An Assessment of the Housing Market in Oslo

Is the Price Development Supported by Fundamental Factors?

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Abstract

Over the past years the housing market in Oslo has been characterized by substantial escalation in house prices, exceeding that of the Norwegian market as a whole. The topic has been widely discussed in the media, both nationally and internationally. Renowned economists, Karl E. Case and Robert J. Shiller, have predicted a housing bubble in Norway since 2012, which has not occurred, making the Oslo market an interesting topic to investigate.

The main purpose of this thesis is to evaluate whether existing house price models have been able to determine fair house prices, and if not, if including more fundamental factors in a house price model would better determine reasonable prices. In addition, to understand the price development from a broader perspective, we have made considerations also from a psychological point of view. Both the historical and current housing market in Oslo is examined to assess whether the house prices are supported by fundamental factors or if the price growth are solely grounded on expectations.

An empirical analysis of several well-known theories is conducted to determine whether existing models are sufficient, among them the Hodrick-Prescott filter (HP-filter), Price-to-Rent ratio (P/R-ratio) and Tobin's Q. In addition, Case and Shiller criteria's for the presence of a housing bubble are presented. The models show contradicting results on whether historical bubbles are captured and if there are bubble tendencies in the current market. The results from the models emphasize that some of the existing house price models to varying degrees is not good enough at determining fair house prices.

Our fundamental factor analysis includes a discussion on identified factors used in various house price models. Our assessment points out that local factors such as a great lack of supply of new housing combined with increasing demand due to urbanization and immigration, are important factors that the existing models do not reflect in a sufficient manner. Based on the existing fundamental P/R-ratio, we present a model enabling the possibility to capture local characteristics of the housing market in Oslo. Using the most important factors found in the fundamental factor analysis, the extended model supports the development in the real P/R-ratio to a higher degree than the original fundamental P/R-ratio.

Conclusively, this thesis state that there is not a housing bubble in the market in Oslo, as the investigated fundamental factors supports the high price level in the current market. Our main finding is that some of the existing models lack the local factors necessary to make well-informed conclusions of the conditions in a market. It is further believed that Case and Shiller's criteria's would have provided better conclusions with more fundamental factors included.

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1. Introduction and Problem Statement

The escalation of prices in the Norwegian housing market has been an important topic in the media over the last decades. Analysts using numerous house price models are trying to predict housing bubbles, but have yet not found one single model able to do so. Among these are the American economists Karl E. Case and Robert J. Shiller, who have predicted a housing bubble in Norway since 2012 (Mohsin, 2015). The purchase of housing is one of the greatest investment households in Norway make during their lifetime. In 2015, 84 percent of Norwegian households owned their housing, which means that changes in the housing market will affect a large part of the Norwegian society and the overall economy (SSB, 2015a).

Nationally, in real terms, house prices have almost tripled since the lowest point in 1992 (NCB, 2015a). The growth in housing prices has, however, been fluctuating at a regional level. Especially the largest cities have experienced exceptionally high growth in this period, even though Stavanger the last two years has experienced decline in house prices of approximately 10 percent, due to the influence of recent reduced oil prices. Over the last two decades Oslo is the city in Norway with the highest level of price per square meter. Also, growth figures show a significant development of around 350 percent between 1980 and 2015 (NCB, 2015a).

We have found the case of Oslo interesting for many reasons. First, due to, among others, urbanization and immigration the demand of housing in the Oslo market has increased constantly over the period 1980-2015. Oslo has grown from a city of about 455,000 in 1980 to approximately 648,000 as of 2015. The prognosis towards 2030 is a population of about 807,000 (SSB, 2016a). Therefore, the pressure on demand will likely continue in the foreseeable future. It illustrates how changes in society affect the housing market and how the price mechanism works.

Secondly, the supply of housing has of numerous reasons not grown to the same extent as the demand due to a low construction rate (Kaspersen, Laustsen and Havnes, 2016). Political wishes to maintain existing residential patterns such as density, height and limit to forest boundary, results in a lack of available sites for building. In addition, administrative challenges in the process of obtaining building permits also affect the supply of new houses. These local factors, in combination with international and national parameters driving the house prices, make Oslo an interesting study to investigate further.

The strong growth in house prices in Oslo raise the question whether the prices are supported by fundamental factors or characterized by bubble formations. There are several house price models available, which include different combinations of fundamental and psychological factors. However, neither of them seems to have been able to consistently determine if house prices are fairly priced, although some of the models have been able to

present fair prices on single occasions. This dissertation seeks thereby to investigate if adding additional fundamental factors to existing house price models will enlighten the issue or if the growth is grounded in expectations.

