95

Appendix 9. PEC – varying base year

Bank name	2008	2009	2010	2011	2012	2013
AASEN SPAREBANK	1,045	1,043	1,067	0,952	0,998	0,999
ANDEBU SPAREBANK	1,003	0,955	1,031	0,957	1,028	1,104
ARENDAL OG OMEGNS SPAREKASSE	0,997	1,003	1,000	0,995	0,957	0,991
ASKIM SPAREBANK	1,022	0,970	1,006	0,997	1,029	1,079
AURLAND SPAREBANK	0,977	1,119	1,000	1,000	0,917	1,090
AURSKOG SPAREBANK	1,053	0,991	1,038	1,008	0,953	1,014
BAMBLE OG LANGESUND SPAREBANK	1,120	0,955	1,010	1,012	0,984	0,975
BERG SPAREBANK	1,194	0,921	0,993	0,958	1,076	1,021
BIRKENES SPAREBANK	1,056				1,007	1,016
BJUGN SPAREBANK	1,000	1,000	1,000	1,000	1,000	1,000
BLAKER SPAREBANK	1,138	0,963	1,027	1,056	0,998	0,992
BUD FRÆNA OG HUSTAD SPAREBANK	1,104	0,924	0,994	0,993	1,037	1,022
BØ SPAREBANK	1,148	0,992	1,016	0,920	1,015	
CULTURA SPAREBANK						
DNB NOR BANK ASA	0,925	0,910	1,002	1,040	1,025	1,045
DRANGEDAL OG TØRDAL SPAREBANK	1,180	0,929	0,985	1,031	1,038	0,946
EIDSBERG SPAREBANK	1,080	0,886	1,097	0,968	1,025	1,068
ETNE SPAREBANK	1,134	0,898	1,031	0,992	1,017	0,981
ETNEDAL SPAREBANK			1,085	1,063	1,004	1,000

EVJE OG HORNNES SPAREBANK	1,066	1,018	0,961	1,048	0,976	1,013
FANA SPAREBANK	0,972	0,937	0,960	0,995	0,998	0,991
FJALER SPAREBANK	1,088	1,058				
FLEKKEFJORD SPAREBANK	1,000	0,953	1,049	0,969	1,004	1,028
Fornebu Sparebank	1,000	0,898	1,114	1,000	1,000	1,000
GILDESKÅL SPAREBANK	0,970	0,875	1,063	0,899	1,050	1,010
GJERSTAD SPAREBANK	0,934	0,942	0,978	0,947	1,025	0,979
GRONG SPAREBANK	1,135	0,917	0,965	0,975	1,074	1,017
GRUE SPAREBANK	1,105	0,903	0,991	1,038	0,991	0,943
HALDEN SPAREBANK	1,028	0,984	0,959			
HALTDALEN SPAREBANK	1,112	0,904	1,173	1,000	1,000	0,968
HARSTAD SPAREBANK	1,082	0,969	1,058	1,009	0,978	0,971
HAUGESUND SPAREBANK	1,011	0,999	0,905	1,028	0,991	1,046
HEGRA SPAREBANK	1,179	0,985	1,060	0,985	1,031	1,070
HELGELAND SPAREBANK	1,128	0,951	1,061	0,982	0,966	1,099
HJARTDAL OG GRANSHERAD SPAREBANK	1,082	0,995	0,947	0,996	1,054	0,916
HJELMELAND SPAREBANK				1,015	1,053	1,038
HOL SPAREBANK	1,130	0,885	1,007	1,019	1,025	
HOLLA OG LUNDE SPAREBANK	1,099	0,986	0,943	0,940		
Høland & Setskog Sparebank	1,055	0,955	1,015	1,050	1,047	1,020
HØNEFOSS SPAREBANK	1,000	0,824	1,213	0,837	1,085	1,050
INDRE SOGN SPAREBANK	1,124	0,941	0,951	1,053	1,054	1,005
JERNBANEPERSONALETS SPAREBANK	1,148	0,795	1,261	1,000	1,000	1,000
KLEPP SPAREBANK	0,873	0,974	1,114	0,869	0,961	1,087
KLÆBU SPAREBANK	1,092	0,995	0,978	1,025	1,028	1,126
KRAGERØ SPAREBANK	1,063	0,933	1,044	0,931	0,997	0,945
KVINESDAL SPAREBANK	1,099	0,921	1,091			
KVINNHERAD SPAREBANK	1,029	1,001				
LARVIKBANKEN BRUNLANES SPAREBANK	0,989	0,916	1,065	0,953	0,999	1,047
LILLESANDS SPAREBANK	1,000	0,964	0,994	1,030	0,967	0,965
LILLESTRØMBANKEN LILLESTRØM SPAREBANK	1,010	0,974	1,022	0,951	1,005	1,028
LOFOTEN SPAREBANK	1,000	1,000	0,986	1,014	1,000	1,000
LOM OG SKJÅK SPAREBANK	1,121	0,956	1,071	0,945	0,988	
LUSTER SPAREBANK	1,039	0,998	0,956	0,990	1,024	0,991
MARKER SPAREBANK	1,110	1,013	1,005	0,944	1,052	1,006
MELDAL SPAREBANK	1,007	0,921	1,047	1,011	1,023	1,048
MELHUS SPAREBANK	1,018	0,973	0,982	0,982	0,967	1,162
MODUM SPAREBANK	1,115	0,981	1,024	0,918	1,044	1,064
NES PRESTEGJELDS SPAREBANK	1,031	1,006	0,997	1,011	0,963	
NESSET SPAREBANK	1,108	1,039	0,884	0,974	1,052	1,044
NØTTERØ SPAREBANK	1,070	0,929				
ODAL SPAREBANK	1,153	0,919	1,006	0,963	1,050	1,014
OFOTEN SPAREBANK	1,059	0,984	0,958	1,020	1,027	0,934
OPDALS SPAREBANK	1,103	0,958	0,959	1,010	0,996	1,010
ORKDAL SPAREBANK	1,045	0,965	0,990	0,950	1,040	1,023

RINDAL SPAREBANK	1,063	1,008	1,040	0,958	1,019	1,015
Ringerikes Sparebank	1,055	0,949				
Rygge-Vaaler Sparebank			0,963			
RØROSBANKEN RØROS SPAREBANK	1,151	0,923	1,034	1,153	0,875	0,974
SANDNES SPAREBANK		1,000	0,922	0,917	0,946	1,192
SAUDA SPAREBANK	1,022					
SELBU SPAREBANK	1,101	0,984	1,039	0,965	1,014	0,968
SELJORD SPAREBANK	1,109	1,045	0,917	1,036	0,964	
SETSKOG SPAREBANK	1,137	0,943				
SKUDENES & AAKRA SPAREBANK	1,000	0,901	1,031	1,005	1,010	1,039
Skue sparebank						
SOKNEDAL SPAREBANK	1,126	1,000	0,991	0,919	1,064	0,987
SPAREBANK 1 GRAN	1,086	1,000				
Sparebank 1 Buskerud-Vestfold		0,958	0,975	0,965	1,006	1,003
SPAREBANK 1 GUDBRANDSDAL FRON SPAREBANK	1,073	0,990	0,983	0,928	1,021	1,085
SPAREBANK 1 HALLINGDAL	0,966	0,969	1,026	0,984	1,066	1,059
Sparebank 1 Lom og Skjåk						
SPAREBANK 1 JEVNAKER LUNNER	1,108	0,920				
SpareBank 1 Kongsberg						
SpareBank 1 Moss	0,989					
SPAREBANK 1 NORD-NORGE	1,110	0,924	0,953	1,009	0,998	1,007
SpareBank 1 Nordvest	1,135	0,962	0,978	0,963	0,973	1,026
Sparebank 1 Nøtterøy-Tønsberg				0,948	1,016	1,093
Sparebank 1 Ringerike Hadeland				0,923	0,986	1,015
SpareBank 1 SMN	1,112	0,927	1,051	0,982	0,987	1,022
SPAREBANK 1 SR-BANK	0,892	0,966	0,999	1,050	0,901	1,046
Bien sparebank	1,002	0,881	0,969	1,107	1,014	1,006
Sparebank 1 Telemark	0,989	1,035	0,968	1,010	0,969	1,084
Sparebank 1 Søre Sunnmøre			0,942	1,016	0,989	1,001
Sparebank 1 Østfold Akershus					0,899	1,019
Sparebanken DIN						
SPAREBANKEN GRENLAND						
SPAREBANKEN HARDANGER	1,074	0,946	1,041			
SPAREBANKEN HEDMARK	1,097	0,939	0,953	1,021	1,048	0,983
SPAREBANKEN HEMNE	1,006	1,003	0,961	0,977	1,073	0,994
SPAREBANKEN MØRE	1,178	0,961	0,988	1,030	1,075	0,910
Sparebanken Narvik	1,171	0,949	0,995	1,019	1,067	1,040
SPAREBANKEN PLUSS	1,000	1,000	1,000	1,000	1,000	1,000
SPAREBANKEN SOGN OG FJORDANE	1,128	0,961	1,081	0,950	0,995	1,049
SPAREBANKEN SØR	1,075	0,958	1,049	0,947	0,946	1,013
SPAREBANKEN VEST	0,906	0,954	0,966	1,009	1,025	0,977
Sparebanken Øst	0,936	0,962	0,986	1,028	0,973	1,015
SPARESKILLINGSBANKEN			1,000	1,000	1,000	1,000
SPYDEBERG SPAREBANK	0,980	0,835	1,036	1,021	1,041	1,058

STADSBYGD SPAREBANK	0,993	1,023	1,042	0,993	1,012	0,978
STRØMMEN SPAREBANK					0,999	1,008
SUNNDAL SPAREBANK	1,113	0,950	1,136	0,893	1,033	0,998
Surnadal Sparebank	1,107	0,944	1,016	0,974	1,076	0,996
SØGNE OG GREIPSTAD SPAREBANK	0,956	0,930	1,040	1,044	0,966	1,006
TIME SPAREBANK	0,915	0,995	1,099	0,963	0,981	1,056
TINGVOLL SPAREBANK	1,000					
TINN SPAREBANK	1,122	0,955	1,043	0,921	1,052	0,952
TOLGA-OS SPAREBANK	1,165	1,007	0,969	0,943	1,043	1,021
TOTENS SPAREBANK	1,088	0,967	1,032	0,962	0,972	1,073
TRØGSTAD SPAREBANK	1,110	0,964	1,018	1,008	1,010	0,993
TYSNES SPAREBANK	1,000	1,000	0,975	0,978	1,049	1,000
VALLE SPAREBANK	0,952	1,034	0,978	1,042	0,990	1,052
VANG SPAREBANK	0,990	0,919	1,098	0,926		
VEGÅRSHEI SPAREBANK	1,089	1,005	1,009	0,970	0,979	0,940
Vestfold Sparebank						
VESTRE SLIDRE SPAREBANK	1,000	1,000	1,000	1,000	1,000	1,000
VIK SPAREBANK	0,953	0,997	1,080	0,950	0,910	1,046
VOLDA OG ØRSTA SPAREBANK	1,054					
VOSS SPAREBANK	1,000	1,000	1,000	1,000	1,000	1,000
ØRLAND SPAREBANK	1,013	0,972	1,013	1,005	0,990	1,010
ØRSKOG SPAREBANK	1,043	1,000	0,986	1,014	0,896	1,028
ØYSTRE SLIDRE SPAREBANK	1,050	1,000	1,000	1,000		
ÅFJORD SPAREBANK	1,059	0,957	0,966	1,077	1,034	0,959

