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Interest Rate Sensitivity of Real Estate Companies' Income Statements

A Study on the Swedish Market in a Low Rate Environment

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Abstract

Title: Interest Rate Sensitivity of Real Estate Companies' Income Statements - A Study on the Swedish Market in a Low Rate Environment

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Key words: Real estate companies, repo rate, income statement sensitivity, pricing of debt, mixed methods research

Purpose: The purpose of this study is to empirically investigate the sensitivity of Swedish real estate companies' income statements towards a 100 basis point increase in the Riksbank's repo rate.

Methodology: A mixed methods research approach is employed. Qualitative research and theory constitute the framework for this study, to later be validated against the findings from three multiple regressions.

Theoretical perspectives: Robert C. Merton's theory of pricing corporate debt is, together with the findings of this study's qualitative research, used as framework for this study.

Empirical foundation: The qualitative research of this study consists of semi-structured interviews with six market experts. The quantitative research is constituted by company data and macro data: The company data includes a sample of ten companies over a ten year period, amounting to 100 firm-years. The macro data constitutes 521 observations over a ten year period.

Conclusions: The study can confirm the sensitivity of Swedish real estate companies' income statement towards changes in the Riksbank's repo rate. The findings imply that two items are affected, interest expenses and revaluation of properties. A hypothetical 100 basis point increase in repo rate implies, according to the results, a 212 basis point decrease in revaluation of properties and a 40 basis point increase in interest expenses. This study's focus on income statements complements previous literature that largely focuses on real estate companies' returns and probability of default. Furthermore, the study investigates the effects of interest rates in the current unique low rate environment in Sweden, strengthening the research on the effects of low central bank rates.

1. Introduction 1
1.1 Background 1
1.2 Problem discussion 3
1.3 Purpose of research 7
1.4 Limitations 7
1.5 Outline 8

2. Theoretical framework 9
2.1 Theory analysis and application 9
2.2 Merton's theory of pricing corporate debt 9

3. Methodology 11
3.1 Procedural outlining 11
3.2 Data collection 13
3.2.1 Data collection - Qualitative research 13
3.2.2 Data collection - Quantitative research 14
3.2.3 Interviews 15
3.2.4 Summary of interviews 19
3.2.5 Sample data 21
3.3 Regressions 22
3.3.1 Variables 23
3.3.1.1 Dependent variables 24
3.3.1.2 Independent variables 25
3.3.1.2.1 Interest rate variables 25
3.3.1.2.2 Control variables 26
3.3.2 Regression 1: STIBOR90 27
3.3.3 Regression 2: INTEREST EXPENSE 27
3.3.4 Regression 3: REVALUATION 28
3.4 Econometric approach 28
3.5 Validity 30
3.5.1 White's test 31
3.5.2 Durbin-Watson test 32
3.5.3 Bera-Jarque test 32
3.5.4 Redundant fixed effects test 32
3.5.5 Test for multicollinearity 33

4. Results 34
4.1 Regression 1: STIBOR90 34
4.2 Regression 2: Interest expense 37
4.3 Regression 3: Revaluation 41

5. Analysis and discussion 46

5.1 Analysis of results 46
5.2 Overall analysis and discussion 48
5.3 Practical Implications 49

6. Conclusions 50
6.1 Concluding remarks 50
6.2 Areas for future research 51

7. References 53

8. Appendices 56
8.1 Appendix 1: List of companies and key financial metrics 56
8.2 Appendix 2: List of respondents 57
8.3 Appendix 3: STIBOR90 and repo rate 59
8.4 Appendix 4: Regression of STIBOR90 60

List of tables

Table 1: Summary of variables
Table 2: Regression of STIBOR90
Table 3: White’s test on STIBOR90-regression
Table 4: Correlation matrix on STIBOR90-regression
Table 5: Regression of Interest Expense
Table 6: White’s test on Interest Expense-regression
Table 7: Correlation matrix on Interest Expense-regression
Table 8: Redundant test on Interest Expense-regression
Table 9: Regression of Revaluation
Table 10: White’s test on Revaluation-regression
Table 11: Correlation matrix on Revaluation-regression
Table 12: Redundant test on Revaluation-regression

List of figures

Figure 1: The Riksbank repo rate and BIS real estate price index, Sweden
Figure 2: Illustration of mixed method research methodology
Figure 3: Interest Rate and Debt to Equity.
Figure 4: Bera-Jarque test on STIBOR90
Figure 5: Bera-Jarque test on Interest expense
Figure 6: Bera-Jarque test on Revaluation
Figure 7: STIBOR90, Repo Rate and spread.
Figure 8: The Interest rate fluctuation model

List of abbreviations

BLUE - Best Linear Unbiased Estimators

CFO - Chief Financial Officer

CLT - Central Limit Theorem

CPI - Consumer Price Index

GDP - Gross Domestic Product

GFC - Global Financial Crisis

ICR - Interest Coverage Ratio

IFRS - International Financial Reporting Standards

IPO - Initial Public Offering

LHS - Left Hand Side

M&A - Mergers & Acquisition

OLS - Ordinary Least Squares

STIBOR - Stockholm Interbank Offered Rate

STIBOR90 - Stockholm Interbank Offered Rate, 3 month maturity

REC - Real Estate Company

REI = Real Estate Investments

REIT - Real Estate Investment Trust

RHS - Right Hand Side

RSS - Residual Sum of Squares

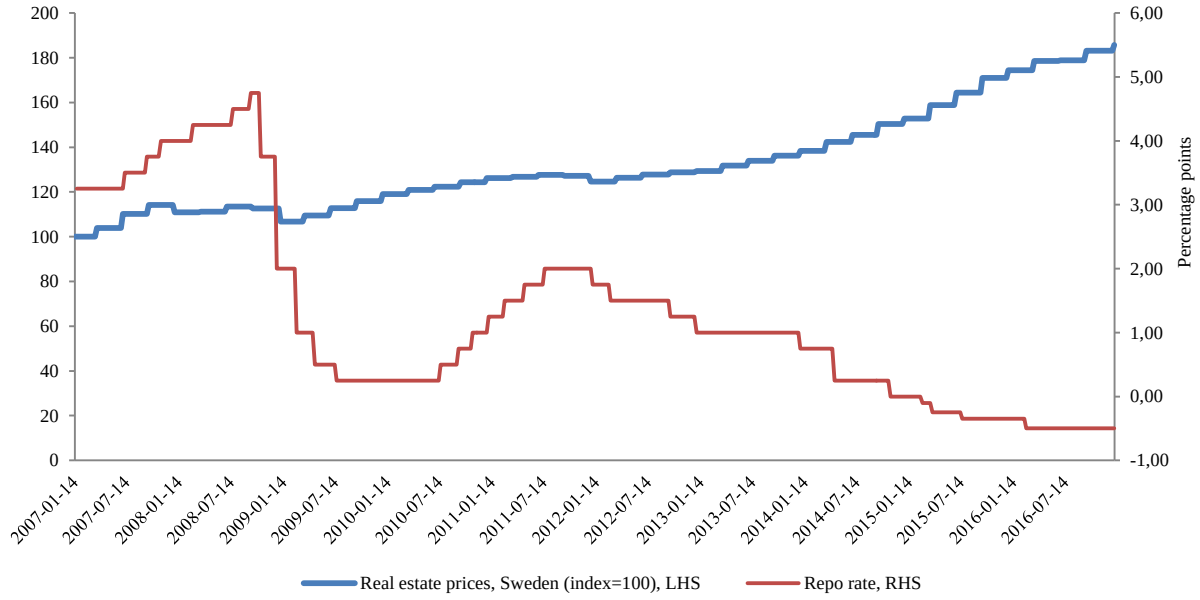
1. Introduction

The first chapter initially provides the reader with an overview of the subject and the problems identified in earlier studies and the results from the qualitative research. Later, the purpose of this study is stated followed by a description of the limitations and the outline of this thesis.

1.1 Background

The past five years, the real estate market in Sweden has soared, partly as an effect of the Swedish central bank, the Riksbank, which has been reducing the repo rate aggressively. At today's level of -0.50 per cent, we are facing a significant deviation from the normalized levels of 2.5-4.0 per cent (the Riksbank, 2017). This development has been highly profitable for Swedish Real Estate Companies (henceforth abbreviated as REC) as a result of their capital intensive nature[1] and the real estate market has thrived, as seen in Figure 1. However, since the expectations indicate rate hikes going forward, stakeholders are starting to investigate these companies' sensitivity to a changing market environment (Megaw, 2017).

The Riksbank's repo rate and Swedish real estate prices



[1] *Capital intensive nature refers to that real estate constitutes the majority of RECs' assets on their balance sheets.*

Figure 1: *The Riksbank's repo rate and the Bank of International Settlement's real estate price index, for Sweden, in a ten year perspective. Sources: The Riksbank, Bloomberg.*

The repo rate is the main monetary tool the Riksbank uses to maintain financial stability in Sweden over time (the Riksbank, 2017). As this is the rate banks can lend money to, it is one of the most important determinants for the price of money (the Riksbank, 2017). Consequently, the repo rate constitutes the foundation for banks' lending rates. The repo rates are currently at historically low levels globally and have therefore been a frequent subject of discussion lately. Since the situation is somewhat historically unpreceded, the subject has been given limited academic research.

In this study, RECs refer to limited liability companies that manage and own real estate. In addition to RECs, Real Estate Investment Trusts (forthcoming abbreviated as REIT) is a common entity internationally, especially in the United States. Glascock et al. (2017) identifies two main differences between the two entities. Firstly, RECs are subject to common company taxation, while REITs can be tax exempt if certain criteria are followed. Secondly, RECs use debt to grow, while REITs are mainly financed by equity. REITs' relation to interest rates has not gone unnoticed historically. Allen, Madura and Springer (2000) proved that REIT returns are highly sensitive to changes in interest rates. Through a cross-country study, Akimov et al. (2015) could similarly confirm the sensitivity of REIT returns to unexpected changes of the interest rate. However, REITs are not yet regulated in Sweden, thus making RECs the relevant entity for this study. As much of the previous research has focused on the U.S., where REITs are the more common entity, the difference between the two is important to take note of. The difference becomes even more intriguing taking Allen et. al. (2000) and Akimov et al.'s (2015) findings of REITs being sensitive to changes in interest rate into account. If REITs have lower debt levels than RECs, and can be proven as highly sensitive to changes in interest rate, RECs' sensitivity towards changes in interest rate might be significantly higher.

The difference in debt levels between the two entities is particularly interesting in today's low rate environment. Looking at the Swedish market, the repo rate has been in a declining trend since 2011 (The Riksbank, 2017). Money supply and credit supply become important due to RECs' capital intensive nature and since they often use leverage to grow (Glascock et al, 2017). Low rates have been favorable for RECs and consequently, Swedish RECs' debt has grown exponentially**.** Simultaneously, the price level of Swedish real estate has escalated, resulting in higher net property values and increasing the balance sheets. Since IFRS 13, which requires RECs to revalue properties to market value, applies to all Swedish RECs, this increase in price levels has also affected net income positively (IASB, 2011).

Contradictory to what the decreasing interest rates might imply however, there is a number of sizable Swedish RECs, whose Interest Coverage Ratios[2] (henceforth abbreviated as ICR) are at relatively low levels (see Appendix 1). It could be argued for, that if interest rates are at record lows, RECs would be able to cover their interest costs very well. Instead, ICR for some of the more important Swedish RECs are at levels where a sudden interest hike could increase the risk of default dramatically.

The current market situation, with soaring real estate prices and record low interest rates, are, for Swedish RECs, undoubtedly unpreceded historically. There is comprehensive previous research determining default risk in relation to fundamental, macro and micro variables. Further, many previous publications have investigated REC and REIT returns on the stock market as a function of fluctuations in interest rates. The results have proven returns to be highly sensitive, but how does fluctuations in interest rate affect the underlying income statement for RECs?

1.2 Problem discussion

Returns of RECs as an effect of interest rates are a well-covered area. Similarly, default risk as a function of interest rates is also a subject that is comprehensively covered by literature. Furthermore, there are several important models applicable to company financials, where Merton's (1974) theory of pricing corporate debt is one of the more important ones. Although there have been research on interest rates during a period with negative central bank rates, there is limited or none focusing on its implications on RECs' financials. Moreover, the majority of the previous literature focuses on real estate returns rather than the underlying companies' financials (i.e. financial statements). The majority of the research subjects mentioned above have in common that they use a quantitative method as their main tool to answer their research question. Lastly, most of the studies focused on the U.S. market and were performed when negative central bank rates still were unexplored.

Starting off with research regarding REIT and REC returns in relation to interest rates, Chen and Tzang (1988) identified U.S. Equity REITs to be sensitive to changes in short- and long-term interest rates. They approached the problem using Merton's (1973) intertemporal capital asset pricing model to analyse the effect fluctuations in various maturity U.S. T-bills have on the price of publicly traded REITs. Allen et al. (2000) complemented this research by investigating whether REIT characteristics, such as leverage and

[2] *Interest Cost Ratio (for RECs) is calculated as follows: ((Earnings-Revaluation of properties) Before Interest expenses and Taxes) / Interest expenses*

asset structure among other variables, are similarly sensitive to changes in interest rates. They concluded that no evidence could be found proving that REITs' management could alter their sensitivity toward rates by changing company specific factors, e.g. leverage. More broadly, Bernanke and Kuttner (2005) analysed the effect a hypothetical unanticipated 25 basis-point cut in the U.S. federal fund rate would have on stock indices. They found that, hypothetically, a 25 basis-point cut would lead to a 100 basis-point increase in the related stock index, implying a strong negative correlation. Later on, Akimov et al. (2015) extended the previous literature, which largely looked at the U.S. REIT sector, by performing a cross-country study on real estates' sensitivity to interest rates. The study could again confirm the relationship between real estate returns and changes in interest rate, although arguably even more significant as the study also included other countries. As becomes clear in this paragraph, much of the previous research has been interested in the short-term market reactions (i.e. the returns) in relationship to interest rates. This study is rather interested in the long-term effect fluctuations in interest rates have on companies' financials.

Another well covered area of research is interest rates' impact on default risk of both RECs and financial institutions. Much of the previous researches applied logit or probit models[3] to analyse the reasons of default. Some of the more important early literature includes Altman (1967) and Martin (1977), with their extensive research on determinants to corporate failures. However, they were limited mostly to company specific factors. Kane, Richardson and Greybeal (1996) suggest two categories of relevant variables: 1) Macro economic variables, and 2) Micro economic variables. Among the macro variables included in their study, they found that interest rates have a significant effect on the default risk. Similarly, Vlamis (2007) identified interest rate to be one of the most important variables when determining default risk of RECs and REITs. As noted however, the previous literature mainly uses probit or logit models and hence focuses on interest rate's effect on default risk rather than its effect on companies' financials.