The problem statement is as follows:

- *"Are the existing house price models sufficient for determining the fair house price?"*
- If not, *"Will including more fundamental factors in a house price model better determine the reasonable price?"*

We will throughout the thesis evaluate the questions from a duplex approach. First, after evaluating some of the existing house price models, we will seek to develop a model that incorporates a set of fundamental factors, which we find the most important. Our assertion is that such a combination of factors can illustrate the importance of the fundamental values more accurately, and possibly highlight the support from fundamental factors. These are factors that are previously not included together in one single model. Second, we are curious as to why Case and Shiller have predicted a housing bubble in Norway since 2012, and why this has not yet occurred. Therefore, we apply their framework to the housing market in Oslo to assess whether the criteria's are present in the local Oslo market as well. This results in the following research questions:

- What does well-known empirical housing price models indicate regarding the housing market in Oslo?
- To what extent can the development in fundamental factors support the house price growth in Oslo?
- Why have Case and Shiller predicted a housing bubble in Norway since 2012, and is the same criterion's fulfilled in the housing market in Oslo?
- Will a new model including more fundamental factors improve the accuracy of the fundamental value of house prices?

1.1 Outline

The reader of this thesis should focus their attention on the fundamental factors that each presented model emphasizes and how the factors relate to the housing market in Oslo. The dissertation evolves from a review of existing models towards a new approach of how housing prices can be evaluated. The analysis conducted throughout the thesis will be discussed both in relation to the historical and current housing market in Oslo, as well as towards Case and Shiller's predictions of the market. A more thorough review of the different parts of the thesis will follow.

The first part of the thesis will present a definition of a housing bubble and other relevant bubble theory. Further, the mechanisms of supply and demand in the housing market will be presented. In order to provide the reader with a solid understanding of the historical and current situation in the housing market in Oslo, an analysis of the historical development in Oslo is presented.

The next part of the thesis contains an empirical analysis of well-known house price models; Hodrick-Prescott filter (HP), Price/Rent-ratio (P/R) and Tobin's Q. These models are used to determine whether the house prices in Oslo appear to be fairly priced according to theory. Further, several other house price models and its explanatory factors are introduced and form the basis of the fundamental factor analysis conducted later.

The third part of the thesis includes our own contribution to determine a fair house price in the market. We have developed an X-factor as an extension to the fundamental P/R-ratio, which we believe reflects the house prices better, using Oslo as a case for our testing. The presentation of the model will contain an explanation of the model and why we believe this model gives a better estimate of reasonable prices. Following is an analysis of relevant fundamental factors to use in our model. The fundamental analysis examines whether factors believed to be drivers of determining house prices can support the current (and historical) house price level in Oslo. This analysis will select what local, national and international factors to be applied in our model. Further, in order to determine whether psychological factors have a dominant part of the house price development, household's expectations and Case and Shiller's criteria's of a housing bubble will be evaluated.

Next, the selected fundamental factors will be implemented in our model, testing whether the model can estimate a new fundamental P/R-ratio closer to the real P/R-ratio. An assessment of psychological factors in relation to our contribution will then be conducted. Finally, a summary of the findings and limitations of the model will be presented.

2. Delimitations, Methodology and Data

In general, as in Oslo, the housing market is complex and characterized by different types of housing, such as detached houses, semi-detached housing, flats etc. This makes analyzing the housing market challenging. We have therefore decided to view all types of housing as one market. Even though this is a simplification of the actual conditions, we do not believe that it will impact our final conclusion to a large degree.

We have chosen to set the time-horizon from 1980 until 2015. This is mainly due to the fact that the housing market was heavily regulated by the government before the 1980s, through price regulation of housing and credit constraints (Grytten, 2003). The regulations prevented a free adaption to the market, and are thus less interesting,

as this thesis seeks to look at factors affecting the price in a free market. In addition, sufficient data from before 1980 is not available for all the desired areas. Also, some data in our selected time period is not retrievable, where data from as far back as possible is used. Longer time horizons can be used if this enlightens the analysis.

We will use the housing market in Oslo merely as an example to test the models on, and will therefore not compare important factors across cities. The model we present is meant to be applied to countries and cities worldwide; however, in order to make a profound analysis we have limited ourselves to look at only one market. Norway could have been evaluated as a whole, but due to great regional differences within Norway, we believe that such an analysis would not give a comprehensive picture of the price development.

We therefore chose to investigate the housing market in Oslo, as we find the distinctive characteristics of the capital interesting, especially as the lack of supply of housing is somewhat self-inflicted. The extreme gap between supply and demand of housing in Oslo over a long time has pushed the prices up further year after year. Even though Norway as a country has experienced a severe drop in the international price of their most important export resource (oil), the prices in the housing market in Oslo has continued to increase. Inhabitants in Oslo are indirectly able to reap the benefits of the oil-price fall, through declining interest rates, further enabling them to invest in more expensive housing. In addition, the discussion of a housing bubble in Oslo has been present for several years, both in the media and by experts.