Appendix 10. TC – 2007 base year

Bank name	2008	2009	2010	2011	2012	2013
AASEN SPAREBANK	1,091	1,061	1,085	1,125	1,045	0,910
ANDEBU SPAREBANK	1,066	1,048	1,007	1,003	0,867	0,818
ARENDAL OG OMEGNS SPAREKASSE	0,859	0,884	0,900	0,912	0,892	1,039
ASKIM SPAREBANK	1,115	1,056	1,027	1,030	0,948	0,870
AURLAND SPAREBANK	1,245	1,149	1,324	1,361	1,197	0,830
AURSKOG SPAREBANK	0,889	0,923	0,950	0,965	0,918	1,049
BAMBLE OG LANGESUND SPAREBANK	1,010	1,022	1,003	1,082	1,007	0,966
BERG SPAREBANK	1,140	1,070	1,027	1,123	1,046	1,081
BIRKENES SPAREBANK	0,994			1,035	0,977	0,922
BJUGN SPAREBANK	0,874	0,927	0,924	0,908	0,845	0,835
BLAKER SPAREBANK	1,119	1,094	1,083	1,061	1,007	1,003
BUD FRÆNA OG HUSTAD SPAREBANK	1,106	1,040	1,007	1,012	1,019	0,927
BØ SPAREBANK		1,065	1,002	1,124	1,065	1,046
CULTURA SPAREBANK						
DNB NOR BANK ASA	0,876	0,756	0,743	0,721	0,761	1,009
DRANGEDAL OG TØRDAL SPAREBANK	1,059	1,129	1,155	1,103	1,039	1,045

EIDSBERG SPAREBANK	1,126	1,086	1,067	1,103	0,944	0,898
ETNE SPAREBANK	1,041	1,085	1,047	1,043	0,966	0,966
ETNEDAL SPAREBANK						
EVJE OG HORNNES SPAREBANK	1,063	1,032	1,025	1,047	1,012	0,933
FANA SPAREBANK	0,869	0,918	0,912	0,928	0,855	0,963
FJALER SPAREBANK					1,129	0,932
FLEKKEFJORD SPAREBANK	0,914	0,944	0,897	0,964	0,888	0,828
Fornebu Sparebank	0,917	0,962	0,824	0,786	0,781	0,816
GILDESKÅL SPAREBANK	0,875	0,875	0,814	0,802	0,669	0,638
GJERSTAD SPAREBANK	0,791	0,808	0,749	0,764	0,797	0,861
GRONG SPAREBANK	1,031	1,010	0,946	0,971	0,946	0,887
GRUE SPAREBANK	1,025	1,052	1,078	1,100	1,044	0,903
HALDEN SPAREBANK				1,093	1,049	0,850
HALTDALEN SPAREBANK	1,112	1,321	1,233	1,325	0,974	1,011
HARSTAD SPAREBANK	1,106	1,129	1,151	1,141	1,000	0,923
HAUGESUND SPAREBANK	0,928	0,964	0,957	0,947	0,934	0,944
HEGRA SPAREBANK	1,341	1,216	1,213	1,232	1,137	0,988
HELGELAND SPAREBANK	1,075	1,006	0,998	1,041	0,980	0,983
HJARTDAL OG GRANSHERAD SPAREBANK	0,941	1,149	1,068	1,083	1,054	0,953
HJELMELAND SPAREBANK	1,030	1,040	0,895	0,878		
HOL SPAREBANK		1,092	1,023	1,036	0,940	1,037
HOLLA OG LUNDE SPAREBANK			0,878	0,942	0,961	0,985
Høland & Setskog Sparebank	1,080	1,035	0,984	1,009	0,935	0,860
HØNEFOSS SPAREBANK	0,627	0,634	0,521	0,579	0,549	0,731
INDRE SOGN SPAREBANK	1,100	1,085	1,048	1,088	1,004	0,961
JERNBANEPERSONALETS SPAREBANK	1,477	1,619	1,394	1,318	1,006	0,970
KLEPP SPAREBANK	0,849	0,752	0,758	0,882	0,833	0,796
KLÆBU SPAREBANK	1,255	1,108	1,109	1,117	1,037	0,948
KRAGERØ SPAREBANK	0,913	0,955	0,957	1,029	0,921	1,008
KVINESDAL SPAREBANK				1,054	0,941	0,963
KVINNHERAD SPAREBANK					1,054	0,859
LARVIKBANKEN BRUNLANES SPAREBANK	0,980	0,923	0,941	1,010	0,860	0,839
LILLESANDS SPAREBANK	0,894	0,968	1,004	1,017	0,984	0,954
LILLESTRØMBANKEN LILLESTRØM SPAREBANK	0,961	0,803	0,784	0,818	0,865	0,968
LOFOTEN SPAREBANK	1,050	1,071	1,136	1,149	1,034	0,785
LOM OG SKJÅK SPAREBANK		1,044	1,015	1,170	0,988	0,949
LUSTER SPAREBANK	1,013	1,081	1,050	1,129	1,060	0,935
MARKER SPAREBANK	1,119	1,107	1,032	1,152	1,078	0,969
MELDAL SPAREBANK	1,053	0,998	0,952	0,970	0,900	0,834
MELHUS SPAREBANK	1,049	0,901	0,963	0,992	0,955	0,965
MODUM SPAREBANK	1,176	1,088	1,043	1,198	1,067	0,942
NES PRESTEGJELDS SPAREBANK		0,990	0,984	0,977	0,933	0,959
NESSET SPAREBANK	1,021	1,054	0,994	1,008	0,989	0,986
NØTTERØ SPAREBANK					0,958	0,973
ODAL SPAREBANK	1,086	1,094	1,031	1,071	0,962	0,972

OFOTEN SPAREBANK	0,991	1,027	1,063	1,039	1,014	0,782
OPDALS SPAREBANK	0,995	0,956	0,936	0,989	0,964	0,939
ORKDAL SPAREBANK	0,966	0,980	0,913	1,009	0,968	0,902
RINDAL SPAREBANK	1,153	1,114	1,059	1,114	1,065	0,923
Ringerikes Sparebank					1,099	0,867
Rygge-Vaaler Sparebank						
RØROSBANKEN RØROS SPAREBANK	1,059	1,096	1,163	1,062	0,951	0,999
SANDNES SPAREBANK						
SAUDA SPAREBANK						0,959
SELBU SPAREBANK	1,087	1,140	1,100	1,142	1,049	0,933
SELJORD SPAREBANK		1,052	1,060	1,126	1,119	0,973
SETSKOG SPAREBANK					1,026	0,964
SKUDENES & AAKRA SPAREBANK	0,987	0,918	0,941	0,956	0,997	0,907
Skue sparebank						
SOKNEDAL SPAREBANK	1,117	1,097	1,012	1,115	1,064	0,964
SPAREBANK 1 GRAN					1,200	0,780
Sparebank 1 Buskerud-Vestfold						
SPAREBANK 1 GUDBRANDSDAL FRON SPAREBANK	1,130	1,021	0,992	1,141	1,023	0,888
SPAREBANK 1 HALLINGDAL	1,150	1,124	1,047	1,085	1,003	0,807
Sparebank 1 Lom og Skjåk						
SPAREBANK 1 JEVNAKER LUNNER					1,047	0,907
SpareBank 1 Kongsberg						
SpareBank 1 Moss						0,863
SPAREBANK 1 NORD-NORGE	0,969	0,954	0,934	0,997	0,977	1,000
SpareBank 1 Nordvest	1,024	0,969	0,981	1,063	1,053	0,921
Sparebank 1 Nøtterøy-Tønsberg						
Sparebank 1 Ringerike Hadeland						
SpareBank 1 SMN	1,031	1,018	1,004	1,075	0,974	0,949
SPAREBANK 1 SR-BANK	0,808	0,762	0,835	0,867	0,814	0,900
Bien sparebank	1,013	1,028	1,036	0,919	0,872	0,807
Sparebank 1 Telemark	1,089	1,029	1,043	1,073	1,078	0,839
Sparebank 1 Søre Sunnmøre						
Sparebank 1 Østfold Akershus						
Sparebanken DIN						
SPAREBANKEN GRENLAND						
SPAREBANKEN HARDANGER				1,215	1,053	0,859
SPAREBANKEN HEDMARK	0,996	0,997	0,978	1,010	0,974	0,997
SPAREBANKEN HEMNE	0,969	1,004	0,976	1,045	0,998	0,920
SPAREBANKEN MØRE	1,015	1,109	0,998	0,995	0,988	1,068
Sparebanken Narvik	1,166	1,103	1,077	1,081	1,064	0,941
SPAREBANKEN PLUSS	0,888	0,924	0,889	0,950	0,947	1,062
SPAREBANKEN SOGN OG FJORDANE	1,045	1,010	0,980	1,109	0,989	0,904
SPAREBANKEN SØR	0,911	0,913	0,930	1,019	0,953	0,976
SPAREBANKEN VEST	0,812	0,810	0,838	0,809	0,841	0,873
Sparebanken Øst	0,777	0,725	0,765	0,741	0,817	0,989