While most of the research on RECs has focused on returns and default risk, other studies have focused on companies' financials. Merton (1974) established a foundation for determining the cost of corporate debt, in this study often referred to as interest rates. He found that the price of corporate debt depends on three variables: 1) The riskless interest rate, 2) Restrictions and provisions in the indenture, and 3) The probability of default. Pricing of debt is fundamental for RECs, as an increase in the repo rate would increase RECs' interest costs (Merton, 1974; Respondent 1-6 2017, personal communication).

[3] *Logit- and probit models are statistical models where there is one true value out of two outcomes (e.g. pass/fail, win/loss etc.), and are often used to calculate probability of default (Vlamis, 2007).*

Merton's (1974) theory provides a framework for pricing debt with restrictions contained in that specific indenture, making it hard to generalize their impact on interest expense when studying a company's performance. Thus, to best optimize the use of Merton's (1974) theory, complementary research seems necessary to achieve a comprehensive framework for RECs.

In summary, even though most of these studies focus on interest rates and RECs, there is a great difference between them. Chen and Tzang (1988) identified U.S. REIT returns to be sensitive to fluctuations in U.S. T-Bills, Allen et al. (2000) discussed if varying characteristics of REITs could explain the interest rate sensitivity, Bernanke and Kuttner (2005) analysed the effects on the broad stock market from a 25 basis-point cut in the U.S. federal fund rate and Akimov et al. (2015) complemented the previous research with a cross-country study. Altman (1969) and Martin (1977) built risk models for analysing reasons of corporate failure, Kane et al. (1996) added interest rate as an explanatory factor for corporate failure and Vlamis (2007) identified interest rate risk to be significant in the case of RECs. These studies discuss a similar subject, but there is, to our knowledge, no existing work focusing exclusively on the income statements of RECs in relation to interest rates. Further, there are limited studies examining the Swedish RECs in the current low rate climate.

Interest rate's impact on RECs' financials has however remained relatively unexplored and previous research is too unrelated to the subject to identify a concrete and narrow literature gap. Instead, to best be able to comprehend the full complexity of RECs in relation to interest rates, this study initially utilizes the expertise of a number of market experts through qualitative research. This approach differs from previous research as our purpose and problem are largely based on the results from our interviews to later be validated with quantitative research. To the authors' knowledge, few studies on RECs have used a mixed methods research[4] approach, including both qualitative and quantitative research. Prior research has been limited mostly to quantitative models when analysing interest rate sensitivity. However, the authors argue that a mixed methods approach is useful to analyse its impact on financial statements due to RECs' complex nature. In this case, we performed qualitative research due to the wide literature gap. Below, we will present part of the relevant information found during the qualitative research.

Going back to the risk model Altman (1968) formulated, many of the key financial metrics are based on the ability to pay principals and amortize debt. One of the key metrics often referred to as being the most

[4] *Mixed methods research includes both qualitative and quantitative research and is often useful to overcome practical constraints (Bryman and Bell, 2011)*

important by our respondents is ICR. To cite one of the respondents, a CFO at one of Sweden largest RECs:

"ICR is always interesting ... It is interesting to follow. If you are at 2x in this low interest environment, you are in a bad position." (Respondent 3 2017, personal communication)

The average ICR in December 2016 was 3.8x for our sample of ten Swedish RECs. The 10 year historical average for the same sample is approximately 2.9x. However, the range goes from 2.2x to 8.6x, meaning that the companies in the lower part of the range could be at critical levels. At the same time, the average interest rate for the sample was 2.4 per cent, which can be compared to the 10 year average of approximately 3.4 per cent (see Appendix 1). We find this discrepancy, where ICRs for a number of sizable Swedish RECs, surprisingly, are below the historical average while rates are significantly below their normalized levels, intriguing. The ICR levels would ideally be higher than the historical levels in a low interest rate environment, since lower interest rates would yield lower cost of debt. Thus, only a marginal change in average interest rate could potentially decrease ICRs to critical levels.

According to IFRS 13, which is the most current guidelines regarding real estate valuation in Sweden, real estate holdings should be valued according to market price (IASB, 2011). These guidelines apply both in an upturn and downturn of the market and have hence, with continuously soaring real estate prices, been very beneficial for Swedish RECs, see Figure 1. However, several of our respondents agree that there could be a negative correlation between real estate prices and hiked interest rates (Respondent 2-6 2017, personal communication). One of the respondents that work within Corporate Finance, with focus on Swedish real estate, describes the correlation as follows:

"Of course interest rate levels will have a significant impact [on RECs]. Even if they don't go into default, it could have an impact ... Hiked interest rates could have a significant impact on real estate valuations." (Respondent 2 2017, personal communication)

This relationship goes back to the repo rate's role as a monetary tool and how an increase in repo is a restrictive monetary policy affecting the economy negatively (Sims, 1980). One respondent (6 2017, personal communication) further described real estate as RECs' main asset and that a decrease in real estate prices would worsen their risk profile. A decrease in assets' values would stress RECs' balance sheets which could potentially increase the default risk. Another respondent, who manages a global hedge

fund at one of the larger Swedish investment banks, is a bit harsher when asked if there are any increasingly exposed RECs:

"I think it is about the life span of the companies … If you look at IPO's the past three years in Sweden I should be able to find more than one that will default the coming [economic] cycle." (Respondent 5 2017, personal communication)

The item "revaluation of properties" has been left out of most previous literature regarding REC's exposure to interest rate fluctuations, including, among others, Altman (1968), Vlamis (2007) and Akimov (2015). The authors however, in accordance with our respondents, find this to be a crucial item when analysing interest risk for RECs.

In conclusion, previous literature provides this study with a background of the subject, but the authors still find the literature gap significant. REITs' sensitivity to changes in interest rates is a well explored area as well as the impact of changes in interest rates on default risk of REITs and RECs. However, the impact of changes in interest rates on Swedish RECs' financials is, according to the authors, of particular interest in this low interest rate environment. Thus, this study will examine Swedish RECs' income statements' exposure to interest rate risk.

1.3 Purpose of research

The purpose of this study is to empirically investigate the interest rate sensitivity of Swedish real estate companies' income statements. In order to fulfill this purpose, we will attempt to answer the following question:

- *To what extent would an increase in the repo rate of 100 basis points affect the income statements of Swedish real estate companies?*

The presumed scenario is an increase in repo rate and the subject for examination is the real estate companies' income statements.

1.4 Limitations

As the specific focus of this study has been given limited research overall, there are factors outside the scope of this study whose possible impact has not been determined. These factors primarily include

hybrid debt and changes in accounting standards, rules and regulations. The results and conclusions of this study are based on the current market situation and do not take hybrid debt into account.

All the studied companies are Swedish and aim to represent the Swedish sector. Due to the many national irregularities in accounting standards and tax systems, the results from this study are only applicable for Swedish RECs and should not be interpreted differently. This study's qualitative research implied that regulations are of high magnitude for the performance of RECs.

The structure of debt is more complicated in practice than it appears on the financial statements. In order to optimize their capital structure, companies can use hybrid debt, also called mezzanine debt, which does not appear on the balance sheet. Hybrid debt is neither classified as equity nor debt and has varying characteristics. Similarly, the different sorts of hybrid debt vary in transparency thus making it hard to quantify and it has therefore not been included in this study. This is in line with earlier research, for example, Vlamis (2007) argues that loans structure does not have any prime importance when assessing UK RECs' default risk.

The time period of this study is 2007-2016 and includes ten companies. The majority of the data is extracted from a period of decreasing central bank rates. The choice of sample companies was based on numerous characteristics which are presented in detail in Section 3.2.5. Thus, the findings of our research are exclusively referring to the sample companies and can only be viewed as an indication for the sector.

1.5 Outline

The remainder of this thesis is outlined as follows:

- **Framework:** This chapter includes a summary and presentation of Merton's (1974) theory of pricing corporate debt, which constitutes a theoretical framework to validate against the study's findings.
- **Methodology:** A thorough description of the working process, collection of both the qualitative and the quantitative data as well as a presentation of the regressions.
- **Results:** The results from the three regressions are presented in this chapter.
- **Analysis and discussion:** The results are analysed in relation to the respondents' answers to later be interpreted in relation to existing literature.
- **Conclusion:** A final summary and review of the findings of this research.

2. Theoretical framework

In this chapter, the theory of pricing corporate debt is presented, which complements the qualitative research as a framework for evaluating the repo rate's impact on interest expense.

2.1 Theory analysis and application

Due to the capital intensive nature of RECs, the pricing of corporate debt becomes relevant when analysing the sensitivity of increases in the repo rate. The purpose of this study is to test the impact of changes in the Riksbank's repo rate on RECs' financials. According to the respondents (1-6 2017, personal communication), revaluation of properties and interest expense are the key financials of RECs exposed to interest rates. To analyse the effect changes in the repo rate has on interest expense, Merton's (1974) theory of pricing corporate debt will complement the qualitative research as a framework.

2.2 Merton's theory of pricing corporate debt

Merton (1974) used Black and Scholes' (1973) formula for pricing options as starting-point when developing a formula for pricing corporate debt. The formula itself was of a quantitative character, however, he also deducted three important qualitative variables. The quantitative formula is applicable for risky bonds assumed a given term structure. Both the qualitative and quantitative results include variables specific for each indenture and are not meant to be generalized for all debt a company holds (Merton, 1974). In accordance with the limitations of the Black and Scholes's (1973) formula, there are a few limitations of this research and formula. These limitations include assumptions such as: No transaction cost, no taxes and invariant firm value in relation to capital structure similar to the Modigliani-Miller theorem (Modigliani and Miller, 1958).

However, Merton (1974) extracted three main qualitative aspects which the pricing of corporate debt essentially depends on. These are as follows.

The required rate of return on riskless debt.
Government bonds are often used as a proxy but high rated corporate bonds can also be classified as an approximation of risk free bonds. The riskless debt is often unique for each country. (Merton, 1974)

Various restrictions and provisions of the debt.

Restrictions refer to the company's obligations towards the lender. These include, among others, debt ratios and ICRs. Provisions are characteristics of the debt and could include coupon rate, maturity date, and seniority in the event of default among others. (Merton, 1974)

The probability of default.

This aspect is mainly referring to the firm's probability of defaulting on their loans. This applies on both the risk of default for the company and the risk that the company defaults on the specific loan. Thus, it aims to price the risk that the company does not have enough cash on hand to pay its debt obligations. (Merton, 1974)

3. Methodology

In this chapter, a detailed description of the methodology in this research is provided in the beginning. This is followed by a presentation and motivations for the data collection and a narrow description of the tests performed and the variables included in them.

3.1 Procedural outlining

A mixed methods research approach is used in this study, as illustrated in Figure 2. The intended outline of this research was primarily a deductive approach[5] based on Merton's (1974) theory of pricing corporate debt. However, in order to do so, and still account for the complexities associated with RECs, qualitative research was performed. The approach is illustrated with a modified version of the criteria presented by Bryman and Bell (2011), see Figure 2. This study's principal data-gathering tool is, by the authors, considered to be quantitative. However, the qualitative research precedes the quantitative research and the bulk of the quantitative data is collected in line with the findings of the qualitative research. E.g., in the qualitative research, our respondents (1-6 2017, personal communication) mention revaluation of properties to be an important variable when assessing RECs. Thus, data points on revaluation was collected and used in Regression 2 and Regression 3. Furthermore, since all respondents underlined the importance of cost of debt, Merton's (1974) theory of pricing corporate debt became relevant for this study and has hence complemented the qualitative research as a framework for the analysis of results, as seen in the lower box in Figure 2 (Respondent 1-6 2017, personal communication).

[5] *Deductive approach is an approach where observations are done on the basis of what is known about a particular domain (Bryman and Bell, 2011).*

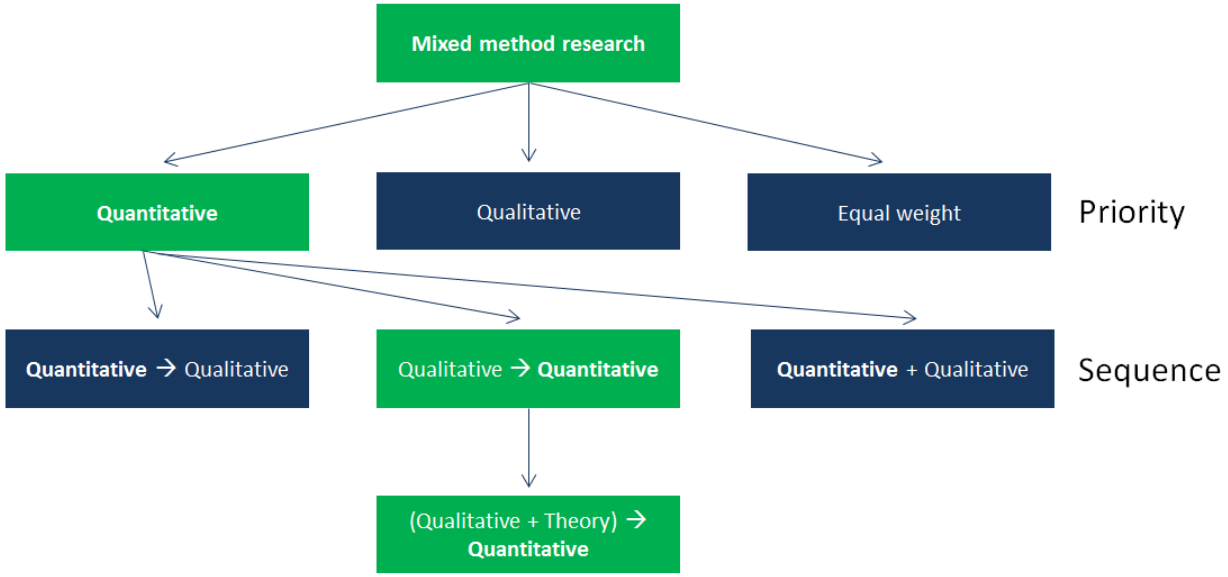


Figure 2: *Illustration of the mixed methods research methodology used in this study. The first stage, Priority, shows that the primary research is quantitative. Sequence illustrates how the quantitative research was approached, i.e. via qualitative research and theory. Source: Modified version of Figure 25.1 in Business Research Methods 3rd ed., Bryman and Bell (2011).*

The second phase of this study includes testing the findings from the quantitative part on the initial framework, comprised by Merton's (1974) theory and qualitative research as described above. This approach is similar to the method referred to by Hammersley (1996) as triangulation[6], which is to validate the qualitative research and Merton's (1974) theory using the quantitative research. E.g., the results of Regression 2 are tested towards the criteria put forward by Merton.

In summary, the data-gathering was divided into a two phased, mixed methods research. The first phase was comprised of qualitative research and the latter phase was quantitative research in accordance with a deductive approach. The sequence of this mixed research method is thus qualitative and theory → quantitative, where the quantitative research was the main priority as its results was used to answer the research question (Bryman and Bell, 2011). Since the quantitative findings then where applied to the qualitative research and Merton's (1974) theory, a methodology similar to triangulation was used.