We believe that the presented theory and analysis' provide a thorough and comprehensive understanding of the mechanisms and conditions within the housing market in Oslo, and contribute to a solid and well-grounded conclusion of the thesis. The data collection for this dissertation was completed on the 25th of March 2016. Information published after this date will thus not be a part of the assessment, but can be commented on.

Methodology

This section will emphasize and discuss the applied methods in this dissertation. It is essential to obtain reliable information with high validity in order to reach well-founded conclusions. This dissertation has a deductive approach, as the analysis is based on specific theory taking basis in a hypothesis, which is tested with the obtained data.

The dissertation is based on a post-positivistic approach, where the ontological framework derived assumes an objective reality. As individuals are characterized by limited intellectual mechanisms, the framework can be apprehended only imperfectly and probabilistically. In practice, this means that the replicated findings probably are true, however, it can also be subjected to falsification (Guba and Lincoln, 1994). The thesis is mostly a descriptive method in that we have basic knowledge of the subject and are thus able to describe existing models

and discuss multiple factors influencing the price formation in the housing market in Oslo. These factors are structured in an X-factor as an extension of the fundamental P/R-ratio. We regard this design method to be appropriate when approaching this kind of hypothesis and draw a relatively firm conclusion based on the relationship between variables (Gripsrud, Olsson and Silkoset 2004).

It will be applied both a qualitative and quantitative research in the dissertation, with an emphasis on quantitative research. The writers analytical assessment will be based on empirical data and theory, and will combined try to answer the problem statement. Both the empirical analysis and the fundamental factor analysis will be based on quantitative data, followed by an analytical discussion of the results. Short interviews and conversations with experts within the field are conducted in order to get an overall understanding of the area. Apart from some data material, the retrieved information is not directly applied in the thesis, but it might have influenced our analysis of the results. Hence, the main part of the thesis is based on secondary data, in addition to some primary data derived from real estate brokers and companies. We believe the data collected is representative for the problem statement we seek to answer, and is discussed in the following section.

Data

Oslo represents the largest housing market in Norwegian context, where we can find the longest series of necessary data to analyze the development in housing prices. A larger market will in general be more efficient than a smaller one. However, for analysis purposes, we believe that the size of the Oslo market is sufficient. This section will refer to the sources used in order to obtain data for this dissertation. Further, the reliability and validity of the collected data is discussed.

The applied data is primarily newspaper articles, reports, journals, and online resources, in addition to materials from statistic banks. The advantage of using secondary data is that it is relatively easy to collect. There exists countless academic articles and research on the topic of house price models and housing bubbles. Several different expert opinions on how to characterize a housing bubble, what drives house prices and whether a housing bubble exists is also present. The fact that the area of house prices is heavily researched increases the reliability and validity of the information we have found.

There are however limitations using mainly secondary data. The data could have been primarily collected for another purpose than this thesis' field of interest. This means that the data might not be applicable or relevant for the factors we want to analyze. In addition, all data may not be comparable for all years; therefore some assumptions are being made in order to be able to use the data. Well-known economists will form the basis of the theoretical framework to ensure high validity of the analysis. We have among others retrieved theory from

economists and renowned scholars such as Jacobsen and Naug, Grytten, Røed Larsen, Case and Shiller, Poterba and Tobin.

In order to analyze the historical development of house prices in Oslo, data is collected from Norway's Central Bank (NCB) in combination with growth in house prices from Eiendom Norge from 2014 to 2015. The consumer price index (CPI) is obtained from NCB and SSB. Besides this, data material from Statistics Norway (SSB) is used to find material on fundamental factors. In sections where it has not been possible to retrieve the full and coherent dataset, data has been constructed from a variety of existing sources, which will be highlighted in the relevant section. Also, source limitations and considerations of the data are presented where it is relevant. Nominal data is adjusted for inflation in order to obtain real value, as this gives a more realistic picture of the development. Hence, real values of assessed data are used throughout the dissertation, with some few exceptions, stated in the relevant chapter. Further, indexed time series are made comparable by re-indexing the time series to take basis in the same year. The underlying calculations are presented in the thesis' accompanying appendices.

3. Bubble Theory

The definition of a bubble will be stated together with a mathematical derivation of a bubble. A short distinction between a bubble and a correction will be presented, as well as a short discussion of the impact of a bubble.