SPARESKILLINGSBANKEN						
SPYDEBERG SPAREBANK	0,927	0,936	0,879	0,852	0,750	0,769
STADSBYGD SPAREBANK	1,025	0,993	1,007	1,031	0,972	0,877
STRØMMEN SPAREBANK				1,090	1,010	0,928
SUNNDAL SPAREBANK	1,153	1,129	1,064	1,239	1,042	0,976
Surnadal Sparebank	1,105	1,111	1,000	1,091	1,028	0,948
SØGNE OG GREIPSTAD SPAREBANK	0,962	1,003	1,041	1,045	0,968	0,855
TIME SPAREBANK	1,042	0,950	0,967	1,015	0,995	0,850
TINGVOLL SPAREBANK						0,949
TINN SPAREBANK	1,081	1,117	1,045	1,168	1,095	0,969
TOLGA-OS SPAREBANK	1,035	1,033	0,975	1,126	1,090	1,011
TOTENS SPAREBANK	0,997	0,965	0,962	1,074	1,020	1,033
TRØGSTAD SPAREBANK	1,074	1,086	1,064	1,117	1,038	0,979
TYSNES SPAREBANK	1,017	1,029	0,966	1,068	1,024	0,937
VALLE SPAREBANK	1,106	1,023	1,056	1,051	0,979	0,813
VANG SPAREBANK	1,000		1,022	1,097	0,925	0,808
VEGÅRSHEI SPAREBANK	0,884	0,981	1,001	1,044	0,994	0,963
Vestfold Sparebank						
VESTRE SLIDRE SPAREBANK	1,024	1,074	1,050	1,059	0,966	0,991
VIK SPAREBANK	1,026	1,022	1,174	1,232	1,013	0,804
VOLDA OG ØRSTA SPAREBANK						0,930
VOSS SPAREBANK	1,072	1,095	1,154	1,203	1,051	0,876
ØRLAND SPAREBANK	0,979	0,959	0,941	0,965	0,927	0,910
ØRSKOG SPAREBANK	0,926	0,905	0,975	0,987	1,002	1,021
ØYSTRE SLIDRE SPAREBANK			1,109	1,157	1,068	0,950
ÅFJORD SPAREBANK	1,037	1,044	1,081	0,978	0,968	0,918
Total number of active banks	93	97	101	105	111	115

Appendix 11. TC – varying base year

Bank name	2008	2009	2010	2011	2012	2013
AASEN SPAREBANK	0,910	1,169	1,089	0,918	0,984	1,017
ANDEBU SPAREBANK	0,818	1,122	1,076	0,953	1,004	1,038
ARENDAL OG OMEGNS SPAREKASSE	1,039	1,032	1,040	0,943	0,976	0,973
ASKIM SPAREBANK	0,870	1,070	1,053	0,987	1,015	1,051
AURLAND SPAREBANK	0,830	1,349	1,167	0,940	0,886	1,112
AURSKOG SPAREBANK	1,049	1,002	1,062	0,975	0,985	0,979
BAMBLE OG LANGESUND SPAREBANK	0,966	1,082	1,054	0,971	0,999	0,971
BERG SPAREBANK	1,081	0,997	1,052	0,934	1,042	1,016
BIRKENES SPAREBANK	0,922				0,999	1,007
BJUGN SPAREBANK	0,835	1,117	0,996	0,998	0,961	1,006
BLAKER SPAREBANK	1,003	0,972	1,044	1,017	0,983	1,010
BUD FRÆNA OG HUSTAD SPAREBANK	0,927	1,129	1,018	0,958	1,022	1,041
BØ SPAREBANK	1,046	1,075	1,063	0,888	0,998	

CULTURA SPAREBANK						
DNB NOR BANK ASA	1,009	0,872	1,023	1,000	0,997	1,049
DRANGEDAL OG TØRDAL SPAREBANK	1,045	0,979	1,034	1,063	1,016	0,936
EIDSBERG SPAREBANK	0,898	1,030	1,129	0,959	0,994	1,047
ETNE SPAREBANK	0,966	0,993	1,059	0,976	0,986	0,995
ETNEDAL SPAREBANK			1,168	1,030	0,973	0,974
EVJE OG HORNNES SPAREBANK	0,933	1,109	0,994	1,009	0,969	1,031
FANA SPAREBANK	0,963	0,982	0,999	0,956	0,988	0,990
FJALER SPAREBANK	0,932	1,262				
FLEKKEFJORD SPAREBANK	0,828	1,094	1,156	0,868	1,034	1,013
Fornebu Sparebank	0,816	1,151	1,087	1,065	0,963	1,071
GILDESKÅL SPAREBANK	0,638	1,018	1,096	0,875	1,014	1,009
GJERSTAD SPAREBANK	0,861	0,933	0,998	0,969	1,010	0,974
GRONG SPAREBANK	0,887	0,989	1,005	0,991	1,033	1,018
GRUE SPAREBANK	0,903	1,099	1,076	0,997	0,975	0,939
HALDEN SPAREBANK	0,850	1,193	1,042			
HALTDALEN SPAREBANK	1,011	0,944	1,237	1,066	1,052	0,844
HARSTAD SPAREBANK	0,923	1,106	1,109	1,001	0,974	0,966
HAUGESUND SPAREBANK	0,944	1,067	0,940	1,003	0,980	1,033
HEGRA SPAREBANK	0,988	1,074	1,080	0,960	1,012	1,088
HELGELAND SPAREBANK	0,983	1,086	1,088	0,945	0,999	1,057
HJARTDAL OG GRANSHERAD SPAREBANK	0,953	1,136	1,028	0,946	1,028	0,910
HJELMELAND SPAREBANK				0,992	1,056	1,028
HOL SPAREBANK	1,037	0,948	1,068	0,976	1,025	
HOLLA OG LUNDE SPAREBANK	0,985	1,031	0,974	0,907		
Høland & Setskog Sparebank	0,860	1,100	1,048	1,011	1,058	1,009
HØNEFOSS SPAREBANK	0,731	0,889	1,076	0,838	1,040	1,044
INDRE SOGN SPAREBANK	0,961	1,106	1,028	0,974	1,058	1,004
JERNBANEPERSONALETS SPAREBANK	0,970	1,068	1,267	1,121	1,201	0,945
KLEPP SPAREBANK	0,796	1,104	1,169	0,812	0,981	1,077
KLÆBU SPAREBANK	0,948	1,112	1,047	0,994	0,997	1,104
KRAGERØ SPAREBANK	1,008	0,966	1,074	0,923	0,968	0,952
KVINESDAL SPAREBANK	0,963	0,984	1,114			
KVINNHERAD SPAREBANK	0,859	1,191				
LARVIKBANKEN BRUNLANES SPAREBANK	0,839	0,980	1,116	0,909	0,998	1,032
LILLESANDS SPAREBANK	0,954	1,101	1,050	0,945	0,995	0,948
LILLESTRØMBANKEN LILLESTRØM SPAREBANK	0,968	1,019	1,040	0,919	0,978	1,039
LOFOTEN SPAREBANK	0,785	1,214	1,068	0,991	0,948	0,992
LOM OG SKJÅK SPAREBANK	0,949	1,051	1,120	0,917	0,973	
LUSTER SPAREBANK	0,935	1,119	1,088	0,904	1,022	0,983
MARKER SPAREBANK	0,969	1,154	1,063	0,907	1,034	1,028
MELDAL SPAREBANK	0,834	1,049	1,082	0,973	1,007	1,029
MELHUS SPAREBANK	0,965	1,059	1,006	0,947	0,970	1,144
MODUM SPAREBANK	0,942	1,205	1,082	0,858	1,032	1,050
NES PRESTEGJELDS SPAREBANK	0,959	0,963	1,031	1,002	0,983	

NESSET SPAREBANK	0,986	1,092	0,955	0,943	1,023	1,049
NØTTERØ SPAREBANK	0,973	1,020				
ODAL SPAREBANK	0,972	1,001	1,088	0,922	1,026	1,009
OFOTEN SPAREBANK	0,782	1,221	1,013	0,985	0,983	0,946
OPDALS SPAREBANK	0,939	1,048	0,997	0,970	1,002	1,007
ORKDAL SPAREBANK	0,902	1,129	1,019	0,917	1,039	1,019
RINDAL SPAREBANK	0,923	1,180	1,067	0,924	0,999	1,004
Ringerikes Sparebank	0,867	1,264				
Rygge-Vaaler Sparebank			0,989			
RØROSBANKEN RØROS SPAREBANK	0,999	0,971	1,074	1,118	0,887	0,991
SANDNES SPAREBANK		0,777	0,816	0,879	0,986	1,120
SAUDA SPAREBANK	0,959					
SELBU SPAREBANK	0,933	1,122	1,085	0,948	0,995	0,970
SELJORD SPAREBANK	0,973	1,202	0,981	1,014	0,942	
SETSKOG SPAREBANK	0,964	1,073				
SKUDENES & AAKRA SPAREBANK	0,907	1,148	1,033	0,971	1,000	1,029
Skue sparebank						
SOKNEDAL SPAREBANK	0,964	1,100	1,019	0,888	1,025	0,981
SPAREBANK 1 GRAN	0,780	1,475				
Sparebank 1 Buskerud-Vestfold		1,071	1,009	0,929	1,002	1,007
SPAREBANK 1 GUDBRANDSDAL FRON SPAREBANK	0,888	1,146	1,052	0,913	0,975	1,078
SPAREBANK 1 HALLINGDAL	0,807	1,214	1,095	0,921	1,083	0,987
Sparebank 1 Lom og Skjåk						
SPAREBANK 1 JEVNAKER LUNNER	0,907	1,185				
SpareBank 1 Kongsberg						
SpareBank 1 Moss	0,863					
SPAREBANK 1 NORD-NORGE	1,000	1,067	0,996	0,970	0,980	1,025
SpareBank 1 Nordvest	0,921	1,163	1,022	0,927	0,956	1,051
Sparebank 1 Nøtterøy-Tønsberg				0,904	1,015	1,068
Sparebank 1 Ringerike Hadeland				0,793	0,989	0,988
SpareBank 1 SMN	0,949	1,082	1,084	0,946	0,996	1,022
SPAREBANK 1 SR-BANK	0,900	1,035	1,035	1,005	0,932	1,033
Bien sparebank	0,807	1,043	1,001	1,079	0,993	0,993
Sparebank 1 Telemark	0,839	1,250	1,048	0,971	0,962	1,053
Sparebank 1 Søre Sunnmøre			0,997	0,964	0,987	1,001
Sparebank 1 Østfold Akershus					0,911	1,044
Sparebanken DIN						
SPAREBANKEN GRENLAND						
SPAREBANKEN HARDANGER	0,859	1,200	1,135			
SPAREBANKEN HEDMARK	0,997	1,062	0,998	0,976	1,001	1,002
SPAREBANKEN HEMNE	0,920	1,158	1,025	0,944	1,056	1,011
SPAREBANKEN MØRE	1,068	1,024	1,014	0,989	1,122	0,870
Sparebanken Narvik	0,941	1,088	1,029	0,982	1,079	1,033
SPAREBANKEN PLUSS	1,062	0,948	1,005	0,947	0,998	0,951