[6] *Triangulation is one of three approaches used for mixed methods research and refers to quantitative research as a tool to validate the previous qualitative research or vice versa (Hammersley, 1996).*

3.2 Data collection

As part of our empirical research we have executed semi-structured interviews[7] including respondent specific questions as a qualitative research (Skärvad and Lundahl, 2016). The group of respondents includes a variety of market experts (see Appendix 2). The interviews were performed in an early phase of the research and played a crucial role in the process as it constitutes the first part of our mixed methods research. First, we wanted to understand their view on the previous, current and future drivers of the real estate market. Secondly, it allowed us to get a deeper understanding of certain characteristics of the industry. These characteristics include accounting standards and key financial metrics. Thirdly, and possibly most importantly, what deducted from our qualitative research constitutes part of this study's framework.

Once we had gotten an overview of the market through our qualitative research and formulated the purpose of this study, we shifted focus towards quantitative research. The major element when performing our quantitative research was to pick RECs relevant to our research. Having chosen our sample, we extracted the relevant metrics in accordance with Merton's (1974) theory of pricing corporate debt and our qualitative research. The relevant metrics included relevant company financials and macro variables such as historical data for the relevant interest rates.

3.2.1 Data collection - Qualitative research

Our selection of respondents was mainly based on three factors: 1) Their availability. This factor is primarily referring to our personal contacts. Our belief is that a previous contact motivated the respondent further to contribute with his or her in-depth knowledge. It also allowed us to ask complementary questions to enhance the quality of the interviews further (Skärvad and Lundahl, 2016). 2) Their ability to contribute with expertise in the relevant market. A high level of expertise allows us to get a good market perspective (Skärvad and Lundahl, 2016). 3) Their current and past role in the market. Graham and Harvey (2001) utilized their qualitative study by the usage of a variety of market experts in order to heighten the quality of their research. We have interviewed employees whose employers either are directly or indirectly exposed to the market. Our respondents' exposure is of varying magnitude and in order to get a comprehensive perspective of the market we have chosen one or two from differing levels of exposure. Each of our respondents has, upon agreement, decided to be anonymous.

[7] *A semi-structured interview refers to an interview where a template of questions is prepared and used, but the interviewers still have the option to add follow-up questions or new questions if deemed needed or necessary (Lundahl and Skärvad, 2016).*

The respondents include six Swedish market experts, who were interviewed during four occasions, see Appendix 2. Respondent 1 and 2 who work as associates within debt capital markets and M&A at a corporate finance firm, solely focusing on RECs, were interviewed in one session. They contributed with market expertise mainly on valuation and Swedish RECs transactions. Their employer is little exposed to the market.

Respondent 3 and 4 work as a CFO and Finance Controller respectively at a listed REC, which was included in our sample. Responsibilities relate include financials and risk management, and their expertise allowed us to get an in-depth view of the company's conception and actions. Their employer is, however, highly exposed to the market and potential partiality has been taken into consideration. In order to get a market perspective, Respondent 5 and 6 who works as Portfolio Managers at a major Swedish investment bank were interviewed. Respondent 5 contributed with market expertise on the macro environment, value drivers and market risks and opportunities. Respondent 6 on the other hand contributed with expertise on interest rates, the credit market and debt structure for RECs. Their employer is indirectly exposed to the market but we do not believe that it affected their answers as their specific department at the bank has limited exposure to the market.

All authors attended everyone but one interview in order to avoid any errors due to interviewer variability[8]. The interviews have been performed via telephone due to geographical differences between the authors and the respondents. A disadvantage of performing interviews via telephone rather than face-to-face is that the respondents interviewed via telephone are more likely to not express an opinion (Bryman and Bell, 2011). The authors are aware of this drawback hence the questions were formulated accordingly and of a semi-structured character (Bryman and Bell, 2011). The questions asked in each interview have been standardized as a base while follow up questions have been customized for each interview. The interviews have been transcribed in order to allow a more thorough examination of what the respondents said (Bryman and Bell, 2011). The transcription can be provided upon request, see Appendix 2.

3.2.2 Data collection - Quantitative research

The quantitative research includes three regressions of both macro variables and company specific variables. The focus is solely on Swedish RECs. Among these, a sample of ten RECs has been chosen as

[8] *Interviewer variability refers to how the respondents may perceive the questions differently depending on who is interviewing and may consequently result in decreased validity (Bryman and Bell, 2011).*

our sample based on the criteria discussed in Section 3.2.5. The time period studied in this thesis is 2007-2016.

This study focuses solely on Sweden due to a number of factors, which are: 1) The development of the domestic real estate market, 2) The development of and current debt levels, 3) The domestic central bank policy, and 4) The access to data, both qualitative and quantitative.

Relevant data has been selected based on the results of our qualitative research and the theoretical framework. Important variables have been identified to be, among others, valuation of real estate, long term debt, ICR, leverage ratio, interest expense and debt terms. The primary dataset has been collected from Bloomberg and S&P Capital IQ. The dataset has been validated with company data, deducted from yearly reports. The company data contains fiscal annual data. As the sample includes ten companies over ten years' time, a total of 100 yearly reports have been reviewed.

Other relevant data points include the repo rate and three month STIBOR (forthcoming abbreviated as STIBOR90), which has been deducted from the Riksbank and Bloomberg. Further, Swedish real estate prices have been deducted from Bank of International Settlements. All of the data above considers the time period 2007-2016.

3.2.3 Interviews

In the following section, the answers from the interviews are presented. Every presented answer is our interpretation of the answers, the transcribed versions can be provided upon request. There have been four separate interviews with a total of six respondents, the selection process of respondents is presented in Section 3.2.1.

Which have, for the last ten years, been the most important value drivers for the real estate industry in Sweden?

In summary, our respondents identified three crucial value drivers for the real estate industry in Sweden: 1) The low interest rate environment, 2) The increased supply of money and credits, and 3) A strong Swedish economy and beneficial supply-demand situation. Firstly, all of our respondents identified the low interest rate environment to be the most important driver. The low repo rate, currently at -0.5 percent, has affected the Swedish economy, the way RECs fund themselves and both money and credit supply.

One respondent adds that in the case of an open economy such as Sweden, the change was rather sudden and no one really expected the repo rate to drop so quickly and to such low levels. Secondly, as the low interest rate has made both bank loans and other types of debt attractively valued in relation to historical prices, the total amount of credit on the market has grown exponentially. Lastly, our respondents identified a beneficial supply-demand situation, where demand has more than offset supply, driving real estate prices up. However, they argue that this effect has primarily been isolated to the bigger Swedish cities. Further, the overall Swedish economy has been strong, with high occupation levels and increasing rental levels. All of our respondents however suggest a relationship between real estate prices, interest rates and central bank policies.

Could you identify any potential real estate market risks in today's environment?

All of our respondents identify increasing interest rates as a risk. However, none of our respondents see the interest rate risk as an immediate catalyst, they argue that the main risk for RECs is rather through a lagged effect. Several respondents mention increasing interest levels' broad impact on the Swedish economy as a noticeable risk. Today heavily fueled by debt, reducing household income would decrease market demand, prices and rental levels for real estate. Increasing vacancies could be another result of increasing interest rate levels. Using measurements such as inflation and GDP-growth, this effect should be able to be captured relatively properly. Decreasing interest levels will, according to our respondents, probably not drive RECs into bankruptcy. However, according to one respondent, there is a risk that at least one REC will go into bankruptcy within this economic cycle. Further, several goes on mentioning that it is important to distinguish RECs from real estate developers as these two types of companies are very different fundamentally. While most RECs should be safe against most real estate market catalysts, developers might not be. Furthermore, real estate is today highly valued and could also be affected by higher interest rates. Since RECs revalue their properties every quarter in accordance with IFRS 13, decreasing property values could have a significant effect on net income. Another event that could affect the real estate market is new market regulations. The respondents identified future tax reforms as a possible event that could have an impact on RECs. There are also market specific risks which potentially could change the market structure. For example, the emerging e-commerce market is a threat for many RECs that are exposed to traditional retail.

How will real estate companies handle a scenario with higher interest rates?

Our respondents highlight that the share of fixed versus floating rates will be crucial in how different companies will be affected. Companies with a large amount of their debt in swap rates with long maturities will come off better since there will be a lagged effect on their borrowing rate. Companies with early maturity debt and floating interest rate will experience a more direct effect by a change in the repo rate since they have to refinance their previous debt. A highlighted key metric is average fixed term credit, which is the average maturity of a company's interest payments. Another important variable that will determine how well companies can handle a scenario of higher interest rates is, according to our respondents, how much debt they have in relation to equity and how it is structured. While some of the companies with a longer history are well capitalized and have used debt cautiously in this environment, some companies have aggressively been growing their real estate portfolio using debt and will thus be more sensitive against increasing interest levels. Further, some of today's RECs have a large share of off-balance sheet debt, such as preferred shares or other types of mezzanine debt that could have an impact in the end.

What determines the price of debt, how has debt structure changed the past couple of years and how will this be affected if interest levels increases?

Our respondents argued that the bond market and bank loans are functions of each other and highly dependent on the interest rate. According to two of our respondents with expertise on the subject, STIBOR90 is the benchmark for interest rates in the real estate sector. STIBOR90 is often used as the reference rate, which the bond market and banks use as a basis for pricing debt. Further, they imply that STIBOR90 should be closely related to the repo rate. In addition to STIBOR90, the bank and the bond market price the interest spread depending on the risk associated with the borrower. However, it is worth noticing that the bond market is using the actual level of STIBOR90, which is circa -0.6 per cent, while the banks use a rate floor set at 0. This becomes very important when a company is deciding whether to finance themselves with bonds or bank loans. If a company wants to borrow from the bond market the price of the bond will be STIBOR90 plus the margin, say 60 points, which then would be 0 basis points. If the same company wants a bank loan, they will get the floor plus the margin, i.e. 60 basis points. Thus, a lot of companies have preferred issuing bonds rather than taking bank loans as we have been experiencing negative repo and STIBOR90 rates. The swap-rate is also of interest since it is the cost of fixing the rate. Further, as bank loans in Sweden are limited to five years, RECs that want to fix their rates for longer time periods can use foreign interest rate swap-rates whose maturity date is ten years from now. Looking forward, one of our respondents investing in real estate bonds among other instruments argue that investors will probably be looking to reduce their risk in a scenario with increasing interest levels.

Such a scenario would likely increase the spread on the bond market, while bank financing probably would not be similarly affected since many of the companies have long going relationships with the bank and are therefore able to negotiate terms better. However, new companies with limited history and relationships with the financial institutions will probably struggle in receiving new loans, as our respondents argue that banks will become more selective in choosing their borrowers if the market becomes more risky.

How have the debt levels in the sector evolved in this low interest rate environment?

Despite the low cost of debt, significant shares of the Swedish RECs have a relatively low debt to equity level according to our respondents. They explain the low debt equity levels as function of four primary factors: 1) Caution from the companies due to the abnormal interest rates, 2) Increasing real estate prices, 3) Increased use of off-balance sheet debt, and 4) Regulations making it more expensive for banks to be exposed to certain sectors. Firstly, since the interest rate has deviated from the normalized interest rate, which, according to our respondents, is closer to 2.0 per cent, many of the RECs have been cautious using too much debt. Secondly, the respondents argue that the quick increase in property prices has decreased the ratios. The main reason for increasing values is mainly due to unrealized increases in property values and not cash flows, making it a bit controversial. Thirdly, it has more difficult to compare debt levels between companies, since mezzanine debt has become more common after the GFC. Many Swedish RECs use preferred shares as one of their main sources of funding today, which will not be reflected in debt levels. Lastly, as banks have become increasingly regulated since the GFC, it has become expensive for banks to be overexposed to certain sectors or types of loans. This has resulted in banks becoming more restrictive in issuing bank loans to industries such as the real estate sector. Moreover, our respondents note that while most of the larger RECs have been cautious, some of the newer market actors have not and therefore carry more risk than the sector average.

How are properties valued in Sweden today and what are the implications?

In accordance with IFRS 13, listed real estate companies are obliged to revalue their properties at market price every quarter. The starting-point of the valuation is to compare the property with similar objects that have been sold. Thus, all the properties are valued at market price in theory. Since it is not always possible to find similar objects that have been sold, the revaluation relies on certain assumptions and inputs as well as benchmarks from third hand sources. Our respondents imply that the interest rates have a direct effect on property valuation. They describe properties as RECs' main asset, adding that a decrease

in price would affect their risk profiles negatively. The risk profile further affects interest expense, making revaluation an important aspect for pricing debt as well. They argue that variables such as vacancies, demand and rental levels could be affected in the long term but that these variables might be hard to put into theory and quantify. However, more inclusive metrics, such as GDP-growth or inflation, might be able to somewhat indicate an economic situation reflecting variables which are hard to quantify.

Which items on the income statement could be affected by fluctuations in the repo rate?

According to our respondents, the ratio between rental income and rental expense will probably not be affected much by an increase in interest rates short term. However, looking at the longer term, this ratio could be affected since the interest rate affects the overall economy. An example of this could be that commercial lenders will have to amortize more debt and pay higher interest costs, which in turn will decrease demand on real estate and potentially also heighten vacancy levels. This kind of change might, according to our respondents, also reflect on revaluations of real estate. The negative revaluation might thus have a significant negative effect on net income. Moreover, the most obvious effect in a scenario with higher rates is heightened interest costs. However, RECs tend to invest in interest derivatives in order to hedge against fluctuations in interest rate. This will partly offset the effect of increased rates. RECs also tend to fix their interest rate over different periods, which will cause a lagged effect on the cost of debt.

Which are the most important company specific financial ratios to look at in relation with interest rates?

In order to evaluate an increased interest rate's impact on RECs there are several important ratios. The respondents identified the following important ratios: 1) Share of fixed versus floating rates, 2) Average fixed term credit, 3) Debt to equity ratios, and 4) Interest Coverage Ratio (ICR).

3.2.4 Summary of interviews

A number of key takeaways have been deducted from the qualitative research. These can be divided into three primary fields: 1) The low interest environment and its implications, 2) The Swedish economy and important data points, and 3) The structure, function and contexture of Swedish RECs.

Starting off with the low interest environment, some further key points can be deducted from our respondents' answers: 1) Low interest rates have increased the credit supply, and 2) Interest risk in today's

environment is primarily long term rather than short term. Firstly, as lending costs have been below the historical average, which can be seen in Figure 3**,** credit and money supply has increased. This, in turn, has increased total debt, but as real estate prices have increased rapidly as well, debt to equity ratios have been rather stable. This is illustrated in Figure 3**.** Secondly, our respondents argue that the short term risk towards fluctuations in interest rates is limited to floating rates. They refer to interest rates being fixed and therefore limiting the short term impact of a hike in repo rate. However, they further argue that there could be a long term risk, where increased interest rate levels would impact various macro-economic variables. Notably, respondent 4 added that the STIBOR90 is subject to market expectations and is the reference rate used when pricing bank loans.