3.1 Definition of a Bubble

The definition of a bubble has been discussed by several researchers and economists. The Norwegian bank, DNB, emphasizes two different definitions. The first is *a situation where there is a continuing high growth in prices without a fundamental explanation, or shifts in structural underlying factors that increase the prices*. A shift can be credit liberalization, leading to households being able to realize a higher debt burden giving increased purchasing power and thus house price growth. The second definition of a bubble is that *a price increase is rooted in the expectation of future price growth.* This means that if expectations are changed from the belief of growing to declining prices, the real housing prices can decline even though the economic factors have not changed considerably (Sparre, 2014).

Stiglitz's (1990) summarize the definition in a good way, and will be the definition we will use in our thesis:
"If the reason the price is high today is only because investors believe that the selling price will be high tomorrow – when "fundamental" factors do not seem to justify such a price – then a bubble exists."

In short, a bubble exists if the deviation between the underlying fundamental factors and the market price is significantly negative or positive (Grytten, 2009). In relation to the housing market in Oslo, a significantly positive deviation is the most relevant. The fundamental value is often based on measurable economic explanatory variables, whereas the market value often is based on a greater expectancy element of the future. This reaction can often be a psychological phenomenon and not grounded in fundamental factors. The expectation of house price development is often self-sustaining, as more people buy at elevated prices, which further increases the prices (Lawrence, 2008).

When evaluating a market to be in a bubble, it can be hard to determine at what stage in the bubble the market is in. The fundamental housing prices are not easily observable, which requires a discretionary evaluation in addition to the empirical analyses when assessing a possible housing bubble. The specter of different house price models proves this, as various financial experts emphasize different fundamental factors in their models. Consequently, there is a widespread perception of whether a housing bubble exists in a market or not.

Bubble test

To measure whether a bubble is present or not, one can utilize a simple bubble test or other models where deviation from trend or other fundamental factors are analyzed. The different methods to analyze house prices and a possible bubble will be elaborated in chapter 6. Here, the simple mathematical bubble test will be presented, in order to increase the understanding of a bubble (Grytten, 2009).

(3.1) $$b_t = \left(\frac{1}{1+r}\right) E_t(b_{t+1})$$

In equation (3.1) with time unit (t), we have (b) as the bubble value, (E) as the expectation, while (r) is the expected return. The return will in this relation be the normal yearly price increase in the housing market. The equilibrium in a financial market can then be written as:

(3.2) $$p_t = \left(\frac{1}{1+r}\right) E_t(d_{t+1} + p_{t+1})$$

Equation (3.2) introduces the price (p) and the return (d). The price in period t (current period) is based on the expected return (d) plus the price of the financial object in the next period (p_{t+1}). This number is discounted with the cost of capital (r). The price of the financial instrument over time will be accumulated in accordance with expression (3.3).

(3.3) $$p_t = \Sigma_{j=1}^{n} \left(\frac{1}{1+r}\right)^j E_t(d_{t+1}) + \left(\frac{1}{1+r}\right)^n E_t(p_{t+n})$$

The first part of equation (3.3) is the sum of the discounted expected return for the whole period, while the second part expresses the expected price at the end of the period. Further, the value of the bubble can be deduced in the following expression:

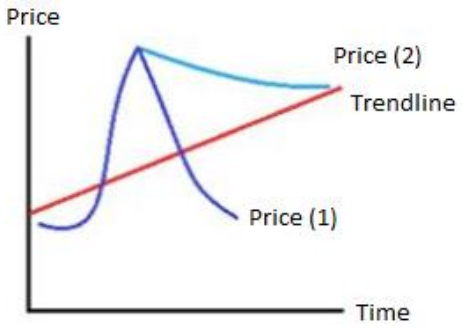
(3.4) $$b_t = p_t - \Sigma_{j=1}^{\infty} \left(\frac{1}{1+r}\right)^j E_t(d_{t+j})$$

Equation (3.4) states that the value of the bubble is the asset market price today less the sum of discounted future return, meaning the fundamental value. One can from this conclude that the value of the bubble will be equal to zero if the fundamental value is the same as the asset market price, and greater than zero if there exists a bubble in the market, thus a market asset price higher than the fundamental value. However, the fundamental value consists of several unknown factors, among others the yearly return on housing and capital gain, making the fundamental value a theoretical measure that needs to be estimated.

Bubble or Correction?

If a bubble is present in the market, it will not necessarily burst, as a price correction or a slowdown in the growth is also possible. Figure 3.1 illustrates the formation of a bubble, whereas two different situations are presented. In situation 1, the market experiences a burst of the bubble and fall in prices, while the second situation shows a gradual correction of prices. This means that even though one believes a bubble is present today, the development of the prices can be hard to predict.

Figure 3.1 Bubble or Correction?