SPAREBANKEN SOGN OG FJORDANE	0,904	1,117	1,132	0,905	1,040	0,996
SPAREBANKEN SØR	0,976	1,010	1,071	0,910	0,975	0,999
SPAREBANKEN VEST	0,873	1,021	0,993	0,971	1,025	0,973
Sparebanken Øst	0,989	0,907	1,000	0,989	0,997	1,003
SPARESKILLINGSBANKEN			0,906	1,011	0,969	0,884
SPYDEBERG SPAREBANK	0,769	1,037	1,043	0,990	1,016	1,032
STADSBYGD SPAREBANK	0,877	1,111	1,063	0,959	1,002	0,993
STRØMMEN SPAREBANK					0,981	1,001
SUNNDAL SPAREBANK	0,976	1,091	1,205	0,852	1,033	0,963
Surnadal Sparebank	0,948	1,128	1,074	0,940	1,068	1,008
SØGNE OG GREIPSTAD SPAREBANK	0,855	1,156	1,074	0,990	0,961	0,996
TIME SPAREBANK	0,850	1,243	1,127	0,916	0,955	1,016
TINGVOLL SPAREBANK	0,949					
TINN SPAREBANK	0,969	1,129	1,111	0,895	1,022	0,960
TOLGA-OS SPAREBANK	1,011	1,125	1,014	0,912	1,054	1,009
TOTENS SPAREBANK	1,033	1,055	1,060	0,927	0,980	1,076
TRØGSTAD SPAREBANK	0,979	1,093	1,039	0,981	0,982	0,997
TYSNES SPAREBANK	0,937	1,119	1,080	0,920	1,060	1,048
VALLE SPAREBANK	0,813	1,133	1,038	1,036	0,939	1,065
VANG SPAREBANK	0,808	1,136	1,227	0,884		
VEGÅRSHEI SPAREBANK	0,963	1,062	1,037	0,966	0,960	0,938
Vestfold Sparebank						
VESTRE SLIDRE SPAREBANK	0,991	1,032	1,034	1,046	0,946	0,981
VIK SPAREBANK	0,804	1,167	1,248	0,933	0,861	1,017
VOLDA OG ØRSTA SPAREBANK	0,930					
VOSS SPAREBANK	0,876	1,170	1,167	0,905	0,958	0,988
ØRLAND SPAREBANK	0,910	1,034	1,030	0,972	0,974	1,017
ØRSKOG SPAREBANK	1,021	1,061	1,013	0,979	0,928	0,996
ØYSTRE SLIDRE SPAREBANK	0,950	1,158	1,108	1,101		
ÅFJORD SPAREBANK	0,918	1,056	1,001	1,072	1,005	0,950

Appendix 12. List of banks in alliances

Eika	Sparebank 1 Gruppen	Independent
ANDEBU SPAREBANK	Sparebank 1 Telemark	CULTURA SPAREBANK
ARENDAL OG OMEGNS SPAREKASSE	LOM OG SKJÅK SPAREBANK	ETNE SPAREBANK
ASKIM SPAREBANK	MODUM SPAREBANK	FANA SPAREBANK
AURLAND SPAREBANK	Sparebank 1 Østfold Akershus	FLEKKEFJORD SPAREBANK
AURSKOG SPAREBANK	SPAREBANK 1 GUDBRANDSDAL FRON SPAREBANK	HAUGESUND SPAREBANK
BAMBLE OG LANGESUND SPAREBANK	SPAREBANK 1 HALLINGDAL	HELGELAND SPAREBANK

BERG SPAREBANK	Sparebank 1 Buskerud-Vestfold	LILLESANDS SPAREBANK
Bien sparebank	SpareBank 1 SMN	LUSTER SPAREBANK
BIRKENES SPAREBANK	SPAREBANK 1 NORD-NORGE	SANDNES SPAREBANK
BJUGN SPAREBANK	SpareBank 1 Nordvest	SKUDENES & AAKRA SPAREBANK
BLAKER SPAREBANK	Sparebank 1 Nøtterøy-Tønsberg	SPAREBANKEN MØRE
BUD FRÆNA OG HUSTAD SPAREBANK	Sparebank 1 Ringerike Hadeland	SPAREBANKEN SOGN OG FJORDANE
DRANGEDAL OG TØRDAL SPAREBANK	SPAREBANK 1 SR-BANK	SPAREBANKEN SØR
EIDSBERG SPAREBANK	Sparebank 1 Søre Sunnmøre	SPAREBANKEN VEST
ETNEDAL SPAREBANK	SPAREBANKEN HEDMARK	Sparebanken Øst
EVJE OG HORNNES SPAREBANK	SPAREBANK 1 GRAN	SPARESKILLINGSBANKEN
Fornebu Sparebank	SPAREBANK 1 GUDBRANDSDAL FRON SPAREBANK	SØGNE OG GREIPSTAD SPAREBANK
GILDESKÅL SPAREBANK	Sparebank 1 Lom og Skjåk	VOSS SPAREBANK
GJERSTAD SPAREBANK	SPAREBANK 1 JEVNAKER LUNNER	Sparebanken Hemne
GRONG SPAREBANK	SpareBank 1 Kongsberg	Sparebanken Narvik
GRUE SPAREBANK	SpareBank 1 Moss	SPAREBANKEN PLUSS
HALTDALEN SPAREBANK		TINGVOLL SPAREBANK
HARSTAD SPAREBANK		SPYDEBERG SPAREBANK
HEGRA SPAREBANK		SELJORD SPAREBANK
HELGELAND SPAREBANK		NES PRESTEGJELDS SPAREBANK
HJARTDAL OG GRANSHERAD SPAREBANK		KVINNHERAD SPAREBANK
HJELMELAND SPAREBANK		KLEPP SPAREBANK
Høland & Setskog Sparebank		HOLLA OG LUNDE SPAREBANK
HØNEFOSS SPAREBANK		FJALER SPAREBANK
INDRE SOGN SPAREBANK		
JERNBANEPERSONALETS SPAREBANK		
KLÆBU SPAREBANK		
KRAGERØ SPAREBANK		
KVINESDAL SPAREBANK		
LARVIKBANKEN BRUNLANES SPAREBANK		
LILLESTRØMBANKEN LILLESTRØM SPAREBANK		
LOFOTEN SPAREBANK		
MARKER SPAREBANK		
MELDAL SPAREBANK		
MELHUS SPAREBANK		

NESSET SPAREBANK		
ODAL SPAREBANK		
OFOTEN SPAREBANK		
OPDALS SPAREBANK		
ORKDAL SPAREBANK		
RINDAL SPAREBANK		
RØROSBANKEN RØROS SPAREBANK		
SELBU SPAREBANK		
Skue sparebank		
SOKNEDAL SPAREBANK		
Sparebanken DIN		
Sparebanken Narvik		
STADSBYGD SPAREBANK		
STRØMMEN SPAREBANK		
SUNNDAL SPAREBANK		
Surnadal Sparebank		
TINN SPAREBANK		
TOLGA-OS SPAREBANK		
TOTENS SPAREBANK		
TRØGSTAD SPAREBANK		
TYSNES SPAREBANK		
VALLE SPAREBANK		
VANG SPAREBANK		
VEGÅRSHEI SPAREBANK		
VESTRE SLIDRE SPAREBANK		
VIK SPAREBANK		
ØRLAND SPAREBANK		
ØRSKOG SPAREBANK		
ÅFJORD SPAREBANK		
AASEN SPAREBANK		
SETSKOG SPAREBANK		
HOL SPAREBANK		
BØ SPAREBANK		

Appendix 13. List of banks receiving funds in 2009

Aurskog Sparebank
Bamble og Langesund Sparebank
Blaker Sparebank
BUD FRÆNA OG HUSTAD SPAREBANK
Gjerstad Sparebank

Grong Sparebank
Hjartdal og Gransherad Sparebank
Hjelmeland Sparebank
Hol Sparebank
Holla og Lunde Sparebank
Indre Sogn Sparebank
Klepp Sparebank
KVINESDAL SPAREBANK
LILLESTRØMBANKEN LILLESTRØM SPAREBANK
Nes Prestegjelds Sparebank
Rørosbanken Røros Sparebank
Sandnes Sparebank
Selbu Sparebank
Seljord Sparebank
Soknedal Sparebank
Sparebank 1 Buskerud-Vestfold
Sparebank 1 SMN
Sparebank 1 SR-Bank
Sparebanken Sør
Sparebanken Vest
Surnadal Sparebank
Tinn Sparebank
Totens Sparebank
VEGÅRSHEI SPAREBANK
Ørland Sparebank

Appendix 14. Statistics for variables

Labour cost	*2013*	*2012*	*2011*	*2010*	*2009*	*2008*	*2007*
Mean	221,0605	206,5671	194,9026	171,275	161,9083	157,7065	146,48
Standard Error	123,4755	115,7184	108,9487	95,79231	84,16118	83,02513	78,04762
Median	33,6195	30,3535	28,36	26,208	28,6	28,462	25,635
Standard Deviation	1283,195	1213,665	1153,004	1022,782	918,0901	913,2765	865,5899
Sample Variance	1646588	1472983	1329419	1046083	842889,3	834073,9	749246
Kurtosis	102,6391	104,8531	106,9665	108,6824	111,7737	114,2859	116,4688
Skewness	10,02172	10,13488	10,23958	10,31814	10,43266	10,56055	10,66628
Range	13262,69	12665,99	12146,45	10865,43	9935,94	9976,013	9537,163
Minimum	7,644	7,666	7,164	5,167	6,389	6,898	5,166
Maximum	13270,33	12673,65	12153,61	10870,6	9942,329	9982,911	9542,329
Sum	23874,54	22722,38	21829,09	19525,35	19267,09	19082,49	18017,04
Count	108	110	112	114	119	121	123
Confidence Level(95,0%)	244,7757	229,3502	215,8891	189,7818	166,662	164,384	154,5031