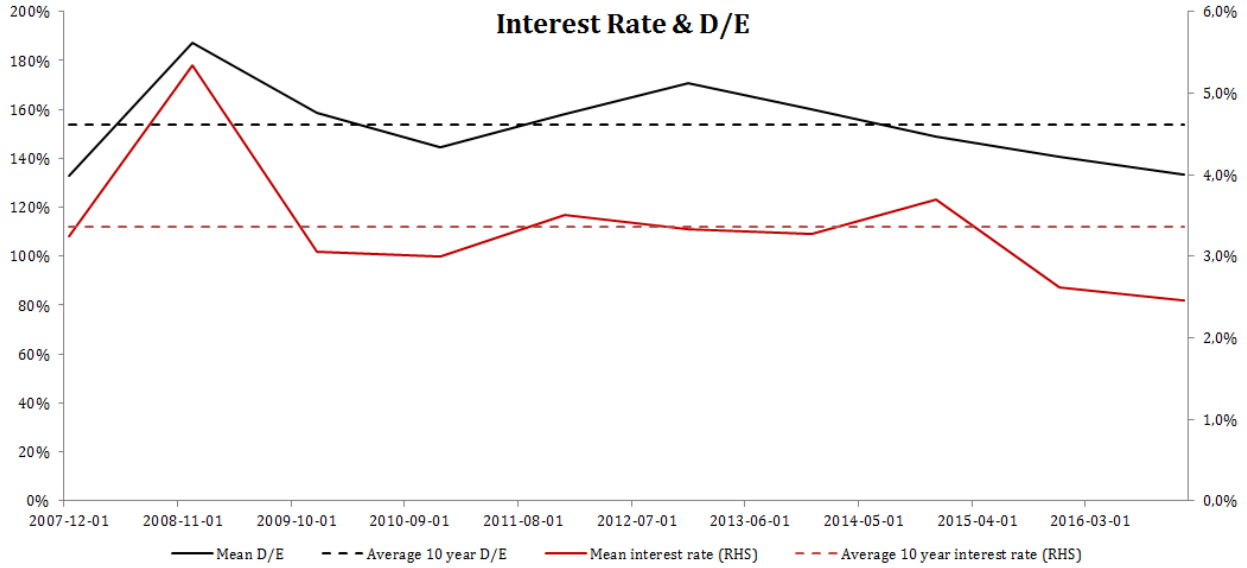


Figure 3: *Interest Rate and Debt to Equity. Sources: Bloomberg, company data.*

The Swedish economy will also be an important determinant for the development of Swedish RECs, according to our respondents. When interest rates start to rise above 0 per cent, there could be certain implications for the Swedish economy. Key takeaways for RECs on this subject include: 1) Vacancies could start to increase, 2) Rental levels might drop due to a lowered demand, and 3) Real estate prices might start to drop due to decreasing demand. Our respondents suggest that all of these variables might be complicated to quantify or put into theory. However, several of our respondents suggest that the variables' effect might be able, to a certain extent, be captured using GDP-growth and CPI.

Other important arguments were made regarding the structure of the Swedish RECs. Firstly, it is, according to our respondents, important to distinguish developers from real estate holding companies,

where the latter is this study's focus. They argue that real estate developers are more exposed to fluctuations in interest rates and that they suffer a greater risk of defaulting. Secondly, the Swedish RECs can be divided into two relatively separate groups: The old RECs and the new RECs. Our respondents argue that the latter have, in general, used debt more aggressively and are therefore more exposed to fluctuations in the interest rate. Furthermore, the structure of debt has changed, highlighting an issue related to measuring debt for today's RECs. The use of mezzanine debt has made the comparison between companies, both in-country and cross-country, difficult. However, the debt to equity measurement is still of vital importance. Other key financial metrics that should, according to our respondents, be taken into account include ICR, fixed versus floating rates and fixed term credit.

The respondents suggest that a hike in interest rate would affect RECs' financials through interest expense and revaluation of properties. However, they express doubts regarding an immediate effect, underlining the impact of a possible lagged effect on the income statement. They argue that STIBOR90 moves similar to the repo rate, making repo an essential factor of pricing debt. Five respondents argue that changes in the repo rate will impact property prices. One respondent continues by adding that a decrease in property prices consequently will affect interest expense due to a worsened risk profile. Another respondent doubts the relation between changes in repo rate and revaluation, underlining the amount of factors that may have an impact on revaluation.

3.2.5 Sample data

The companies considered are (for detailed information, see Appendix 1):
Atrium Ljungberg AB, Castellum AB, Corem Property Group AB, Diös Fastigheter AB, Fabege AB, Fastighets AB Balder, Hufvudstaden AB, Klövern AB, Victoria Park AB and Wallenstam AB.

Selecting our sample, we considered the following variables: 1) Diversified real estate holdings, 2) Limited real estate development as percentage of sales, 3) Well diversified geographically, 4) Enterprise value[9] > USD 1.0 billion. The criterion aim to create a well-diversified and dynamic sample for testing our hypothesis. The sample is solely based on their ability to represent the sector thus avoiding self-fulfilling choices, which is described as one of the main reasons for sample selection bias (Heckman, 1977). No firms that fulfill the four mentioned criteria have been eliminated due to exogenous factors, which are described as another reason for sample selection bias by Heckman (1977) and are further discussed in Section 3.5.

[9] *Enterprise value is calculated by adding long term debt and subtracting cash from market capitalization.*

It became clear that there are many complexities connected to RECs such as accounting standards, tax reforms and hedging derivatives. The authors also noted that you need to be well acquainted with the companies and market in order to analyse the results thoroughly. Since the many complexities often are country specific the authors decided to solely focus on Swedish companies in order to analyse them in detail. The details examined are valuation of property, debt provisions and their practical impact and interest hedging among others. The chosen companies are well diversified geographically and through property types when compiled as a sample.

In regard to these facts, the samples' collective characteristics should make them a good reflection of the real estate sector. The multiple regression analyses are performed on a ten year period. The time frame was limited by the dates the companies went public since accounting standards does not apply in the same extent to private companies. The variables included in this study are either updated on a yearly, quarterly or weekly basis, making a ten year period more reliable in this case.

3.3 Regressions

In the following section the regressions used in order to answer the research question are defined. Regression 1 aims to investigate the relationship between the repo rate and the reference rate used for pricing debt in the case of RECs, STIBOR90. Once a correlation coefficient between repo and STIBOR90 was generated, Regression 2 tested the relationship between STIBOR90 and interest expense, determining repo's impact on interest expense. Lastly, Regression 3 was performed to establish the relationship between STIBOR90 and revaluation of properties.

For the first regression, which consists of time series data, a general model is used and presented below. The *t* indicates the time period of the variable, which in this case on a monthly basis.

$$Y_t = \alpha + \beta_1 X_{1t} + \ldots + \beta_n X_{nt} + \varepsilon_t$$

where;

Y_t is the dependent variable
α is the constant
X_{nt} are the independent variables
ε_t is the error term

Another general model is followed for the last two regressions, which contains panel data. The *i* differentiates the observations while *t* indicates the period.

$$Y_{it} = \alpha + \beta_1 X_{1it} + \ldots + \beta_n X_{nit} + \varepsilon_{it}$$

where;

Y_{it} is the dependent variable
α is the constant
X_{nit} are the independent variables
ε_{it} is the error term

When applied, Regression 1-3 are formulated as follows:

Regression 1: $STIBOR_t = \alpha + \beta_1 REPO_t + \beta_2 GDP_t + \beta_3 CPI_t + \varepsilon_t$
Regression 2: $INTEXP_{it} = \alpha + \beta_4 STIBOR_t + \beta_5 REVAL_{it} + \beta_6 DERATIO_{it} + \beta_7 FXTCR_{it} + \varepsilon_{it}$
Regression 3: $REVAL_{it} = \alpha + \beta_8 STIBOR_t + \beta_9 GDP_t + \beta_{10} CPI_t + \varepsilon_{it}$

Below, these regressions are presented and explained in more in detail.

3.3.1 Variables

Summary of Variables

Variables	Abbreviation	Definition	Relation to net income[10]
Interest expense	INTEXP	Interest expense as per cent of long term debt, where long term debt is defined as outstanding interest bearing debt.	(-)
Revaluation	REVAL	Revaluation of net real estate investments, measured as per cent of the ingoing real estate investments balance on the balance sheet.	(+)

[10] *Based on this study's findings.*

Debt to Equity ratio	DERATIO	Long term debt as per cent of total shareholder equity.	(none)
Fixed term credit	FXTCR	The average number of years that the rates are fixed to.	(none)
Repo rate	REPO	Overnight rate set by the Swedish central bank, the Riksbank.	(-)
STIBOR90	STIBOR	Stockholm Interbank Offered Rate with 90 days maturity.	(-)
GDP growth	GDP	Swedish gross domestic product growth, measured quarter over quarter.	(none)
CPI	CPI	Swedish consumer product index, measured month over month.	(none)

Table 1: *Summary of variables.*

3.3.1.1 Dependent variables

In a regression model, the movement of a dependent variable, Y, attempts to be explained by the movement in other variables, X (Brooks, 2008). Since this study aims to explain the sensitivity of the income statement to rate hikes, two of three dependent variables in the regression models will be items on the income statement possibly affected by interest rate fluctuations. According to our respondents, the two most important items on the income statement, in relation to changes in the repo rate, are interest expense and revaluation of properties (Respondent 1-6 2017, personal communication). Moreover, STIBOR90 is the main component in pricing corporate debt for RECs according to the respondents (1-6 2017, personal communication). Thus, as this study aims to test the effect of changes in repo on RECs income statements, a regression with STIBOR90 as the dependent variable and repo rate as the independent variable is conducted.

STIBOR90

According to our respondents, STIBOR90 is commonly used as a reference rate when pricing corporate debt (Respondent 1-6 2017, personal communication). As STIBOR90 is determined by a market price, the rate could be affected by additional variables such as market expectations (Respondent 1 2017, personal communication). In the regression, STIBOR90 will be denoted as: STIBOR

Interest expense

Interest expense on the income statement is the interest costs related to the company's debt. The interest expense for each company is calculated by dividing the interest expense in absolute numbers with interest

bearing debt. Thus, the interest expense will be expressed in per cent to balance the difference in firm size.

$$INTEXP_t = \frac{Interest\ Expense_t}{(Long\ Term\ Borrowing_t\ +\ DebtInterest\ Bearing\ Share\ of\ Short\ Term\ Debt_t)}$$

Revaluation

Revaluation of property on the income statement is the change in value of the RECs' real estate holdings. As mentioned, in accordance with IFRS 13 RECs are obliged to revalue their properties to market value each quarter (IASB, 2011). The revaluation for each company is calculated by dividing the revaluation in absolute numbers with the net Real Estate Investments (forthcoming abbreviated as REI) from the previous year. The revaluation will therefore express the percentage change in property value from the previous year.

$$REVAL_t = \frac{(REI_t - Accumulated\ D\&A_t) - (REI_{t-1} - Accumulated\ D\&A_{t-1})}{(REI_{t-1} - Accumulated\ D\&A_{t-1})}$$

3.3.1.2 Independent variables

In a regression model the independent variable(s) is used to explain the dependent variable (Brooks, 2008). Interest rate variables are used as primary explanatory variables. Control variables are included in the model in order to make the regressions more accurate and reliable.

3.3.1.2.1 Interest rate variables

Repo rate

In Regression 1, the repo rate is the explanatory variable. The repo rate is set approximately six times per annum by the Riksbank and is used to test the relationship between the repo rate and STIBOR90. Since the purpose of this study is to test the sensitivity of changes in the repo rate, its relationship to STIBOR90 needs to be tested.

STIBOR90

In Regression 2 and 3, STIBOR90 is the explanatory variable. When determining the cost of debt, i.e. interest expense, STIBOR90 is used as the explanatory variable in accordance with our respondents. Further, STIBOR90 is used as the explanatory variable when determining the relationship between

property revaluation and interest rate, due to its presumed impact on real estate prices. (Respondent 1-6 2017, personal communication)

3.3.1.2.2 Control variables

Control variables are variables related to the dependent variable and which might affect the dependent variable. Several control variables are included in the regressions, which are constant and included to test the relative impact of independent variables (Brooks, 2008). By the inclusion of control variables in our regressions we can control for the impact of firm-specific factors as well as macro factors on our model. In order get a model as complete as possible, the control variables are selected from what the market experts in our interviews regarded most likely to affect the dependent variables. The control variables used in the regressions are determined as follows:

Capital structure and leverage

The capital structure and leverage ratio is defined as the debt to equity ratio. This value is calculated by dividing total long term debt with total shareholder equity, thus capturing the leverage in REC's capital structure. In his model for determining risk of default, Altman (1967) used the inverted ratio, total equity to book value of debt, and could confirm the significance of using a capital structure variable. However, our respondents agreed that the most relevant ratio to use for RECs' was debt to equity. In this study, this control variable is denoted as: DERATIO

Fixed term credit

The average fixed term credit is expressed in years and represents the average maturity of interest rates. The ratio is calculated as the weighted average maturity of all accumulated principals, with the exception of hybrid debt costs. Merton (1974) argued that one of the most critical qualitative components when pricing debt was, among other, provisions. This is contradictory to Vlamis (2007), who argues that loan structure is of no prime importance to UK RECs' default risk. Fixed term credit is, according to our respondents, one of the most important provisions in a debt contract (Respondents 1-4 2017, personal communication). Companies with higher average fixed term credit are expected to be less sensitive to changes in interest rates, due to their limited exposure to short term fluctuations. It is therefore used as a control variable in Regression 2, and is denoted as: FXTCR

Revaluation of properties

Revaluation of properties is both used as a dependent variable and a control variable in our model, however never in the same regression. Revaluation of properties is measured in percentage and calculated

by dividing the revaluation of properties in absolute numbers with the net REI from the previous year, further explained in Section 3.3.1.1. In the regression this is denoted as: REVAL

Growth in gross domestic product (GDP)

To capture some of the macro effects possibly altering certain items on the income statement, Swedish GDP-growth has been selected as an explanatory variable. According to one respondent, by including GDP-growth, the model might capture the economic situation, reflecting the more complexly quantifiable variables (Respondent 5 2017, personal communication). The metric is calculated as growth in GDP in relation to the same quarter previous year. The measurement is seasonally adjusted. In the regression this is denoted as: GDP

Change in consumer price index (CPI)

According to one respondent, the Swedish CPI might capture some of the external macro effects that are otherwise complex to quantify (Respondent 5 2017, personal communication). It is calculated as change in price levels of a market basket. The index is measured on a monthly basis, compared with the year before. In the regression this is denoted as: CPI

3.3.2 Regression 1: STIBOR90

$$STIBOR_t = \alpha + \beta_1 REPO_t + \beta_2 GDP_t + \beta_3 CPI_t + \varepsilon_t$$

This equation aims to test the relationship between the repo rate and STIBOR90. According to our respondents, STIBOR90 is the most important rate for RECs (Respondent 3-6 2017, personal communication). Thus, in order to answer our research question, which is to test the sensitivity of changes in repo rate, the relationship between the repo rate and STIBOR90 must be determined. Further, GDP growth and CPI are included in the regression model to capture the possible macro effects and get a more accurate coefficient for the explanatory variable REPO.