Source: Own Creation

In the second situation, we have equilibrium in the short-term. The prices is, as earlier discussed, often based on psychological factors, as future growth expectations cause a further price increase. Due to the short-term

equilibrium price, some will state that a bubble is not present. In order to be able to identify a bubble, the prices in relation to the long-term trend is more important. However, a burst rarely occurs without a macroeconomic shock appearing, such as a fall in the oil price and subsequent changes in the economy (Grytten, 2011).

Impact of a Bubble

A housing bubble will eventually affect the overall economy, as house prices are a key factor in an economic business cycle. Edward E. Leamer (2007) states in his article "Housing is the Business Cycle" that the business cycles in the economy largely are driven from investment in housing. A decline in the price of housing will cause the economic activity in the country to decrease, which in turn will reduce household's consumption. The reduction in consumption will reduce the profit for companies, causing them to lay more people off, increasing the unemployment rate. Often, this leads to self-reinforcing effects as psychological factors have a great impact, where the negative spiral can slow down the economic activity further. Moreover, house owners often have to realize a loss when selling as the prices are lower, which reduces their equity and in turn disables them from buying the desired housing. Leamer (2007) further emphasize that employment is an important part of GDP, as it is a result of the production in the country. Consequently, a decline in housing investments will affect a country's overall economy and GDP negatively to a great extent.

3.2 Case and Shiller's Criteria's for a Housing Bubble

Although housing bubbles can be hard to detect, by looking closer at typical characteristics in the market it can be easier to recognize. Case and Shiller (2004) presents seven characteristics in the market that implies that there is a housing bubble. It is however important to emphasize that these criteria's leave room for subjective interpretation. One should thus not base a decision on whether there is a housing bubble solely on these criteria's. The seven criteria's are as follows:

1. Widespread expectations of increase in house prices
2. Increase in house prices deviates from the increase in private income
3. Great interest and attention to the housing market in both the media and in private
4. A general understanding that it is profitable to invest in housing
5. Limited understanding of the risks associated with the investment
6. Simplified perceptions regarding the mechanisms of the housing market
7. Widespread expectations that one should buy housing

4. Supply and Demand in the Housing Market

In the market economy, the price of housing is based on the level of supply and demand. This chapter will therefore elaborate on the function of supply and demand and how the equilibrium within the housing market is created. The purpose of this chapter is to present what variables are the most important for the housing price development. This part of the thesis is mostly based on the article "What Drives the Housing Prices?[1]" by Jacobsen and Naug (2004). The mathematical derivation is retrieved from said article.

We will distinguish between the short- and long-term horizons when evaluating the supply within the housing market. In the short term, the supply of housing is relatively stable, whereas the price is mainly affected by the change in demand in the market. The process of planning, getting the necessary permits and building housing can be comprehensive and long lasting. However, according to theory, the supply will in the long-term adjust to the demand (Jacobsen and Naug, 2004). This will be further elaborated upon later in the chapter.

4.1 The Demand of Housing

In the housing market, there are mainly two different types of buyers;

1. People who buy for consumption purposes
2. People who buy for pure investment purposes

It is reasonable to assume that the first group is greater than the other, and therefore this dissertation will focus on the most important factors influencing the demand for consumption purposes. Further, people can consume housing by either owning or renting the housing.

The analysis is based on the following aggregate function of demand:

$$H^D = f\left(\frac{V}{P}, \frac{V}{HL}, Y, X\right), \quad f_1 < 0, \quad f_2 < 0, \quad f_3 > 0 \tag{4.1}$$

Where H^D represents the demand for housing, V is the total housing costs for a typical owner, P is the price index for other goods and services except housing (CPI), HL is the total housing costs for a typical tenant (rent), Y is the real disposable income for household's, X is a vector of other fundamental factors influencing the demand for housing, while f_i is the partial derivative of f(x) with regards to i.

The equation explains that the demand for housing increases if the real disposable income increase (Y), and decline if the costs of owning housing increases compared to rent (V/HL) or if the price on other goods and

[1] "Hva driver boligprisene?"

services (V/P) increase. The X variable captures the impact of other factors affecting demand, and will be elaborated upon later.