Total assets	*2013*	*2012*	*2011*	*2010*	*2009*	*2008*	*2007*
Mean	13164,34	12608,58	12090,38	11193,94	11404,2	11365,41	8452,964
Standard Error	9064,125	8648,761	8146,304	7140,159	7509,128	7509,503	5332,406
Median	879,4205	832,1995	836,7595	899,698	940,341	852,142	785,129
Standard Deviation	94197,15	90708,97	86212,38	76236,04	81914,92	82604,53	59139,24
Sample Variance	8,87E+09	8,23E+09	7,43E+09	5,81E+09	6,71E+09	6,82E+09	3,5E+09
Kurtosis	105,0528	107,2534	109,1765	109,8016	115,56	117,4062	118,8458
Skewness	10,18878	10,29913	10,38996	10,39434	10,68091	10,764	10,81962
Range	976443,7	949484	910669,5	810635,9	891119,4	905846,3	653530,4
Minimum	75,698	57,163	58,256	53,867	46,708	55,889	44,579
Maximum	976519,4	949541,2	910727,8	810689,8	891166,1	905902,1	653574,9
Sum	1421749	1386944	1354123	1276109	1357100	1375215	1039715
Count	108	110	112	114	119	121	123
Confidence Level(95,0%)	17968,57	17141,56	16142,45	14145,94	14870,12	14868,29	10556,03
Interest expences	*2013*	*2012*	*2011*	*2010*	*2009*	*2008*	*2007*
Mean	436,1154	478,0452	471,7962	431,1519	468,6079	811,0313	571,8396
Standard Error	203,1433	242,7951	241,3453	225,597	247,4549	444,4911	340,9055
Median	69,459	64,141	64,297	63,8445	66,869	110,206	69,346
Standard Deviation	2111,128	2546,457	2554,158	2408,717	2699,414	4889,402	3780,825
Sample Variance	4456860	6484442	6523724	5801915	7286837	23906249	14294640
Kurtosis	95,40453	100,8973	103,0404	105,916	111,0938	113,9445	118,0552
Skewness	9,535421	9,86998	9,979355	10,1356	10,38886	10,53944	10,76887
Range	21520	26387,54	26718,54	25466,94	29177,56	53367,51	41744,87
Minimum	4,844	3,941	3,554	3,621	4,977	5,967	2,99
Maximum	21524,84	26391,48	26722,09	25470,56	29182,54	53373,48	41747,86
Sum	47100,46	52584,97	52841,18	49151,31	55764,34	98134,79	70336,27
Count	108	110	112	114	119	121	123
Confidence Level(95,0%)	402,708	481,212	478,2418	446,9483	490,028	880,0614	674,8566
Credit losses	*2013*	*2012*	*2011*	*2010*	*2009*	*2008*	*2007*
Mean	134,5323	133,842	120,0143	104,5517	94,97472	67,65289	40,83767
Standard Error	75,46309	75,30279	61,46453	46,99536	42,14681	23,72001	13,42841
Median	21,3305	20,131	21,658	21,157	18,886	15,258	11,06
Standard Deviation	784,2354	789,7823	650,4794	501,7732	459,7674	260,9202	148,9282
Sample Variance	615025,1	623756,1	423123,5	251776,3	211386,1	68079,33	22179,62
Kurtosis	102,5094	104,9517	104,7504	102,0615	106,8499	95,22884	90,11538
Skewness	10,01346	10,14085	10,08908	9,873644	10,1081	9,327447	8,990745
Range	8104,927	8246,612	6829,982	5271,879	4938,666	2751,062	1558,565
Minimum	2,294	1,945	2,351	1,923	0,675	0,954	0
Maximum	8107,221	8248,557	6832,333	5273,802	4939,341	2752,016	1558,565
Sum	14529,49	14722,62	13441,6	11918,9	11301,99	8186	5023,034
Count	108	110	112	114	119	121	123
Confidence Level(95,0%)	149,5968	149,2477	121,7961	93,10629	83,46216	46,96398	26,58287

Deposits	*2013*	*2012*	*2011*	*2010*	*2009*	*2008*	*2007*
Mean	13953,01	12780,48	11406,08	10199,49	9052,943	8663,481	7748,578
Standard Error	7888,769	7184,097	6317,877	5508,397	4905,983	4736,581	4175,87
Median	2155,507	1917,201	1783,032	1745,571	1638,66	1512,868	1468,441
Standard Deviation	81982,5	75347,45	66862,12	58813,59	53517,95	52102,4	46312,64
Sample Variance	6,72E+09	5,68E+09	4,47E+09	3,46E+09	2,86E+09	2,71E+09	2,14E+09
Kurtosis	103,3859	105,1178	106,6846	108,0613	113,1723	115,226	116,736
Skewness	10,07207	10,15257	10,22137	10,27712	10,52403	10,62212	10,68431
Range	848680	786829,1	704032,9	624218	580594,6	570025,4	510511,7
Minimum	456,552	415,72	405,012	370,453	318,336	286,782	233,366
Maximum	849136,5	787244,8	704437,9	624588,4	580913	570312,2	510745
Sum	1506925	1405853	1277481	1162742	1077300	1048281	953075
Count	108	110	112	114	119	121	123
Confidence Level(95,0%)	15638,57	14238,65	12519,29	10913,13	9715,182	9378,101	8266,552

Appendix 15. Statistics – basic ratios

Ratio 1	*2013*	*2012*	*2011*	*2010*	*2009*	*2008*	*2007*
Mean	63,30578027	62,62057	60,63657	65,45696	56,97415	55,50984	53,87831
Standard Error	1,132981778	1,264462	1,022295	1,23475	1,061858	1,062185	1,054085
Median	61,26999922	60,96801	59,21631	63,80995	55,73107	54,61382	52,8959
Standard Deviation	11,77429202	13,26179	10,81896	13,18353	11,53473	11,63566	11,69037
Sample Variance	138,6339526	175,8752	117,0498	173,8054	133,0499	135,3885	136,6646
Range	72,85949151	102,1331	81,75411	86,58795	74,37864	74,75967	79,23969
Minimum	31,25153374	26,23896	29,52398	26,17487	29,15113	31,20388	27,67392
Maximum	104,1110253	128,3721	111,2781	112,7628	103,5298	105,9636	106,9136
Sum	6837,024269	6888,263	6791,296	7462,093	6722,95	6661,181	6627,032
Count	108	110	112	114	118	120	123

Ratio 2	*2013*	*2012*	*2011*	*2010*	*2009*	*2008*	*2007*
Mean	2,515004	2,461217	2,269385	2,088818	1,917654	1,891905	1,985512
Standard Error	0,116187	0,11785	0,116235	0,10529	0,101345	0,095786	0,098394
Median	2,190633	2,13198	1,961056	1,769066	1,628743	1,590588	1,712556
Standard Deviation	1,20745	1,236023	1,230111	1,124189	1,105541	1,053649	1,09124
Sample Variance	1,457935	1,527753	1,513174	1,263802	1,22222	1,110176	1,190805
Range	5,467829	6,833342	6,56904	6,387038	6,629915	6,006015	5,376082
Minimum	0,857781	0,829079	0,604676	0,490141	0,494903	0,436597	0,497531
Maximum	6,32561	7,662421	7,173716	6,877179	7,124818	6,442612	5,873613
Sum	271,6204	270,7339	254,1712	238,1252	228,2008	228,9205	244,218
Count	108	110	112	114	119	120	123

Ratio 3	*2013*	*2012*	*2011*	*2010*	*2009*	*2008*	*2007*
Mean	30,91074	29,27675	28,39832	29,2733	24,44742	14,06943	20,78481
Standard Error	0,851769	0,953613	1,08029	1,004049	0,706315	0,444557	0,727344
Median	29,10816	28,01183	26,51621	27,48447	23,52859	13,2284	19,48412
Standard Deviation	8,851846	10,00157	11,43272	10,72031	7,704983	4,890131	8,066636
Sample Variance	78,35517	100,0315	130,707	114,9251	59,36677	23,91338	65,07062
Range	78,52887	92,2752	103,3279	90,27376	59,06006	47,67216	79,35568
Minimum	20,32249	18,86588	14,26129	12,03306	7,804715	5,038919	6,988804
Maximum	98,85136	111,1411	117,5892	102,3068	66,86478	52,71108	86,34448
Sum	3338,36	3220,443	3180,612	3337,156	2909,243	1702,401	2556,531
Count	108	110	112	114	119	120	123

Rario 4	*2013*	*2012*	*2011*	*2010*	*2009*	*2008*	*2007*
Mean	131,7589881	129,209	123,2064	117,9091	122,1189	131,61	173,9664
Standard Error	9,31200343	9,986769	8,956568	9,875371	17,99678	13,96861	15,40549
Median	106,397601	101,8899	96,48083	89,84329	81,87144	98,66087	130,7235
Standard Deviation	96,77317837	104,7421	94,78741	105,4401	196,3217	153,6547	170,1592
Sample Variance	9365,048051	10970,91	8984,653	11117,62	38542,23	23609,77	28954,16
Range	748,8251565	814,1513	586,6583	697,4864	2027,48	1389,914	1373,633
Minimum	29,67423729	27,75258	15,97338	27,95725	14,56131	11,9011	25,96338
Maximum	778,4993938	841,9039	602,6316	725,4437	2042,041	1401,816	1399,596
Sum	14229,97071	14212,99	13799,11	13441,63	14532,15	15924,81	21223,9
Count	108	110	112	114	119	120	123

Ratio 5	*2013*	*2012*	*2011*	*2010*	*2009*	*2008*	*2007*
Mean	74,94735	75,75327	74,95762	84,18349	75,47758	76,04502	75,37509
Standard Error	1,52815	1,636163	1,306984	1,568681	1,38952	1,521062	1,532863
Median	73,57151	73,72701	73,9159	81,85748	74,08148	73,77329	72,92107
Standard Deviation	15,8073	17,08204	13,76994	16,67531	15,09405	16,6624	17,00027
Sample Variance	249,8708	291,7961	189,6111	278,066	227,8303	277,6357	289,0092
Range	105,8669	124,4294	75,92117	84,98105	106,4358	115,0538	118,9608
Minimum	23,64404	51,4672	46,6547	50,04468	29,27585	31,64574	22,70211
Maximum	129,511	175,8966	122,5759	135,0257	135,7117	146,6995	141,6629
Sum	8019,367	8257,107	8320,296	9512,735	8906,355	9125,402	9271,137
Count	108	110	112	114	119	120	123

Ratio 6	*2013*	*2012*	*2011*	*2010*	*2009*	*2008*	*2007*
Mean	2,832897	2,8142	2,631266	2,508252	2,380874	2,408256	2,585449
Standard Error	0,096039	0,096469	0,09623	0,087444	0,085654	0,081136	0,083351
Median	2,638716	2,646663	2,415257	2,337706	2,189838	2,133571	2,352309
Standard Deviation	0,998065	1,011776	1,018402	0,933644	0,934376	0,892498	0,924408
Sample Variance	0,996134	1,023692	1,037142	0,871691	0,873059	0,796553	0,85453
Range	5,698292	5,184531	5,357517	5,50857	5,79795	5,470616	4,706109
Minimum	0,696468	0,751672	0,781756	0,825783	0,703355	0,909837	1,097249
Maximum	6,39476	5,936203	6,139272	6,334353	6,501305	6,380453	5,803358
Sum	305,9529	309,562	294,7018	285,9408	283,324	291,399	318,0103
Count	108	110	112	114	119	120	123