3.3.3 Regression 2: INTEREST EXPENSE

$$INTEXP_{it} = \alpha + \beta_4 STIBOR_t + \beta_5 REVAL_{it} + \beta_6 DERATIO_{it} + \beta_7 FXTCR_{it} + \varepsilon_{it}$$

Interest expense was identified as one of the most important items on the income statement for RECs (Respondent 1-6 2017, personal communication). Therefore, interest expense is an important element when investigating RECs' income statements. STIBOR90 is selected as the interest rate in the model

since it is used as a reference rate when determining the cost of debt (Respondent 5 and 6 2017, personal communication). The reason STIBOR90 is used as a reference rate instead of the repo rate is that the repo rate is set by the Riksbank while STIBOR90 is a market rate. To relate interest expense to the repo rate, the relationship between STIBOR90 and the repo rate is determined in Regression 1. The choice of control variables in the model is based on the answers we got from the respondents in the interviews. Revaluation, leverage and fixed credit term are variables that might have an effect on the firm specific interest expense (Merton, 1974; Respondent 1-6 2017, personal communication).

3.3.4 Regression 3: REVALUATION

$$REVAL_{it} = \alpha + \beta_8 STIBOR_t + \beta_9 GDP_t + \beta_{10} CPI_t + \varepsilon_{it}$$

Unlike interest expense, revaluation is not a cash generating item on the income statement but it has significant effect on RECs' net income due to an increase in property value during the time period of the research. Five respondents identified this item as an important item to test towards changes in the repo rate (Respondent 2-6 2017, personal communication). Similar to Regression 2, the choice of explanatory and control variables derives from previous studies and our qualitative research. However, the model does not contain any firm-specific control variables since we could not identify any firm-specific variables in the interviews. The lack of control variables might deteriorate the legitimacy of the regression but it does not disregard the relationship between revaluation and STIBOR90.

3.4 Econometric approach

In order to answer the research question of this study we use an econometric approach. According to Brooks (2008) the most important tool in econometric is the regression analysis. A regression model aims to examine the relationship between different variables. More specific, the regression seeks to explain movement in a dependent variable by movement in the independent variable(s) (Brooks, 2008). In order to examine the relationship, the most common regression technique used is the Ordinary Least Square (OLS). The OLS method finds the trend line where the residual sum of squares (RSS) is minimized. Thus, the OLS estimators are Best Linear Unbiased Estimators (BLUE). Throughout the regression analysis in this research we will use OLS as our econometric technique.

In order for the OLS estimators to be BLUE, six assumptions must hold. These assumptions are known as the Gauss-Markow theorem and will be presented in the following section. (Dougherty, 2016)

Assumption 1 - The model is linear in parameters and correctly specified

In order for the OLS to work, the model must be linear in parameters but it is not a requirement that the model is linear in variables. Linear in parameters refers to all the beta parameters on the right hand side of the equation being linear. (Dougherty, 2016)

Assumption 2 - There is some variation in the regressor in the sample

In order to regress Y on X, X cannot be a constant. In a scenario where X is a constant, it would not be possible to compute the regression coefficients since it cannot account for any variation in Y. (Dougherty, 2016)

Assumption 3 - The disturbance term has zero expectation

$$E(u_i) = 0 \; for \; all \; i$$

The underlying assumption is that the disturbance term is zero but it is not necessarily violated by fluctuations in the disturbance term (Dougherty, 2016). The disturbance term is usually positive or negative in practice hence the sum of all disturbance terms is assumed to be zero for this assumption to hold.

Assumption 4 - The disturbance term is homoscedastic

$$E\left(u_i^2\right) = \sigma_u^2 \; for \; all \; i$$

A homoscedastic disturbance term means in practice that the errors have constant errors. If the disturbance on the contrary would be heteroskedastic, there is an evident trend in declining or increasing residuals in the samples. (Brooks, 2014)

Assumption 5 - The values of the disturbance term have independent distribution

$$E(u_i)E\left(u_j\right) = 0$$

This assumption mainly refers to how the disturbance term is not subject to autocorrelation (Dougherty, 2016). If a high value of the disturbance term in period one increases the probability of a high value in period two autocorrelation is prevalent and needs to be adjusted for.

Assumption 6 - The disturbance term has a normal distribution

For the regression coefficients to be normally distributed the disturbance term has to be proven or assumed to be normally distributed as well (Dougherty, 2016). Bera-Jarque is a standardized and common test to examine whether the disturbance term has a normal distribution (Brooks, 2014).

3.5 Validity

Bryman and Bell (2011) underline the distinction between internal and external validity. They refer to internal validity as the degree of the causal relationship between the independent variable(s) and the dependent variable. External validity, on the other hand, is the degree of the sample's representativeness of the analysed sector as a whole (Bryman and Bell, 2011).

In order to ensure a high external validity this research has been thorough in its choice of companies. Firstly, the authors established that the national differences between RECs were substantial enough to undermine the influence of a cross-country study on this subject. This problem was avoided in Akimov et al.'s (2017) study, due to the focus on returns, where national difference becomes less of a problem. Therefore, this study is limited to one country, i.e. Sweden, in order to avoid differences in monetary policies and accounting among others, which can make the results and analysis deceiving. This is in line with, for example, Vlamis (2000) who uses variables such as debt ratios which could be undermined by cross-country differences.

Secondly, the choice of companies has been based solely on their respective characteristics' ability to diversify our portfolio accordingly. Brooks (2014) highlights the frequent occurrence of sample selection bias and defines it as a human tendency to predetermine choices. The two major reasons for sample selection bias are self-fulfilling choices to establish desired results and the elimination of samples due to exogenous factors (Heckman, 1977). The authors have chosen the research's sample based on their common coverage of the sector alone, i.e. coverage geographical and in types of property, and no company have been excluded due to exogenous factors. It should however be noted that the size of the chosen companies is somewhat bigger than the market average, see Section 3.2.5. The reason for the

bigger size of the researched companies is mainly to avoid data problems, which is another common reason for sample selection bias (Heckman, 1979).

The internal validity of this research is ensured by establishing the OLS model's six assumptions' applicableness on this particular study (Dougherty, 2016). The three regressions are of varying character due to the frequency of available data. While all regressions are based on a ten year period the observed data varies from annual to weekly which makes the number of observations differ between the regressions. Our models further differ in character since the first regression analysis between repo and STIBOR90 contains time series data while the other two regressions contain panel data. Panel data contain a combination of features from time series data and cross-sectional data and requires different treatment (Dougherty, 2016).

In order to determine whether the assumptions of the OLS method hold for our three multiple regressions, a number of tests have been conducted. The financial data included in the regressions is, similar to much other financial data, linear in its nature and Assumption 1 does not need to be tested in this case. Since there is variation between the sample companies and an intercept is included in all the regressions, Assumption 2 and 3 are fulfilled (Dougherty, 2016). The three remaining assumptions accompanied by implicit assumptions in the OLS model could not be assured at this stage hence the following tests have been carried out.

3.5.1 White's test

White's (1980) test for heteroscedasticity has been performed on all three regressions in order to establish whether Assumption 4 of the OLS model holds. If one or many of the regressions would prove to be heteroskedastic, that would offset the OLS estimators role as BLUE (Brooks, 2014). This means that the OLS estimators would still give unbiased and consistent coefficient estimates but the standard error for the slope would either be too low or too high. Since a different standard error offsets the coefficient in the regression, White's (1980) test was performed to determine whether the disturbance term was heteroskedastic. If the *p*-value of the F-statistics is significant, it implies that heteroscedasticity is present in the regression (Brooks, 2014).

In order to perform the heteroscedasticity test, the econometric software EViews is used. EViews offer a pre-built White's test for time series data and cross-sectional data which resulted in that the test was conducted on Regression 1 since it only contains time series data. However, EViews do not offer the test

on panel data which results in that the test for heteroscedasticity was conducted manually by running an auxiliary regression analysis for Regression 2 and 3.

3.5.2 Durbin-Watson test

The Durbin-Watson test is the first developed framework to detect autocorrelation (Durbin & Watson, 1950). The Durbin-Watson test is therefore used to identify possible deviations from Assumption 5 of the OLS model. Regression 1 with STIBOR90 as dependent variable contains time series data while the other two regressions contain panel data hence the Durbin-Watson test was only performed on Regression 1. If $p=0$ and $d=2$ there is no autocorrelation present. If $0<d<2$ there is a positive autocorrelation and if $2<d<4$ there is a negative autocorrelation (Dougherty, 2016). Certain fluctuations in d is however usual in cases where autocorrelation is not present. A d-value between 1.5 and 2.5 is commonly accepted as evidence of no existing autocorrelation (EViews, 2017).

3.5.3 Bera-Jarque test

The Bera-Jarque-test is commonly applied to test for normality and can be used to determine if Assumption 6 of the OLS model holds (Brooks, 2014). A disturbance term should have a coefficient of excess kurtosis of zero in order to be normally distributed and hence not be skewed (Dougherty, 2016). Normal distribution is a necessity for all three regressions and a Bera-Jarque test has subsequently been performed on all three regressions. The Bera-Jarque test is expressed through a histogram where a bell-shaped, i.e. normally distributed, histogram implies normal distribution. In the conducted test, the Bera-Jarque statistic should not be significant in order to not reject the null hypothesis (Brooks, 2014). A p-value over the significance level of 5 per cent indicates residual normality.

3.5.4 Redundant fixed effects test

A relationship between two variables can sometimes depend upon an unknown characteristic not measured. These sorts of relationships are called omitted variable bias and are a common risk for panel data, and has therefore been tested for on Regression 2 and 3 (Brooks, 2014). Fixed effects can be implemented in the regression to adjust for a possible omitted variable bias. The lack of omitted variable bias is no explicit assumption of the OLS model, but it is however a necessity for panel data to avoid the OLS regression to be pooled (Dougherty, 2016). The redundant fixed effects test is useful to establish whether the fixed effects are necessary or not. If the cross-section F has a significant p-value, i.e. less than 5 per cent, there is an omitted variable bias which needs to be adjusted for (Brooks, 2014).

3.5.5 Test for multicollinearity

When using the OLS model, there is an implicit assumption that no independent variables correlate with one another (Brooks, 2014). Independent variables that correlate are subject of multicollinearity, which can result in unsatisfactory lack of precision and is more common in smaller sample sizes (Dougherty, 2016). Dougherty further mentions how multicollinearity is a common problem for time series data. Since Regression 2 and 3 consist of panel data and have a somewhat smaller sample than that of the time series data, a correlation matrix has been constructed for all three regressions to ensure high reliability. There is no multicollinearity evident if the correlation between two independent variables is less than 80 per cent (Brooks, 2014).

4. Results

In this chapter, the results from the performed regressions are presented.

4.1 Regression 1: STIBOR90

The primary regressions showed signs of heteroscedasticity and autocorrelation see Appendix 4. In order to minimize these errors a Newey-West procedure was performed, which produces heteroscedasticity and autocorrelation consistent standard errors (Brooks, 2014). The adjusted results can be seen in Table 2. However, the adjusted regression still suffers from autocorrelation and the implications of that will be discussed below.

The regression proves a significant relationship between STIBOR90 and the repo rate since the *p*-value is lower than the significance level of 5 per cent. A beta coefficient of 1.11 for STIBOR indicates a positive relationship between the repo rate and STIBOR90. The model indicates that the STIBOR90 is more volatile than the repo rate since it takes a value greater than one. Thus, in a scenario where the repo rate increases with 100 basis points, STIBOR90 increases with 111 basis points. Furthermore, neither GDP nor CPI had a significant *p*-value and we can therefore conclude that their impact on STIBOR90 cannot be statistically proven.

Dependent Variable: STIBOR
Method: Least Squares
Date: 12/17/17 Time: 14:52
Sample: 1/14/2007 1/01/2017
Included observations: 521
HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 6.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.196432	0.029464	6.666892	0.0000
REPO	1.109380	0.013875	79.95351	0.0000
GDP	0.007806	0.008205	0.951393	0.3418
CPI	0.006205	0.054692	0.113453	0.9097

R-squared	0.978517	Mean dependent var	1.607251
Adjusted R-squared	0.978392	S.D. dependent var	1.642961
S.E. of regression	0.241511	Akaike info criterion	0.003840
Sum squared resid	30.15523	Schwarz criterion	0.036514
Log likelihood	2.999576	Hannan-Quinn criter.	0.016639
F-statistic	7849.333	Durbin-Watson stat	0.320413
Prob(F-statistic)	0.000000	Wald F-statistic	2544.713
Prob(Wald F-statistic)	0.000000		

Table 2: *Regression of STIBOR90*

White's test for heteroscedasticity

According to Brooks (2014) the F-statistics *p*-value should be higher than the significance level to conclude that no sign of heteroscedasticity is present in the model. As shown in Table 3, the *p*-value is lower than the significance level of 5 per cent, which indicate that the model might suffer from heteroscedasticity. Thus, in order to get consistent estimators we adjust the model and use Newey-West robust standard errors.

Heteroskedasticity Test: White

F-statistic	12.60083	Prob. F(9,511)	0.0000
Obs*R-squared	94.62621	Prob. Chi-Square(9)	0.0000
Scaled explained SS	310.7824	Prob. Chi-Square(9)	0.0000

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 12/13/17 Time: 12:43
Sample: 1/14/2007 1/01/2017
Included observations: 521
White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.020737	0.016913	-1.226089	0.2207
REPO^2	-0.010596	0.003565	-2.972255	0.0031
REPO*GDP	-0.004831	0.002594	-1.862745	0.0631
REPO*CPI	-0.043191	0.023653	-1.826028	0.0684
REPO	0.066673	0.015022	4.438423	0.0000
GDP^2	0.001326	0.000506	2.619043	0.0091
GDP*CPI	-0.004097	0.011790	-0.347506	0.7284
GDP	0.004754	0.001587	2.995629	0.0029
CPI^2	0.101329	0.062943	1.609855	0.1080
CPI	0.050437	0.034900	1.445199	0.1490

R-squared	0.181624	Mean dependent var	0.057880
Adjusted R-squared	0.167211	S.D. dependent var	0.149633
S.E. of regression	0.136551	Akaike info criterion	-1.125232
Sum squared resid	9.528174	Schwarz criterion	-1.043548
Log likelihood	303.1230	Hannan-Quinn criter.	-1.093236
F-statistic	12.60083	Durbin-Watson stat	1.524338
Prob(F-statistic)	0.000000		

Table 3: *White's test on STIBOR90*

Bera-Jarque test for normality

Figure 4 displays the distribution of the residuals in the model. The distribution is proven to be normal if the null hypothesis cannot be rejected which can be determined if the *p*-value is larger than the significance level. The *p*-value in the model is smaller than the significance level of 5 per cent, implying

that the residuals are not normally distributed. However, a large enough sample size tends, according to the Central Limit Theorem (CLT), to be approximately normally distributed which means that the OLS estimators satisfy asymptotic normality (Wooldridge, 2013). In order to determine if the sample size is big enough a rule of thumb says that a sample size larger than 30 observations satisfy the CLT. Since the sample size in the model is 521, we assume that the model is approximately normally distributed and the no corrections are needed. Thus, the Assumption 6 of the OLS model holds.