The four parts of the equation (4.1) will be elaborated in order to provide a better understanding of the theoretical demand for housing. The total housing costs for a typical owner (V) measures the value of the goods the owner has to sacrifice to be able to own and utilize housing for a given period of time. The real housing costs for the owners are more easily expressed in equation (4.2). It will however not be the optimal approach to the real costs, as tax benefits and maintenance costs from owning housing are excluded in the calculation.

$$\frac{V}{P} = \frac{PH}{P} BK = \frac{PH}{P}[i(1-\tau) - E\pi - (E\pi^{PH} - E\pi)] \tag{4.2}$$

Where BK is the living costs invested in housing (real terms), PH is the price on average housing, i is the nominal interest rate, τ marginal tax rate on financial income and expenses, $E\pi$ is the expected inflation (the expected growth in P and HL, measured as a rate), while $E\pi^{PH}$ is the expected growth in PH (measured as a rate). The expression [i (1 - r) - $E\pi$] represents the real interest rate after taxes. It measures the real interest expenses of the mortgage and/or the lost real interest income (alternative cost) as equity is invested in housing.

Consequently, we see that a growth in the real interest rate will increase both the interest costs and also the interest income (the alternative cost increases). As expressed by the formula, such a growth will decrease the demand as the cost of living is increased. Further, the expression [$E\pi^{PH}$ – $E\pi$] is the expected real house price growth. The expected housing wealth increases if the expectation of the real house prices rises. Thus, the real cost of owning housing decreases. In this situation, it will become relatively more favorable to own housing compared to renting, and the demand for housing will increase. The equation (4.2) is then simplified, where BK is the nominal interest rate after tax less the expected price increase for housing:

$$\frac{V}{P} = \frac{PH}{P} BK = \frac{PH}{P}[i(1-\tau) - E\pi^{PH}] \tag{4.2a}$$

The third part of the initial equation presents the real disposable income (Y). Jacobsen and Naug (2004) define it as:

$$Y = \frac{YN}{P^{\alpha 1} HL^{\alpha 2} PH^{\alpha 3}}, \alpha_1 + \alpha_2 + \alpha_3 = 1, \qquad \alpha_1 < \beta_1, \alpha_2 < \beta_2 \tag{4.3}$$

Here, YN represents the nominal disposable income. The three components in the denominator will reduce the purchasing power of households and further affect the demand negatively. The components are the general increase in the consumer price level (P), rent (HL) and the price level on average housing (PH).

The last part of equation (4.1) is the variable X, which accumulates the effect of factors such as demographic variables, the banks' lending policies and the expectations of households regarding future income and costs of housing. These factors are assumed to be observable.

Important demographic factors pointed out by Jacobsen and Naug are the population size, the number of people in the establishment phase, the migration patterns and a strong level of urbanization. These aspects will increase the demand for housing. Even though they can explain some of the growth in house prices, they cannot explain why house prices vary considerably over time.

The second factor Jacobsen and Naug emphasize is the impact of banks' lending policies. Changes in the availability of credit can have a great impact on the demand for housing and the price, as most housing is financed through a mortgage. Lending policies are often dependent on the banks profitability, government regulations and the expected creditworthiness of the customers.

They present the banks credit offerings to households (L_S) as follows:

$$L_S = h\left[O, REG, Y, U, \frac{PH}{P}\right], h_1 > 0, h_2 < 0, h_3 > 0, h_4 < 0, h_5 > 0 \tag{4.4}$$

Where L_S is the banks credit offerings to households, O is the bank's profitability, REG is a measure of the government regulations, U is the unemployment ratio, while h_i is the derived of h (*) with respect to i.

The equation states that the credit offerings will decrease if the bank's profitability is reduced, if stricter governmental regulations are imposed, or if the customers expected income or collateral values declines. An increased unemployment rate will have a negative impact on the expectations of future income and solvency, and will reduce the banks credit offerings to households.

Jacobsen and Naug lastly present three main reasons for the importance of future expectations from consumers; (a) housing is a durable consumer good, (b) buying a house is one of the greatest investments for most households and, (c) most households housing purchases are significantly leveraged. The expectations related to future income are heavily relied on the labor market. Increasing unemployment rate leads to expectations of lower income in the future, and can also increase the reluctance towards risk. This can limit the loan and credit access for households, and thereby reduce the demand for housing. A low unemployment rate and easy access to credit will on the other hand increase expectations and thus increase the housing demand.

From this derivation of Jacobsen and Naug's model, we see that the demand for housing is dependent on several factors. They state a housing bubble may occur if the deviation from the fundamental value is great and positive.

These deviations can be caused by a significant change in one or more of the factors described above and in turn cause a shift in the price expectations. A positive price expectation can be said to be self-fulfilling, as demand increases with expectations of further growth, increasing the prices even more. Thus, this process can result in house prices far above their fundamental value, creating a housing bubble.

4.2 The Supply of Housing

In the introduction of this chapter it has been stated that the characteristics of the market makes the housing supply different in the short- and long term. Due to official regulations and the time-consuming process of construction, the supply of housing will only be able to change substantially in the long-term. Therefore, we will distinguish between supply in the short –and long term. Hendry's (1984) model is presented in equation (4.5), and explains the development in the housing stock.

$$H_t = (1 - \delta_t)H_{t-1} + c_t \tag{4.5}$$

Where H_t is the housing stock in period t, δ is the depreciation rate of present housing stock, H_{t-1} is the housing stock in the previous period, while C_t is the net additions in Period t[2].