Ratio 5	*2013*	*2012*	*2011*	*2010*	*2009*	*2008*	*2007*
Mean	35,63808861	34,24294	33,72004	36,18602	31,43055	18,54806	27,92935
Standard Error	0,54221786	0,637918	0,761797	0,725775	0,522333	0,272765	0,470505
Median	35,31946172	33,59347	32,44102	35,33085	30,90818	18,1574	26,87739
Standard Deviation	5,634893289	6,690545	8,062104	7,749155	5,697984	3,00041	5,218151
Sample Variance	31,75202238	44,76339	64,99753	60,0494	32,46703	9,002459	27,2291
Range	49,73431817	58,37048	70,86726	60,73026	40,85579	31,06179	54,93887
Minimum	25,0538734	22,33848	21,02864	19,54646	13,4908	11,43578	15,89323
Maximum	74,78819158	80,70896	91,89589	80,27672	54,34659	42,49757	70,83211
Sum	3848,91357	3766,723	3776,645	4125,207	3740,236	2244,316	3435,31
Count	108	110	112	114	119	120	123

Ratio 8	*2013*	*2012*	*2011*	*2010*	*2009*	*2008*	*2007*
Mean	153,5859	151,5116	149,3446	147,1365	158,1197	176,7363	248,4218
Standard Error	9,712283	10,15035	10,33895	11,38651	21,28685	17,3159	22,18472
Median	130,1252	124,0473	119,1324	118,0188	105,4313	132,8249	182,6414
Standard Deviation	100,933	106,4577	109,4172	121,5747	232,2122	190,4749	245,0383
Sample Variance	10187,47	11333,25	11972,12	14780,41	53922,49	36280,69	60043,76
Range	700,1963	712,9709	625,0346	795,6918	2391,255	1728,005	1841,093
Minimum	32,39573	28,8728	14,52777	42,00875	19,38104	17,34518	29,91723
Maximum	732,5921	741,8437	639,5623	837,7005	2410,636	1745,35	1871,01
Sum	16587,28	16666,27	16726,6	16773,56	18816,25	21385,09	30307,46
Count	108	110	112	114	119	120	123

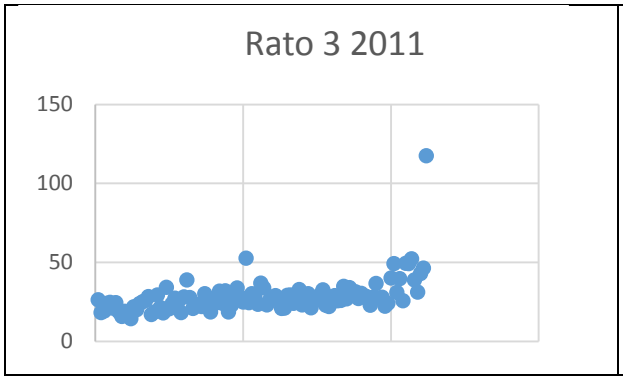
Ratio 9	*2013*	*2012*	*2011*	*2010*	*2009*	*2008*	*2007*
Mean	3,843282	3,994771	4,032377	4,330101	4,23163	6,140915	4,594517
Standard Error	0,072425	0,085189	0,070466	0,076587	0,083112	0,126606	0,088858
Median	3,908194	3,878289	3,961329	4,289761	4,168417	6,027168	4,493848
Standard Deviation	0,749165	0,889403	0,742402	0,814133	0,902824	1,386896	0,985478
Sample Variance	0,561248	0,791038	0,551161	0,662813	0,815091	1,923481	0,971166
Range	4,799447	6,498698	4,761625	5,284711	6,829598	9,798483	7,091423
Minimum	1,486033	2,615293	2,467295	2,756319	1,546296	2,591159	1,591167
Maximum	6,28548	9,113991	7,228921	8,041029	8,375895	12,38964	8,682591
Sum	411,2312	435,4301	447,5938	489,3014	499,3323	736,9098	565,1256
Count	108	110	112	114	119	120	123

Ratio 10	*2013*	*2012*	*2011*	*2010*	*2009*	*2008*	*2007*
Mean	0,145548184	0,148349	0,140947	0,129247	0,132868	0,193605	0,158202
Standard Error	0,004913912	0,005177	0,005029	0,004501	0,004735	0,006305	0,005218
Median	0,134090537	0,14151	0,130487	0,121866	0,116726	0,176864	0,142936
Standard Deviation	0,051066869	0,054301	0,053217	0,048053	0,051655	0,069355	0,057869
Sample Variance	0,002607825	0,002949	0,002832	0,002309	0,002668	0,00481	0,003349
Range	0,256852873	0,329209	0,306024	0,300214	0,362624	0,43724	0,298813
Minimum	0,043934466	0,051142	0,052738	0,054493	0,050025	0,077799	0,078376
Maximum	0,300787339	0,380351	0,358761	0,354707	0,412649	0,515039	0,377188
Sum	15,71920388	16,31834	15,78606	14,73414	15,8113	23,42622	19,45882
Count	108	110	112	114	119	120	123

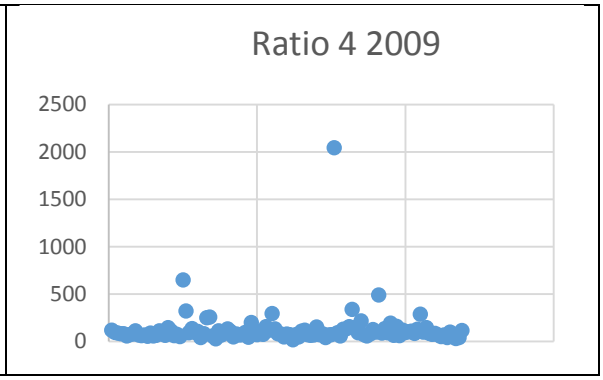
Ratio 11	*2013*	*2012*	*2011*	*2010*	*2009*	*2008*	*2007*
Mean	1,834283	1,808355	1,810276	1,861651	1,752365	1,494175	1,707984
Standard Error	0,031609	0,038253	0,042644	0,038204	0,026432	0,021236	0,032059
Median	1,798668	1,773389	1,745925	1,800007	1,710961	1,443599	1,643433
Standard Deviation	0,32849	0,401198	0,451303	0,407912	0,288344	0,233598	0,355555
Sample Variance	0,107905	0,16096	0,203674	0,166392	0,083142	0,054568	0,126419
Range	3,270111	4,080199	4,460649	3,89642	2,646092	2,42127	3,676665
Minimum	1,430343	1,436675	1,420049	1,380299	1,226522	1,193947	1,287884
Maximum	4,700454	5,516874	5,880698	5,276719	3,872614	3,615217	4,964548
Sum	198,1026	198,9191	202,7509	212,2282	208,5314	180,7952	210,082
Count	108	110	112	114	119	120	123

Ratio 12	*2013*	*2012*	*2011*	*2010*	*2009*	*2008*	*2007*
Mean	7,840754	7,932095	7,8773	7,454458	8,706397	14,02128	15,14345
Standard Error	0,481465	0,509834	0,488198	0,535023	1,177983	1,31251	1,367532
Median	6,846621	6,813715	6,560631	5,995252	6,256929	11,11834	11,43594
Standard Deviation	5,003529	5,347185	5,166605	5,712478	12,85028	14,43761	15,10488
Sample Variance	25,03531	28,59239	26,6938	32,63241	165,1297	208,4445	228,1575
Range	34,46636	38,98698	29,89222	39,60179	136,0309	130,9072	111,3843
Minimum	1,738921	1,625148	0,768289	2,162947	1,296486	1,552953	2,199735
Maximum	36,20528	40,61213	30,66051	41,76473	137,3274	132,4602	113,584
Sum	846,8014	872,5305	882,2576	849,8082	1036,061	1696,574	1847,501
Count	108	110	112	114	119	121	122

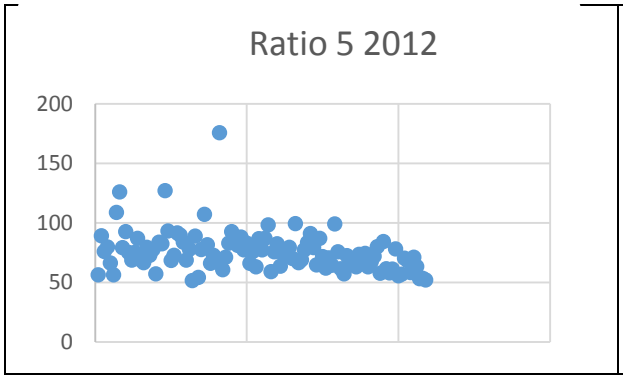
Appendix 16. Plots for basic ratios – possible outliers