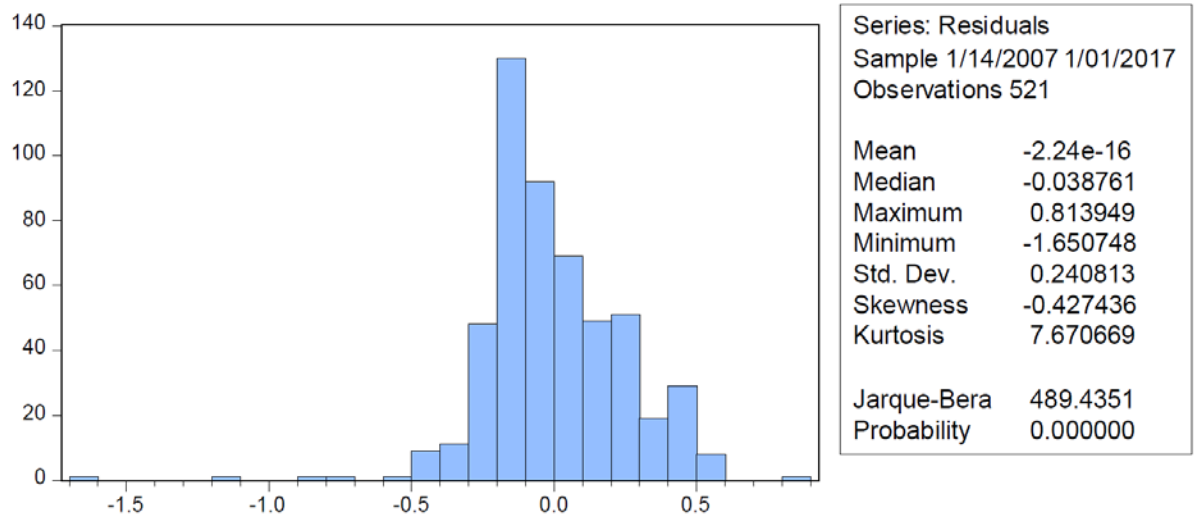


Figure 4: *Bera-Jarque test on STIBOR90*

Test for multicollinearity

In order to test for multicollinearity between the independent variables a correlation matrix was conducted. In Table 4, the highest correlation between two variables is 0.21 which is between GDP and CPI. Since the correlation is far from the correlation limit for multicollinearity of 80 per cent, explained in Section 3.5.5, we can conclude that there is no sign of multicollinearity in the model. Thus, the implicit assumption of the OLS model holds.

Correlation

	STIBOR	REPO	GDP	CPI
STIBOR	1.000000	0.989078	-0.178629	0.087448
REPO	0.989078	1.000000	-0.195918	0.083251
GDP	-0.178629	-0.195918	1.000000	0.214932
CPI	0.087448	0.083251	0.214932	1.000000

Table 4: *Correlation matrix for STIBOR90*

Autocorrelation test - Durbin-Watson

The Durbin-Watson statistic is at 0.32, illustrated in Appendix 4, which indicates a positive autocorrelation. Since the statistic is below the limit of 1.5 there are signs of autocorrelation in the model. The autocorrelation can be explained by that the levels in all the variables in the regression are highly correlated with the previous period. The implication of that the regression suffer from autocorrelation is that the OLS is no longer efficient, meaning that there is another regression technique that yield estimators with smaller variances (Dougherty, 2016). However, the OLS is still unbiased. In order to make the standard errors more correct the Newey-West fixed standard errors are included in the regression. However, this does not remove the autocorrelation from the model and the OLS do not hold. The relation between repo and STIBOR90 is still significant. Hence, even though they are autocorrelated, the correlation is still evident.

4.2 Regression 2: Interest expense

Table 5 shows significant impact from STIBOR90 on interest expense. A beta coefficient at 0.36 implies that an increase in STIBOR90 of 100 basis points would, on average, increase a company's interest expense with 36 basis points. We can also conclude that there is a highly significant negative correlation between revaluation and interest expense. The beta coefficient at -0.035 shows how interest expense on average lowers with 3.5 basis-points when properties' values increase with 100 basis-points. Fixed credit term also proved to have a significant impact on interest expense. The coefficient tells us that a longer fixed credit term is correlated with higher interest expense.

Dependent Variable: INTEXP
Method: Panel Least Squares
Date: 12/18/17 Time: 18:50
Sample: 2007 2016
Periods included: 10
Cross-sections included: 10
Total panel (unbalanced) observations: 94
White cross-section standard errors & covariance (d.f. corrected)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.337235	0.273257	8.553255	0.0000
STIBOR	0.360431	0.066993	5.380171	0.0000
REVAL	-0.035322	0.005395	-6.546920	0.0000
DERATIO	0.002045	0.001524	1.341977	0.1830
FXTCR	0.169430	0.052167	3.247850	0.0016

R-squared	0.531675	Mean dependent var	3.476438
Adjusted R-squared	0.510627	S.D. dependent var	1.064678
S.E. of regression	0.744798	Akaike info criterion	2.300317
Sum squared resid	49.37042	Schwarz criterion	2.435598
Log likelihood	-103.1149	Hannan-Quinn criter.	2.354961
F-statistic	25.25976	Durbin-Watson stat	1.539035
Prob(F-statistic)	0.000000		

Table 5: *Regression of Interest expense*

White's test for heteroscedasticity

The test for heteroscedasticity was performed manually by running an auxiliary regression analysis. In order to conclude that there is no sign of heteroscedasticity in the model, the *p*-value of the F-statistic should be higher than the significance level. In Table 6, the *p*-value takes a value of 0.0027 which is lower than the significance level of 5 per cent. Therefore, it can be concluded that the model might suffer from heteroscedasticity. In order to get consistent estimators, White cross-section standard errors are included in the model.

Dependent Variable: RESID01^2
Method: Panel Least Squares
Date: 12/18/17 Time: 13:17
Sample: 2007 2016
Periods included: 10
Cross-sections included: 10
Total panel (unbalanced) observations: 94

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	7.329592	2.172598	3.373653	0.0012
STIBOR	0.273260	0.631379	0.432799	0.6663
REVAL	-0.303272	0.131748	-2.301920	0.0240
DERATIO	-0.039941	0.012756	-3.131192	0.0024
FXTCR	-2.429071	0.719937	-3.374005	0.0012
STIBOR^2	-0.010079	0.076392	-0.131935	0.8954
REVAL^2	-0.001466	0.000981	-1.493670	0.1392
DERATIO^2	6.76E-05	2.91E-05	2.324045	0.0227
FXTCR^2	0.156212	0.071245	2.192621	0.0313
STIBOR*REVAL	-0.009462	0.018886	-0.501024	0.6177
STIBOR*DERATIO	0.000426	0.001733	0.245702	0.8065
STIBOR*FXTCR	-0.065039	0.103347	-0.629321	0.5310
REVAL*DERATIO	0.000975	0.000532	1.833978	0.0704
REVAL*FXTCR	0.073274	0.033199	2.207100	0.0302
DERATIO*FXTCR	0.005968	0.002130	2.802264	0.0064

R-squared	0.323859	Mean dependent var	0.525217
Adjusted R-squared	0.204037	S.D. dependent var	1.412341
S.E. of regression	1.260045	Akaike info criterion	3.445473
Sum squared resid	125.4293	Schwarz criterion	3.851318
Log likelihood	-146.9372	Hannan-Quinn criter.	3.609405
F-statistic	2.702827	Durbin-Watson stat	1.449936
Prob(F-statistic)	0.002739		

Table 6: *White's test on Interest expense*

Bera-Jarque test for normality

Figure 5 shows how the values are relatively normally distributed since the piles embody a bell-shaped form. On the other hand, the *p*-value is highly significant hence it cannot be determined with certainty that the residuals are normally distributed (Dougherty, 2016). The CLT uses a sample size of 30 as a reference point to determine whether the sample is big or not. 94 observations are included in this regression which defines it as a big sample according to the CLT (Wooldridge, 2013). Woolridge (2013) further argues that a big sample size by definition is accepted as normally distributed. The residuals can thus be defined as normal based on the bell-shaped histogram and the CLT.

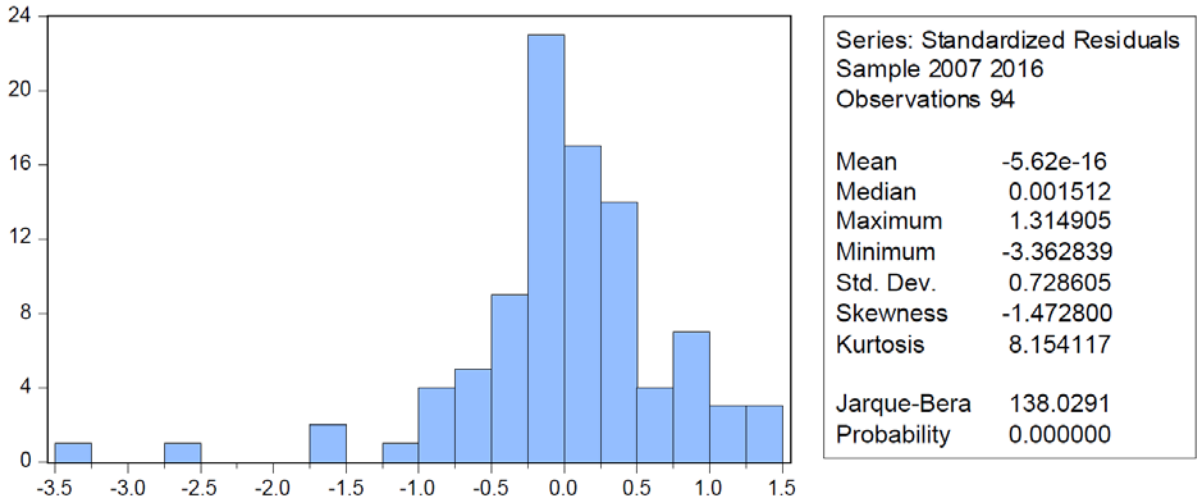


Figure 5: *Bera-Jarque test on Interest expense*

Test for multicollinearity

The correlation matrix, illustrated in Table 7, shows a negative correlation between STIBOR90 and revaluation at -0.34. This is the highest correlation between two independent variables in this regression. Since the benchmark is plus minus 80 per cent when determining whether multicollinearity is evident, there is no multicollinearity existing between the variables included in this regression. The OLS model's implicit assumption has proven to hold for this regression making the model applicable.

Correlation

	INTEXP	STIBOR	REVAL	DERATIO	FXTCR
INTEXP	1.000000	0.630885	-0.481127	0.214814	0.140680
STIBOR	0.630885	1.000000	-0.335588	0.100382	-0.098219
REVAL	-0.481127	-0.335588	1.000000	-0.123247	-0.005658
DERATIO	0.214814	0.100382	-0.123247	1.000000	0.009677
FXTCR	0.140680	-0.098219	-0.005658	0.009677	1.000000

Table 7: *Correlation matrix on Interest expense*

Redundant fixed effects test

In Table 8, a redundant fixed effect test is presented, where the cross-section F's *p*-value is the main subject of interest. The *p*-value is not significant hence there is no need to include fixed effects in this model.

Redundant Fixed Effects Tests
Equation: Untitled
Test cross-section fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	0.523375	(9,80)	0.8535
Cross-section Chi-square	5.377879	9	0.8002

Cross-section fixed effects test equation:
Dependent Variable: INTEXP
Method: Panel Least Squares
Date: 12/13/17 Time: 12:35
Sample: 2007 2016
Periods included: 10
Cross-sections included: 10
Total panel (unbalanced) observations: 94
White cross-section standard errors & covariance (d.f. corrected)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.337235	0.273257	8.553255	0.0000
STIBOR	0.360431	0.066993	5.380171	0.0000
REVAL	-0.035322	0.005395	-6.546920	0.0000
DERATIO	0.002045	0.001524	1.341977	0.1830
FXTCR	0.169430	0.052167	3.247850	0.0016

R-squared	0.531675	Mean dependent var	3.476438
Adjusted R-squared	0.510627	S.D. dependent var	1.064678
S.E. of regression	0.744798	Akaike info criterion	2.300317
Sum squared resid	49.37042	Schwarz criterion	2.435598
Log likelihood	-103.1149	Hannan-Quinn criter.	2.354961
F-statistic	25.25976	Durbin-Watson stat	1.539035
Prob(F-statistic)	0.000000		

Table 8: *Redundant effects text on Interest expense*

4.3 Regression 3: Revaluation

The effect of changes in STIBOR90 on revaluation of properties proved to be significant, as illustrated in Table 9. A beta coefficient at -1.91 implies that a decrease in STIBOR90 with 100 basis points would increase property values with 191 basis points. It can be concluded that CPI have a significant effect on revaluation in properties with a beta coefficient of 0.20. The interpretation of this result is that if the market basket's price levels increase with 100 basis points, the property values increase with 20 basis points. The independent variable GDP has to high of a *p*-value to be proven as statistically significant. The adjusted R^2 equals the coefficient of determination and is relatively low for this regression.

Dependent Variable: REVAL
Method: Panel Least Squares
Date: 12/19/17 Time: 21:55
Sample: 2007 2016
Periods included: 10
Cross-sections included: 10
Total panel (unbalanced) observations: 99

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.057445	0.010254	5.602150	0.0000
STIBOR	-1.910820	0.326687	-5.849079	0.0000
GDP	0.051930	0.220390	0.235626	0.8142
CPI	0.202886	0.063135	3.213510	0.0018

R-squared	0.287464	Mean dependent var	0.054140
Adjusted R-squared	0.264963	S.D. dependent var	0.059007
S.E. of regression	0.050589	Akaike info criterion	-3.090586
Sum squared resid	0.243132	Schwarz criterion	-2.985733
Log likelihood	156.9840	Hannan-Quinn criter.	-3.048163
F-statistic	12.77553	Durbin-Watson stat	1.547645
Prob(F-statistic)	0.000000		

Table 9: *Regression of Revaluation*

White's test for heteroscedasticity

Similarly as in Regression 2, this test was conducted manually. As presented in Table 10, the *p*-value of the F-statistic is higher than the significance level of 5 per cent which indicates that no sign of heteroscedasticity is present in the model. Thus, no corrections are made and Assumption 4 holds.