The housing supply in the market is explained as a function of the housing stock in the previous period (H_{t-1}), plus the difference between new construction (C_t) and the housing falling out of the market (δ). In the short term, the depreciation and number of housing are assumed to be insignificant, making the housing supply equal to the previous period (H_{t-1}). Thus, in the short term, the supply curve is defined to be perfectly inelastic (Hendry, 1984).

In the medium term, the supply will increase if the investment in new construction exceeds the depreciation of housing. The rate of increase of housing is dependent on the economic cycle and market constraints on sites and labor (Røed Larsen, 2005). The supply curve in the medium term will therefore follow the marginal cost curve and is rising.

In the long term, the housing supply adjusts to demand, making the supply curve perfectly elastic. Røed Larsen and Sommervoll (2004) are however somewhat critical to this statement. They emphasize that the housing supply can be limited, even in the long term. People often have preferences to be situated in specific regions, whereas areas with proximity to the city center or other attractive places are a scarce commodity and cannot be replicated. Hence, to be perfectly elastic and provide a given equilibrium price in the housing market, the household's preferences would have to change.

[2] Private new completions plus net supply from other sectors such as the public or private rental markets (Hendry, 1984)

Short-Term Adjustment in the Housing Market

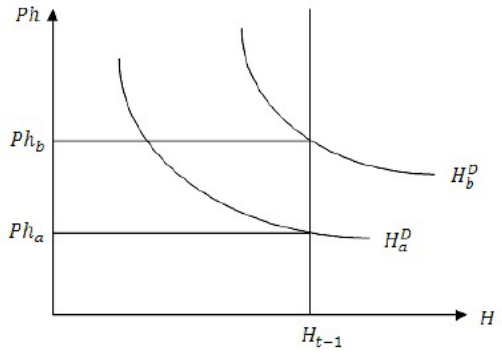
In a perfect frictionless market, the equilibrium price occurs where the supply curve and the demand curve intersect. From the above presentation by Jacobsen and Naug (2004), we have a declining demand of housing with increasing prices.

Moreover, the supply is inelastic (constant) in the short-term. Rødseth (1987) states that equilibrium price is determined by the final consumer's willingness to pay. Based on these assumptions, we have a market situation where homebuyers with willingness above the equilibrium price will buy, while those with willingness below the equilibrium price will refrain from purchases. Thus, with a limited housing stock, there will be no vacant housing for people paying below the equilibrium price. Jacobsen and Naug describe this relationship through the following expression:

$$P = H^D = f\left[\frac{V}{P}, \frac{V}{HL}, Y, X\right] = H^s \tag{4.6}$$

A price below (above) the equilibrium price will lead to a demand surplus (deficit). Therefore, if the demand rises unexpectedly in the short term, the equilibrium price will change. The demand will exceed the supply, and the housing prices will increase. As the short-term of supply is inelastic, the willingness to pay from the marginal consumer will have to rise. The adjustment between short-term demand and corresponding house prices is illustrated in figure 4.1. Subsequently, an inelastic supply side can result in relatively large volatility in the house prices.

Figure 4.1 Short-Run Equilibrium in the Housing Market



Source: Hendry (1984)

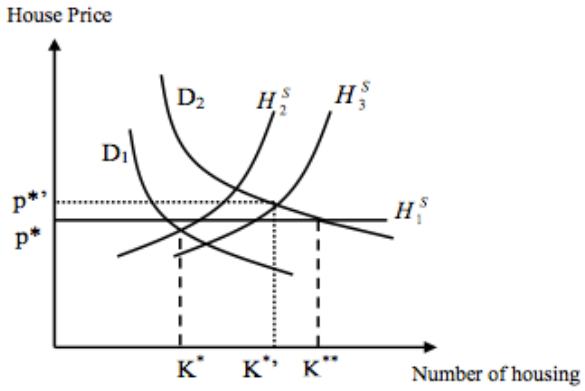
The graph express that the housing stock is constant in the short term (H_{t-1}). H^D_a and H^D_b illustrate the demand curve in the short-term, a and b, whereas a is the original demand, while b is the demand after a demand shock.

These demand curves results in the equilibrium prices Ph_a and Ph_b. As stated earlier, we see that the small change in demand can cause a drastic rise in the house price.