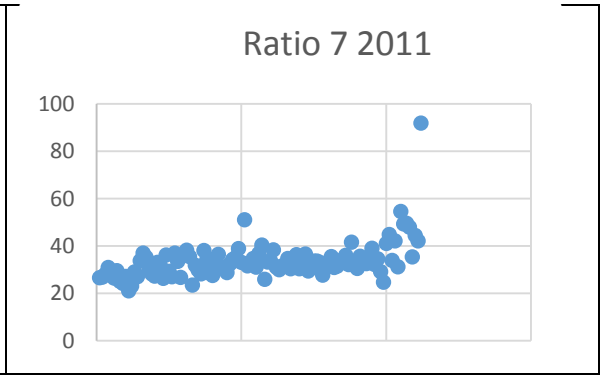


Outlier: Cultura Sparebank

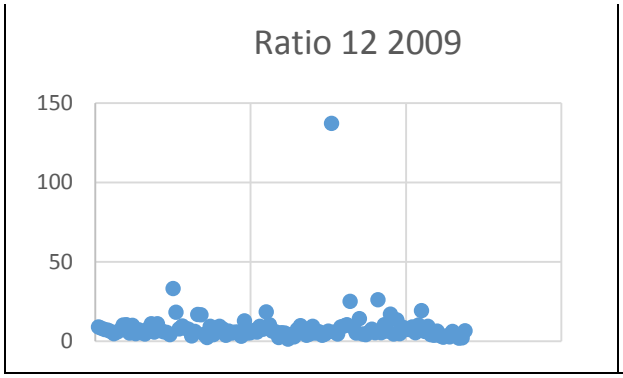


Outlier: Strømmen Sparebank

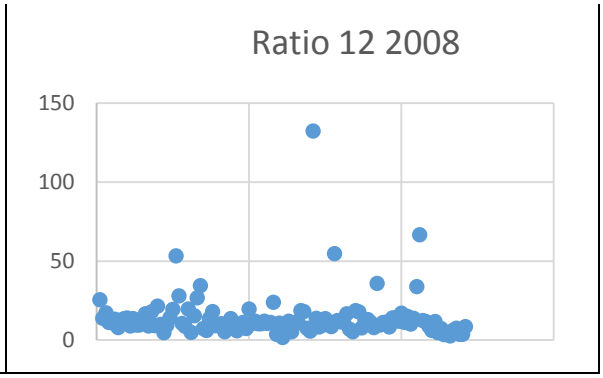




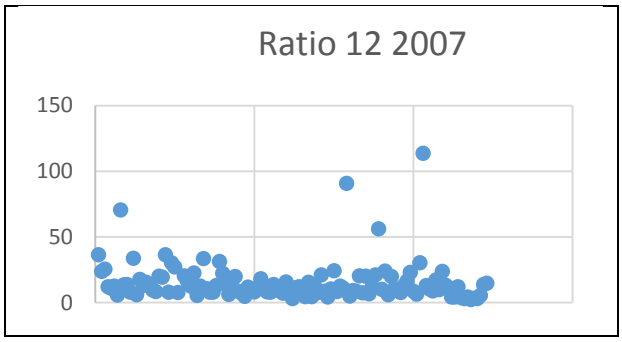
Outlier: Cultura Sparebank



Outlier: Strømmen Sparebank

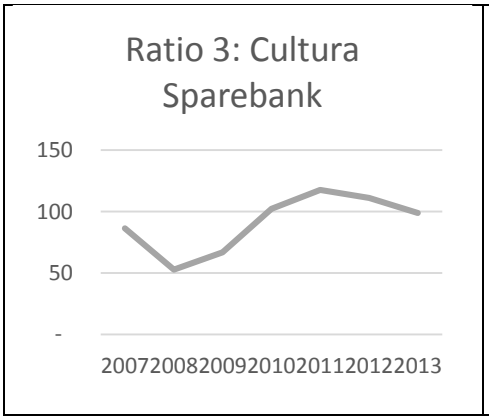


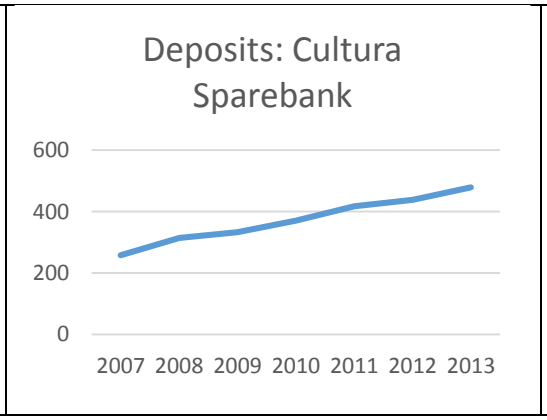
Outlier: Strømmen sparebank

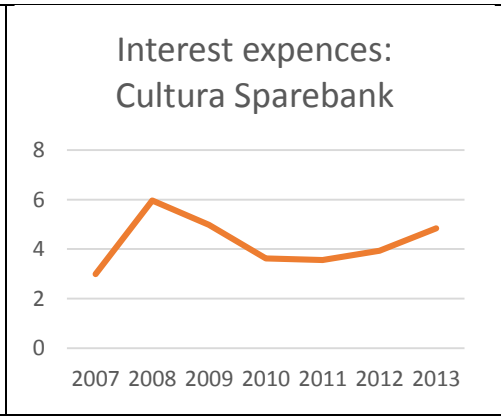


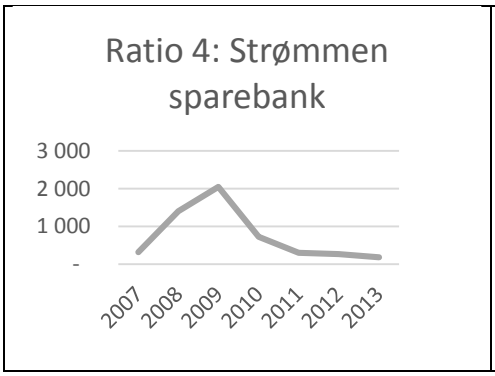
Outlier: Strømmen sparebank, Birkenes sparebank.