Dependent Variable: RESID^2
Method: Panel Least Squares
Date: 12/19/17 Time: 21:14
Sample: 2007 2016
Periods included: 10
Cross-sections included: 10
Total panel (unbalanced) observations: 99

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.007257	0.022963	0.316028	0.7527
STIBOR	0.162100	0.745760	0.217362	0.8284
GDP	-0.166624	0.485885	-0.342929	0.7325
CPI	-0.085534	0.190754	-0.448399	0.6550
STIBOR^2	-0.378771	5.379349	-0.070412	0.9440
GDP^2	0.538329	31.00743	0.017361	0.9862
CPI^2	0.472610	0.936445	0.504686	0.6150
STIBOR*GDP	-8.825866	15.63269	-0.564578	0.5738
STIBOR*CPI	-3.617924	7.059563	-0.512486	0.6096
GDP*CPI	2.967422	3.459315	0.857806	0.3933

R-squared	0.063051	Mean dependent var	0.002456
Adjusted R-squared	-0.031696	S.D. dependent var	0.008562
S.E. of regression	0.008696	Akaike info criterion	-6.556278
Sum squared resid	0.006731	Schwarz criterion	-6.294145
Log likelihood	334.5358	Hannan-Quinn criter.	-6.450219
F-statistic	0.665465	Durbin-Watson stat	1.788468
Prob(F-statistic)	0.737842		

Table 10: *White's test on Revaluation*

Bera-Jarque test for normality

As Figure 6 illustrates, the residuals are relatively normally distributed for this regression as well. The *p*-value is however significant in this case indicating that the residuals are not normally distributed (Dougherty, 2016). Similar to the two other regressions the number of observations is bigger than 30 (99) and can thus be defined as normally distributed according to the CLT (Wooldridge, 2013).

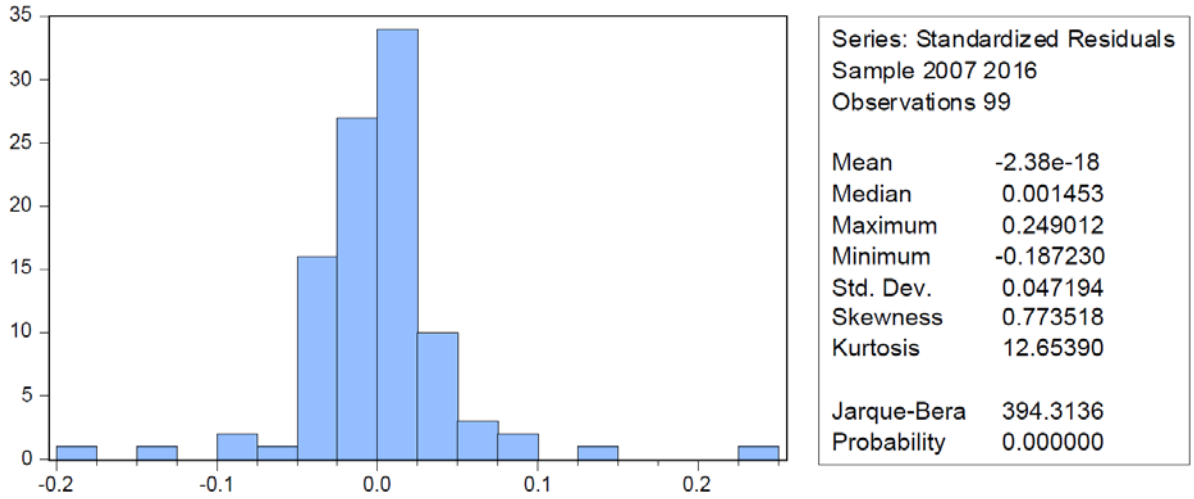


Figure 6: *Bera-Jarque test on Revaluation*

Test for multicollinearity

In order to test for multicollinearity between the independent variables a correlation matrix was conducted. In Table 11 the highest correlation between two variables is 0.22, which is between STIBOR90 and CPI. Since the correlation is well below correlation limit for multicollinearity of 80 per cent, we can conclude that there is no sign of multicollinearity in the model. Thus, the implicit assumption of the OLS model holds.

Correlation

	REVAL	STIBOR	GDP	CPI
REVAL	1.000000	-0.456090	-0.016761	0.171847
STIBOR	-0.456090	1.000000	0.133738	0.223939
GDP	-0.016761	0.133738	1.000000	0.113457
CPI	0.171847	0.223939	0.113457	1.000000

Table 11: *Correlation matrix on Revaluation*

Redundant fixed effects test

The cross-section F's *p*-value is the main subject of interest in Table 12. Similar to Regression 2, the *p*-value is not significant in this case either, hence it is not necessary to include fixed effects in this regression. Since there is no need for fixed effects in the model, we can conclude that the model is representative, even if no firm-specific variables are included.

Redundant Fixed Effects Tests
Equation: Untitled
Test cross-section fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	1.088227	(9,86)	0.3799
Cross-section Chi-square	10.677463	9	0.2985

Cross-section fixed effects test equation:
Dependent Variable: REVAL
Method: Panel Least Squares
Date: 12/19/17 Time: 21:03
Sample: 2007 2016
Periods included: 10
Cross-sections included: 10
Total panel (unbalanced) observations: 99

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.057445	0.010254	5.602150	0.0000
STIBOR	-1.910820	0.326687	-5.849079	0.0000
GDP	0.051930	0.220390	0.235626	0.8142
CPI	0.202886	0.063135	3.213510	0.0018

R-squared	0.287464	Mean dependent var	0.054140
Adjusted R-squared	0.264963	S.D. dependent var	0.059007
S.E. of regression	0.050589	Akaike info criterion	-3.090586
Sum squared resid	0.243132	Schwarz criterion	-2.985733
Log likelihood	156.9840	Hannan-Quinn criter.	-3.048163
F-statistic	12.77553	Durbin-Watson stat	1.547645
Prob(F-statistic)	0.000000		

Table 12: *Redundant effects test on Revaluation*

5. Analysis and discussion

In this chapter, the results from the regressions are first used to validate the findings from the qualitative research. The results are later analysed and discussed in relation to theoretical framework and existing literature.

5.1 Analysis of results

This study examines whether, and then how, a hike in the repo rate would affect the income statement of Swedish RECs. The findings from the qualitative research suggested that there would be a correlation between the repo rate, STIBOR90 and interest expense. The respondents further suggested a relation between repo rate and revaluation of properties (Respondent 1-6 2017, personal communication). In order to formally test these statements, STIBOR90 was tested towards the repo rate. Sequentially, revaluation of properties and interest costs were tested against STIBOR90.

All three tests showed statistical significance. Indeed, applying these results to the findings of the qualitative research, which implied a clear correlation in all three tests, we can conclude that the qualitative and quantitative findings are in alignment. It should however be noted that the degree of explanatory power, measured as adjusted R^2, is somewhat low for Regression 2 and 3, implying that some skepticism should be entitled to our models. Further, the high adjusted R^2 in Regression 1 could be impaired by autocorrelation, as discussed in Section 4.1.

In Regression 1, the beta coefficient of the repo rate was 1.11, implying that STIBOR90 is closely correlated with the repo rate. The result implies that STIBOR90 will be more volatile than the repo rate, which is in line with the statements of one of our respondents. The respondent argued that, since STIBOR90 is a market price while the repo rate is a fixed rate, STIBOR90 will be subject to the markets expectations (Respondent 6 2017, personal communication). Further, the adjusted R^2 was very high which can partly be explained by the autocorrelation presented in the model. However, since the beta coefficient was significant, we could still confirm the theory of the close correlation between the two rates. The relationship is illustrated in Figure 7.

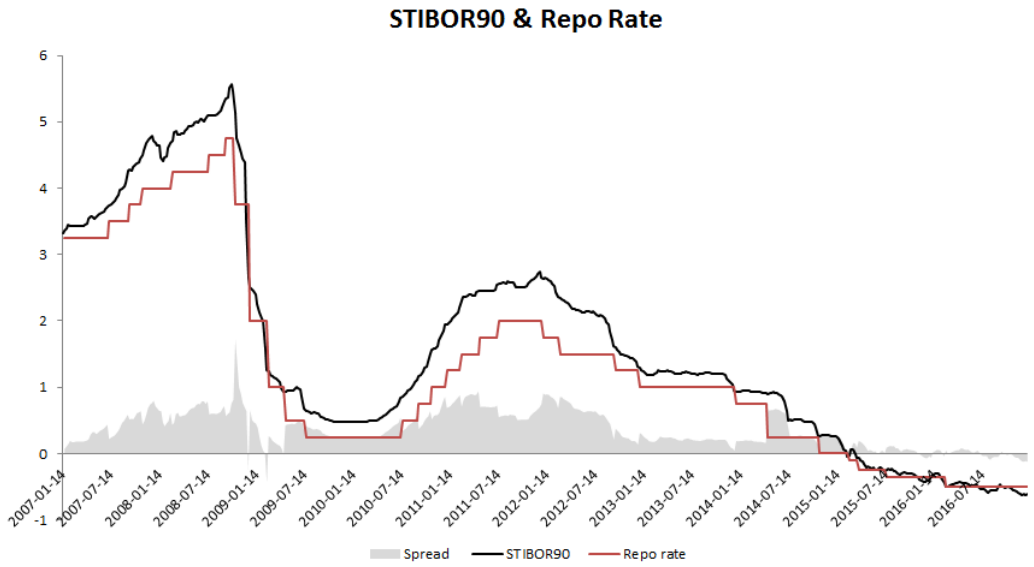


Figure 7: *STIBOR90, Repo Rate and spread. Sources: The Riksbank, Bloomberg*

As described by our respondents, STIBOR90 is used when pricing Swedish RECs' debt (Respondent 3-6 2017, personal communication). Thus, they imply that changes in the repo rate, and subsequently, STIBOR90, should have a significant impact on interest costs. Regression 2 confirms the theory that STIBOR90 has a significant effect on interest expenses. The beta coefficient of 0.36 is in line with expectations of many of our respondents, arguing that only the floating rates will be immediately affected by fluctuations of STIBOR90 (Respondent 1-6 2017, personal communication). The average share of floating rates for our sample was 42 per cent over a ten year period (see Appendix 1)**.** As the two values, 0.36 and 0.42 are arguably very close, we are confident in confirming the significance of both STIBOR90's significance on interest expense as well as the importance of measuring floating versus fixed rates when evaluating the effect of an interest hike on the income statement of Swedish RECs.

The item revaluation of properties is undoubtedly complex in its nature, which can be interpreted with the low adjusted R^2 of Regression 3, meaning that the explanatory power is low. The result from the regression implies a significant relationship between STIBOR90 and property revaluation. As the correlation is negative, the result implies that an increase in STIBOR90 would have a negative effect on revaluation of property. The result is in resemblance with the view of our respondents as most of them agreed that there is a negative correlation between interest rates and revaluation of properties (Respondent 2-6 2017, personal communication). One respondent further expressed doubts regarding a direct or highly significant correlation pattern between interest rates and revaluation. The respondent argued that there should be numerous other variables determining revaluation of properties (Respondent 1 2017, personal

communication). We conclude that this is in line with the low adjusted R^2 for Regression 3, but can still confirm the significance of STIBOR90 affecting revaluation of properties.

5.2 Overall analysis and discussion

We reason that the model put forward by Merton (1974) might further explain some of our findings. Since interest cost will be dependent on pricing of debt, we test whether our findings fit Merton's theory. Merton (1974) argues that debt mainly will be priced attributable to three aspects: 1) The required rate of return on riskless debt, 2) Various restrictions and provisions, and 3) The probability of default.

Firstly, our respondents argued that STIBOR90 is the main variable when pricing corporate debt. The respondents explained how STIBOR90 works as base of the cost of debt similar to the risk free interest rate referred to in Merton's (1974) theory of pricing corporate debt. STIBOR90 proved to be significant to interest expense, implying that the first aspect of Merton's (1974) theory applies to RECs.

Secondly, fixed term credit was identified as a crucial provision and ICR as an important restriction by our respondents (Respondent 1-6 2017, personal communication). However, banks answer to certain restrictions themselves, making ICRs among other restrictions similar for all loans (Respondent 4 and 6 2017, personal communication). This makes the restrictions included in Merton's theory non-applicable for RECs, hence only fixed term credit was included in Regression 2. Fixed term credit proved to have a significant impact on interest expense and this provision affects the pricing of corporate debt, in accordance with Merton's (1974) theory. We can therefore prove the impact of provisions such as fixed term credit on interest expense but not restrictions such as ICR.

Thirdly, several of our respondents argued that increasing interest rate levels would lead to concerns being raised regarding the real estate market (Respondent 1, 3 and 6 2017, personal communication). The respondents added that real estate is RECs' largest asset by far and that a decrease in price would heighten the cost of debt due to a higher risk. Revaluation proved to have a significant impact in accordance with the respondents' arguments of an increased risk (Respondent 2-6 2017, personal communication). However, revaluation is not a direct measure of default risk, hence we cannot confirm the third aspect of Merton's (1974) theory with certainty.

5.3 Practical Implications

The methodological approach and the limitations of this study may affect the findings' practical applicableness to some extent. Firstly, we included ten companies over a ten year period in this research. The examined period has been characterized by decreasing interest rates. Consequently, this may impair an analysis of how increasing interest rates would affect RECs' income statements. We can therefore not determine the magnitude of the adverse relationship with certainty. Secondly, this research does not take hybrid debt into account. For example, a company that is mainly financed through preferred shares would have a lower debt to equity ratio than a company whose debt is mainly comprised of bank loans. Since preferred shares are hybrid debt and their pricing works similar to that of bank loans, they should also be affected by an increased repo rate. Thirdly, the research is based on the current market situation, but possible changes in rules, regulations and accounting standards would potentially distort the results' applicableness.

Furthermore, the qualitative research manifested complexities related to pricing corporate debt and the RECs' interest expense. Respondent 4 and 6 (2017, personal communication) agreed that STIBOR90 is used a reference rate for bank loans but continued with adding that the reference never falls below zero. Since STIBOR90 is currently negative, an increase would not apply to the pricing of bank loans as long as STIBOR90 remains below zero. We can also conclude that RECs efficiently use fixed credit terms and derivatives to decrease their exposure towards fluctuations in the repo rate. However, even though they limit fluctuations' immediate impact, the RECs will be equally affected once these instruments reach their term to maturity. Thus, the usage of instruments as tools for hedging, limits RECs' short term exposure towards the repo rate but results in a presumed lagged effect on their interest costs.

6. Conclusions

In this chapter follows a conclusion of the results obtained and an answer to the research question stated in the purpose.

6.1 Concluding remarks

This paper examines the potential implication of hikes in the repo rate on the income statements of Swedish RECs. Inspired by a lack of previous research on the subject, as well as an unique market situation, this study complements previous research on RECs with a new focus area, income statements, where previous focus has mainly been on returns or default risk.

To determine the effect fluctuations in interest rates have on the income statement, three tests were conducted in accordance with the results of the study's qualitative research: STIBOR90 against the repo rate, interest expense towards STIBOR90 and revaluation of properties against STIBOR90. Regression 1 contained time series data while the latter two contained panel data, and in all three regressions control variables were added to further strengthen the results. The findings suggest that there is a significant relationship between items on the income statement and changes in the repo rate. Regression 2 indicates that an increase in STIBOR90 with 100 basis points would increase the interest expense on the income statement with 36 basis points. Regression 3 indicates that an increase in STIBOR90 with 100 basis points would decrease property values with 191 basis points. To reiterate to changes in the repo rate, Regression 1 indicates a positive relationship between STIBOR90 and the repo rate. Further, since STIBOR90 fluctuate more than the repo rate, we can conclude that a change in the repo rate would affect STIBOR90 more and sequentially the items on income statement more.

The findings of the study support the hypothesis that interest rate fluctuations would have a significant effect on the income statements of Swedish RECs. To answer this study's research question, an increase in the repo rate of 100 basis points would increase interest expenses with 40 basis points and decrease revaluation of properties with 212 basis points. In Figure 8, the calculations behind the results are presented. The findings also highlight the complexity of the subject and suggest that other factors are of high importance when analysing RECs' income statements.

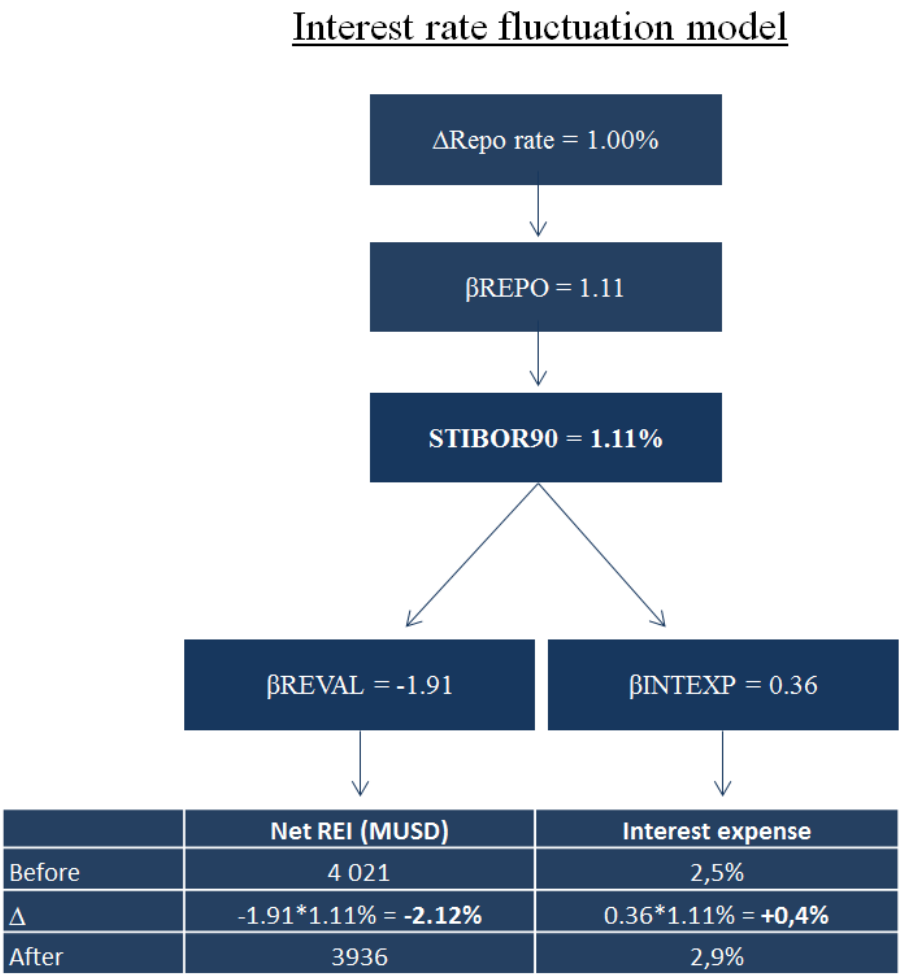


Figure 8: *The Interest rate fluctuation model illustrates how a change in repo rate hypothetically translates to the income statement of Swedish RECs. The model utilizes the beta coefficients of Regression 1, 2 and 3. The specific scenario illustrates how a 100 basis point increase in repo rate affects STIBOR90, which in turn affects revaluation of properties and interest expense. Sources: Company data, Bloomberg.*

6.2 Areas for future research

One aspect the authors find intriguing is the possible cross-country differences for RECs. The sample companies included in this research follows the Swedish accounting standard IFRS 13 for revaluing their properties, which proved to be an important variable. Since accounting standards and repo rates differ between domiciles, it would be interesting to see if the results are consistent with those of foreign companies.

Another area left out of this thesis, which nonetheless is interesting, is Swedish real estate developers. All the respondents included in this research highlighted how real estate developers are more exposed and suffer greater risk of defaulting (Respondent 1-6 2017, personal communication). It would be interesting to test their tolerance to increases in repo rate using the framework of this study.

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Respondent 1, Associate, Corporate Finance firm (2017). Telephone interview November 21.

Respondent 2, Associate, Corporate Finance firm (2017). Telephone interview November 21.

Respondent 3, CFO, Swedish Real Estate Company (2017). Telephone interview November 24.

Respondent 4, Finance Controller, Swedish Real Estate Company (2017). Telephone interview November 24.

Respondent 5, Portfolio Manager, Swedish Investment Bank (2017). Telephone interview November 23.

Respondent 6, Portfolio Manager, Swedish Investment Bank (2017). Telephone interview December 2.

Databases

Bloomberg Professional Version 07 (Available via LINC)

Standard & Poor's Capital IQ (Available via LINC)

8. Appendices

8.1 Appendix 1: List of companies and key financial metrics

Company	Country	Type of company	Geographical split	Market Cap	Enterprise Value
Hufvudstaden AB	Sweden	OS (RT)	STHLM	3 313	4 040
Fabege AB	Sweden	OS	STHLM	3 405	6 429
Klövern	Sweden	DV	DV	1 177	4 168
Corem	Sweden	OT	DV	416	1 358
Wallenstam	Sweden	PV/ OS	DV (GBG)	3 051	5 211
Victoria Park	Sweden	PV	DV	845	1 787
Fastighets AB Balder	Sweden	DV	DV	4 616	11 541
Castellum AB	Sweden	DV (OS)	DV	4 323	9 137
Atrium Ljungberg AB	Sweden	DV (RT)	STHLM	2 094	4 338
Diös Fastigheter AB	Sweden	DV (OS)	NRLND	899	2 267

Company	D/E (%)	D/TC (%)	ND/EBITDA	Current ratio	ICR
Hufvudstaden AB	26,3	20,8	4,7x	0,2x	8,6x
Fabege AB	93,1	48,2	0,0x	0,1x	3,1x

Klövern	183,6	64,6	13,2x	0,1x	3,3x
Corem	205,9	67,2	11,8x	0,0x	2,2x
Wallenstam	92,6	48,1	15,6x	0,0x	3,8x
Victoria Park	169,8	61,6	4,3x	0,8x	2,6x
Fastighets AB Balder	160,4	61,6	13,3x	0,9x	3,2x
Castellum AB	126,1	55,8	11,3x	0,7x	3,6x
Atrium Ljungberg AB	103,3	50,8	12,1x	0,3x	3,5x
Diös Fastigheter AB	167,9	62,7	11,8x	0,2x	3,9x

Key:

PV = Private space

OS = Office space

OT = Other

DV = Diversified

STHLM = Stockholm

GBG = Gothenburg

NRLND = Northern Sweden

Enterprise value = Market cap plus long term debt less cash holdings

D/E = Total long term debt to total shareholder equity

D/TC = Total long term debt to total capital

ND/EBITDA = Net debt to Earnings Before Interest Taxes Depreciation and Amortization

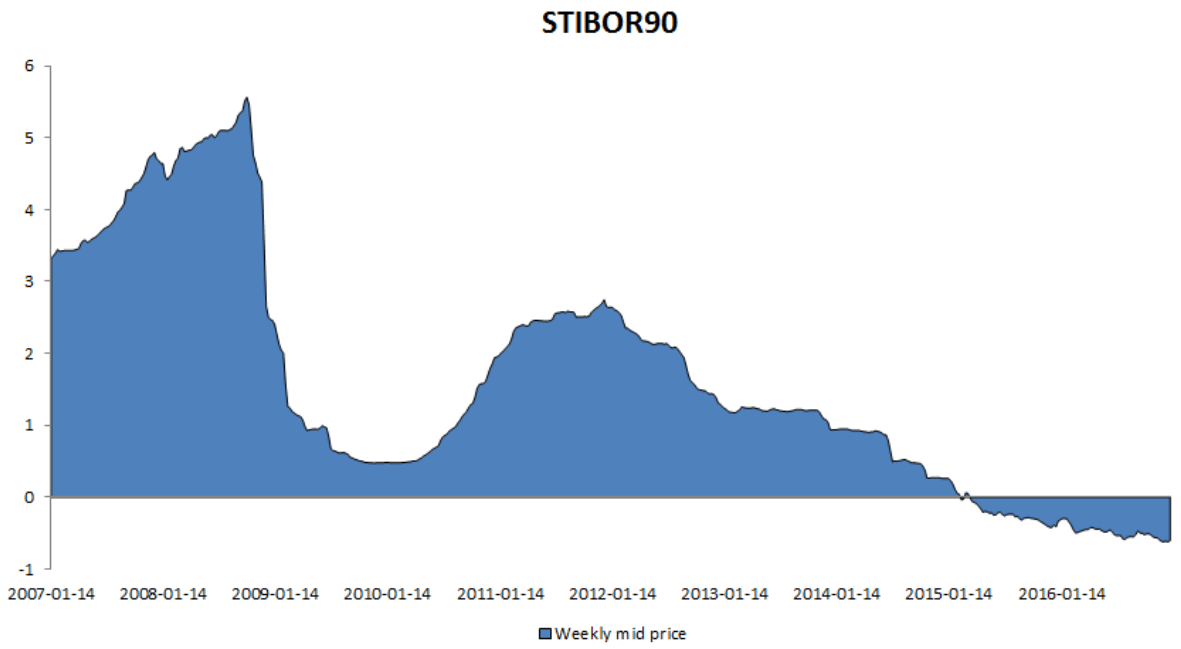
Current ratio = Current assets / Current liabilities

8.2 Appendix 2: List of respondents

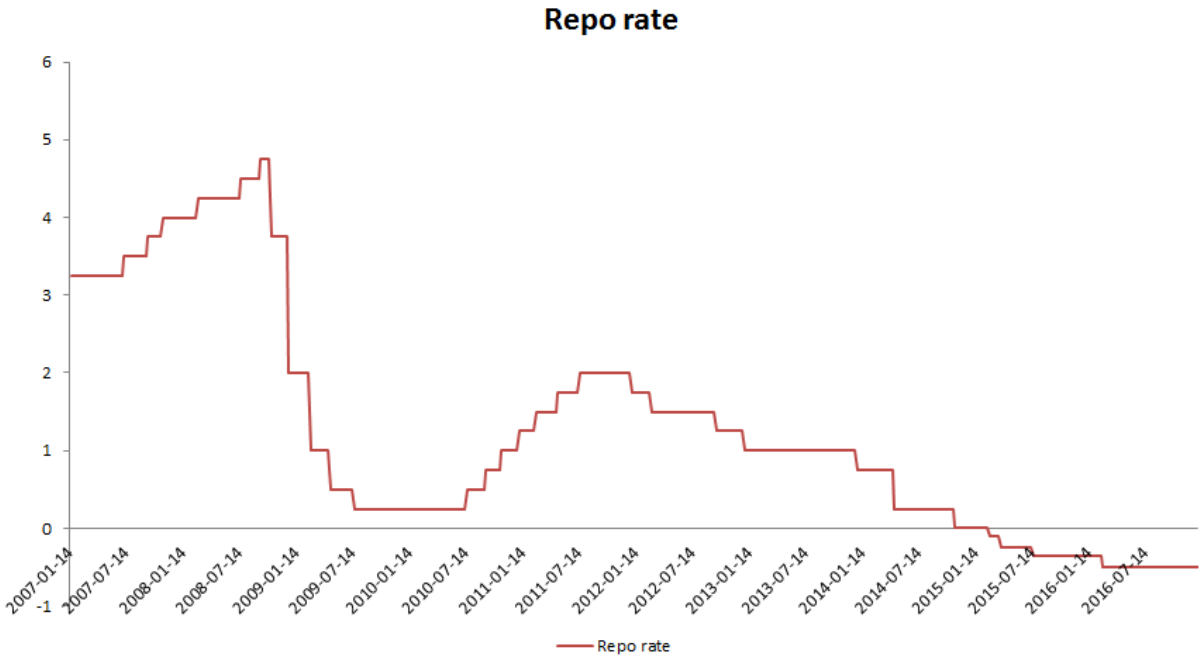
Table of respondents

Abbreviation	Field of work	Position	Expertise(s)	Date of interview / transcript
Respondent 1	Corporate Finance, real estate focus	Associate	Due diligence, valuation and transactions	2017/11/20 / 2017/11/21
Respondent 2	Corporate Finance, real estate focus	Associate	Due diligence, valuation and transactions	2017/11/20 / 2017/11/21
Respondent 3	Real estate company	CFO	Financing, debt restructuring, valuation of properties, risks and opportunities	2017/11/23 / 2017/11/24
Respondent 4	Real estate company	Finance Controller	Financing, debt restructuring, valuation of properties, risks and opportunities	2017/11/23 / 2017/11/24
Respondent 5	Asset management	Portfolio Manager	Macro environment, value drivers, risks and opportunities	2017/11/21 / 2017/11/23
Respondent 6	Asset management	Portfolio Manager	Rates, credit, credit ratings, bonds and debt structures	2017/12/01 / 2017/12/02

8.3 Appendix 3: STIBOR90 and repo rate



Three month STIBOR. Source: Bloomberg



Swedish

Repo rate. Source: The Riksbank

8.4 Appendix 4: Regression of STIBOR90

Dependent Variable: STIBOR
Method: Least Squares
Date: 12/12/17 Time: 19:22
Sample: 1/14/2007 1/01/2017
Included observations: 521

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.196432	0.015910	12.34669	0.0000
REPO	1.109380	0.007416	149.6014	0.0000
GDP	0.007806	0.003434	2.272982	0.0234
CPI	0.006205	0.026471	0.234405	0.8148

R-squared	0.978517	Mean dependent var	1.607251
Adjusted R-squared	0.978392	S.D. dependent var	1.642961
S.E. of regression	0.241511	Akaike info criterion	0.003840
Sum squared resid	30.15523	Schwarz criterion	0.036514
Log likelihood	2.999576	Hannan-Quinn criter.	0.016639
F-statistic	7849.333	Durbin-Watson stat	0.320413
Prob(F-statistic)	0.000000		