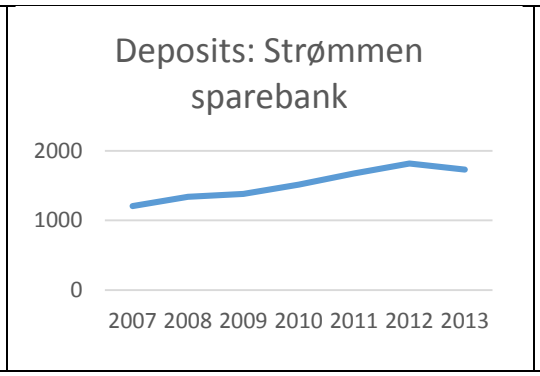
Appendix 17. Plots – outlier banks

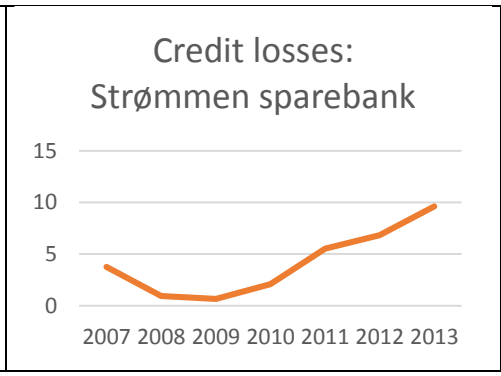


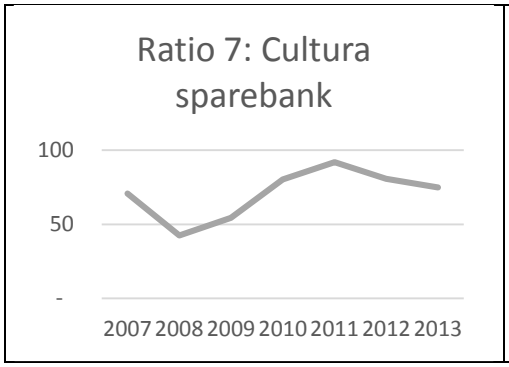


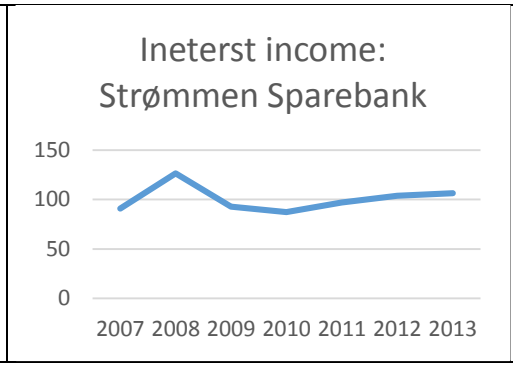


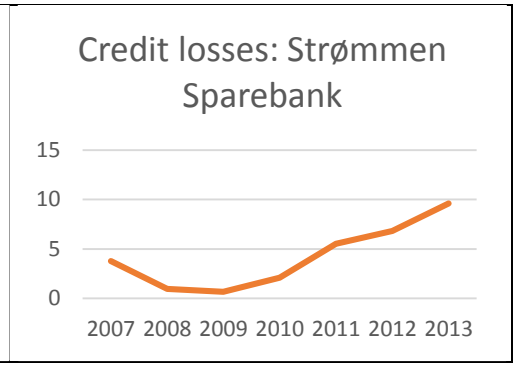


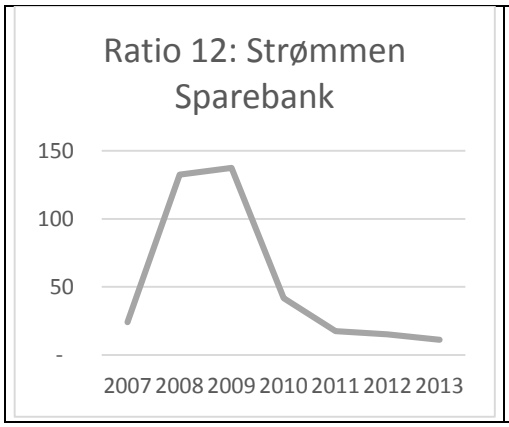


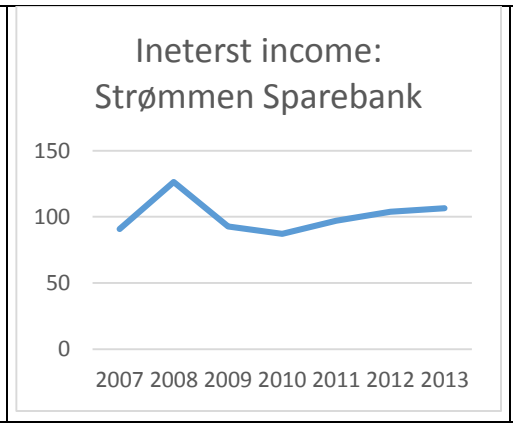


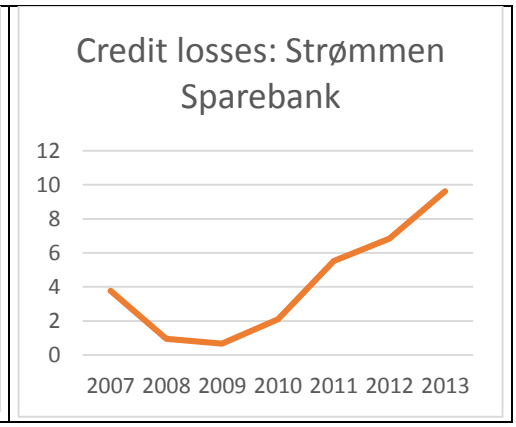




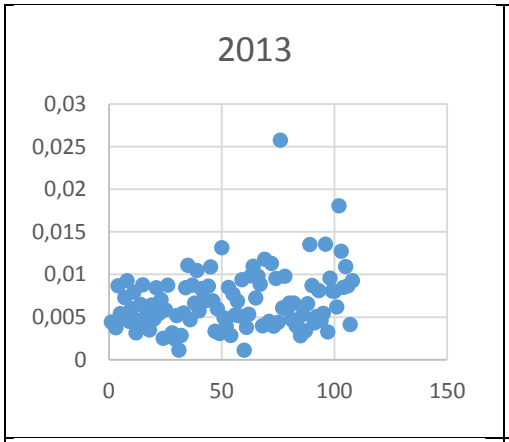


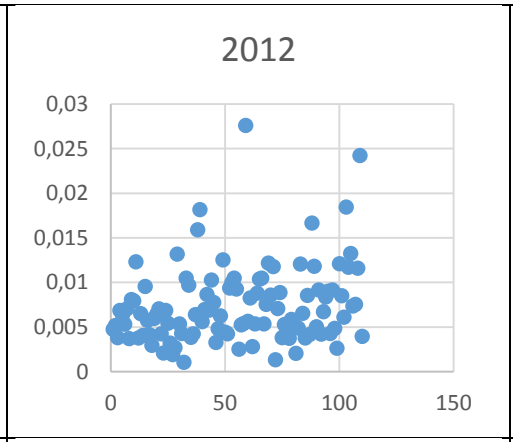


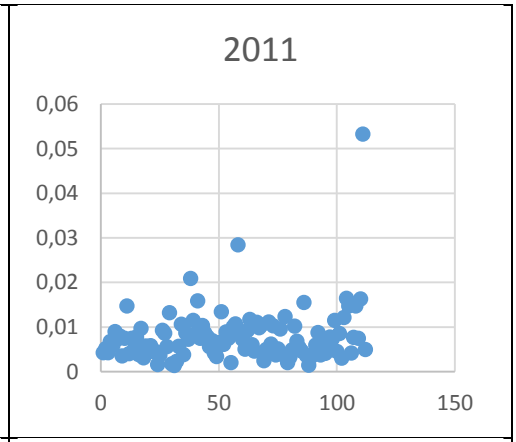


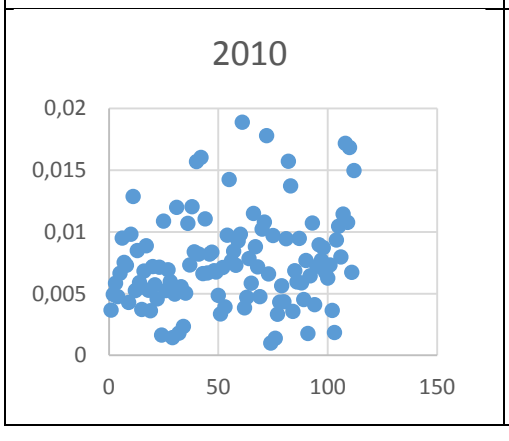


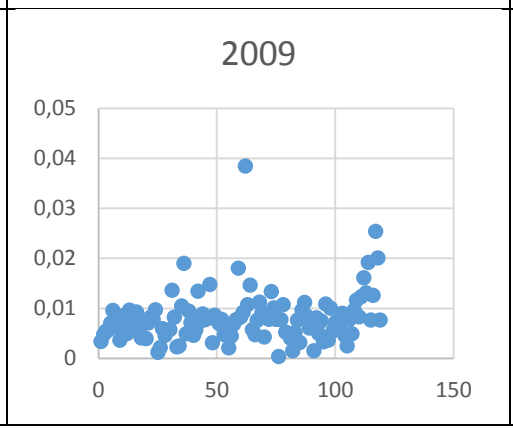
Appendix 18. Plots of ratio – credit losses/total assets

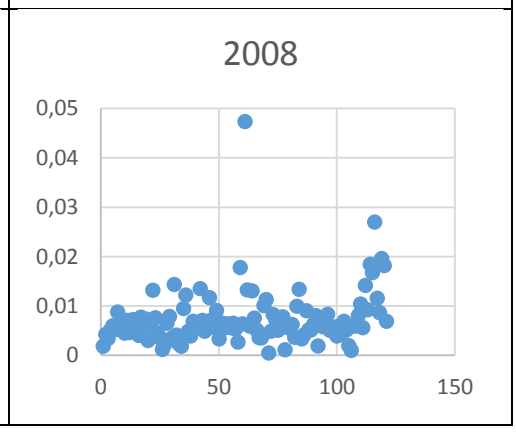












Appendix 19. Values for outliers based on Appendix 19

Credit losses / Total assets							
	2013	2012	2011	2010	2009	2008	2007
Kvinsedal sparbank	0,026	0,028	0,003	0,008	0,008	0,003	0,005
Vang Sparebank	0,009	0,024	0,053	0,008	0,020	0,020	0,016
SPAREBANK 1 GUDBRANDSDAL FRON SPAREBANK	0,011	0,016	0,021	0,016	0,013	0,014	0,009
HJELMELAND SPAREBANK	0,012	0,012	0,012	0,018	0,038	0,047	0,004
SELBU SPAREBANK	0,008	0,009	0,007	0,008	0,009	0,006	0,007
VESTRE SLIDRE SPAREBANK	0,008	0,007	0,008	0,011	0,013	0,017	0,013
AURLAND SPAREBANK	0,006	0,012	0,015	0,017	0,016	0,018	0,017
Etnedal sparebank	0,011	0,012	0,016	0,015	0,025	0,027	0,026
Credit losses							
	2013	2012	2011	2010	2009	2008	2007
Kvinsedal sparbank	60,541	69,921	5,472	20,331	20,942	6,864	10,323
Vang Sparebank	4,987	12,831	26,218	3,665	9,071	9,113	7,095
SPAREBANK 1 GUDBRANDSDAL FRON SPAREBANK	57,799	67,543	87,240	61,176	48,497	48,641	29,384
HJELMELAND SPAREBANK	28,515	26,511	25,174	38,566	94,217	114,460	9,141
SELBU SPAREBANK	26,170	29,251	20,111	21,952	23,494	15,708	16,873
VESTRE SLIDRE SPAREBANK	5,801	4,925	5,017	6,576	7,822	9,583	6,930
AURLAND SPAREBANK	5,627	10,292	11,900	13,127	11,427	12,769	10,468
Etnedal sparebank	6,700	6,189	8,040	7,730	12,192	14,042	12,807
Total assets							
	2013	2012	2011	2010	2009	2008	2007
Kvinsedal sparbank	2351,450	2534,983	1656,208	2667,495	2720,318	2553,863	2170,822
Vang Sparebank	538,463	529,712	492,433	468,526	451,422	465,349	431,089
SPAREBANK 1 GUDBRANDSDAL FRON SPAREBANK	5229,875	4250,668	4177,801	3898,242	3613,587	3593,315	3264,170
HJELMELAND SPAREBANK	2417,144	2250,777	2038,123	2165,371	2449,014	2418,055	2146,469
SELBU SPAREBANK	3081,777	3130,073	2701,711	2598,585	2559,422	2458,854	2268,004
VESTRE SLIDRE SPAREBANK	683,669	671,402	652,926	610,950	595,561	572,575	536,348
AURLAND SPAREBANK	910,329	879,232	810,643	764,755	707,874	691,450	631,101
Etnedal sparebank	613,902	533,860	493,748	516,149	480,107	520,027	491,247

Appendix 20. Key results – super-efficiency with outliers

	2013		2012		2011	
		Score		Score		Score
Bank 1	Cultura Sparebank	2,268314	3060 SPARESKILLINGSBANKEN	1,51615	SPARESKILLINGSBANKEN	1,810517
Bank 2	Jernbanepersonalets Sparebank	1,825952	2601 BAMBLE SPAREBANK	1,39148	JERNBANEPERSONALETS SPAREBANK	1,68248
Bank 3	Fornebu Sparebank	1,470309	1440 JERNBANEPERSONALETS SPAREBANK	1,382235	Fornebu Sparebank	1,250915
Bank 4	Spareskillingsbanken	1,296787	1450 Fornebu Sparebank	1,284974	SPAREBANKEN PLUSS	1,200702
Bank 5	SPAREBANKEN PLUSS	1,141782	4355 HALTDALEN SPAREBANK	1,163801	ØYSTRE SLIDRE SPAREBANK	1,171133
Median		0,892789		0,906475		0,898924
Bank -1	SpareBank 1 BV	0,743275	3930 SpareBank 1 Nordvest	0,759281	SpareBank 1 Nordvest	0,780665
Bank -2	SpareBank 1 NordVest	0,749171	1081 SpareBank 1 Østfold Akershus	0,783925	SpareBank 1 Buskerud-Vestfold	0,784434
Bank -3	Bamble Sparebank	0,754375	3290 KLEPP SPAREBANK	0,784909	SpareBank 1 Nøtterø-Tønsberg	0,786547
St.dev		0,189148		0,116334		0,140874
	2010		2009		2008	
Bank 1		Score		Score		Score
Bank 2	Spareskillingsbanken	1,56097	SPARESKILLINGSBANKEN	1,840716	SPARESKILLINGSBANKEN	2,109557
Bank 3	Sparebank 1 Ringerike Hadeland	1,245049	SANDNES SPAREBANK	1,289758	SPAREBANKEN PLUSS	1,250801
Bank 4	Haltdalen Sparebank	1,180207	SPAREBANKEN PLUSS	1,212766	VESTRE SLIDRE SPAREBANK	1,196883
Bank 5	Voss Sparebank	1,12391	BJUGN SPAREBANK	1,113333	SANDNES SPAREBANK	1,1854
Average	Sparebanken Pluss	1,31957	SPAREBANK 1 GRAN	1,063115	TYSNES SPAREBANK	1,15344
Bank -1		0,902902		0,885666		0,913646
Bank -2	Strømmen Sparebank	0,704378	JERNBANEPERSONALETS SPAREBANK	0,780642	STRØMMEN SPAREBANK	0,488125
Bank -3	Halden Sparebank	0,748628	HALDEN SPAREBANK	0,780903	HALDEN SPAREBANK	0,793543
st.dev	Bien Sparebank	0,77674	STRØMMEN SPAREBANK	0,226429	KVINNHERAD SPAREBANK	0,811782
		0,110317		0,131228		0,13462
	2007					
		Score				
Bank 1	SANDNES SPAREBANK	1,398344				
Bank 2	FLEKKEFJORD SPAREBANK	1,244457				
Bank 3	SPAREBANKEN PLUSS	1,113028				
Bank 4	BJUGN SPAREBANK	1,083054				
Bank 5	VESTRE SLIDRE SPAREBANK	1,03613				
Median		0,84571				
Bank -1	SPARESKILLINGSBANKEN	8,54E-08				
Bank -2	HEGRA SPAREBANK	0,736412				
Bank -3	SpareBank 1 Nordvest	0,758484				
St.dev		0,120732				