Long-Term Adjustments in the Housing Market

As mentioned earlier, housing supply will adapt to the demand in the long-run. A higher (lower) demand increases (decreases) the house prices, as well as the profitability of construction projects. The housing stock can increase in the medium term if the change in new construction relative to the depreciation of housing increases. The supply curve will be more elastic, and can help to control the price pressure from the increased demand. However, the elasticity can be different in urban areas and non-central areas. Urban areas often have a site scarcity, causing the change in demand in the short-term to also affect the prices in the long-term (Røed Larsen and Sommervoll, 2004).

Figure 4.2 Long-Run Equilibrium in the Housing Market



Source: Based on figures from Geoff Kenny (1998)

From the figure, we see that the equilibrium price in the medium-term is the intersection between demand (D_1) and supply (H_2^S). In the long term it will be where D_1 and H_1^S intersect. An unexpected shift in demand, from D_1 up to D_2, will make the house price increase towards p*' and the housing stock to the right of K*. Further, the supply will also have a positive shift (from H_2^S to H_3^S), as existing suppliers will increase the construction of new housing. As the stock of housing increases, the price increase will be somewhat dampened, whereas the sum of the shifts can lead to the new adjustment to p*' and K*'. This will also be dependent on the available sites in the given area, whereas scarcity can increase house prices considerably.

Assuming there are no restrictions to the construction of new housing (such as available sites), the supply will increase as long as the marginal revenue (house price) of construction projects is higher than the cost. In the

infinite term, where profitable construction projects are completed, housing supply will adapt to demand, and create the equilibrium price (Kenny, 1998).

Limitations of Jacobsen and Naug's Housing Market Model

The model by Jacobsen and Naug has been used extensively and is considered to provide a decent picture of house price developments and the housing market. Regardless, the limitations of the model have to be taken into consideration.

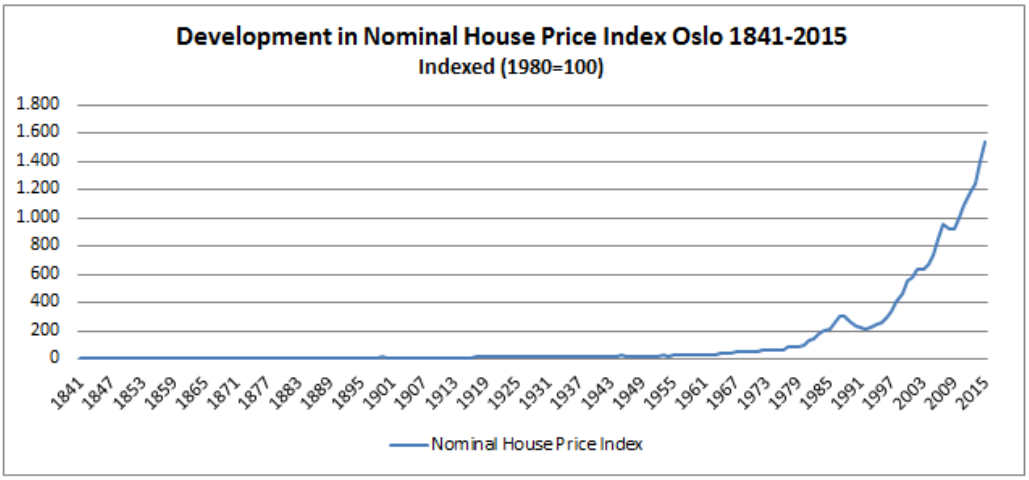
Heidi Fredriksen (2007) discusses limitations of the model in her dissertation "A Critical Review of Jacobsen and Naug's Model for What Drive House Prices". The main limitations will be presented shortly, while a more thorough assessment can be obtained from her study. Fredriksen finds that the main problem of the model is the systematic residuals. The autocorrelation in the model can lead to inaccurate conclusions in relation to the impact the variables have on the model's final result. Moreover, Fredriksen argues that a weakness of the model is not to include the underlying trends. This is based on that there are underlying trends in several of the nominal variables applied in the model. Including trend could provide a better prediction if their chosen variables are correct.

Further, the model uses simplifications, which causes the model to exclude several important fundamental factors. Examples of such factors are the maintenance cost and tax benefits of owning housing. The tax benefits can affect the demand for housing, and are therefore important to consider. When these factors are left out, the model can give house prices that can be somewhat misleading.

5. Historical Development in the Housing Market

In order to get a deeper understanding of the development of the housing prices we have looked at historical house prices in Oslo. By identifying factors that occurred before historical housing bubbles we can try to determine what factors had an impact on the market. We have looked at historical numbers as far back as retrieved data is available to get an overall overview of the housing market in Oslo. The NCB has published historical data for the nominal house price indices for Oslo from 1841 to 2015 and is presented in figure 5.1 below.

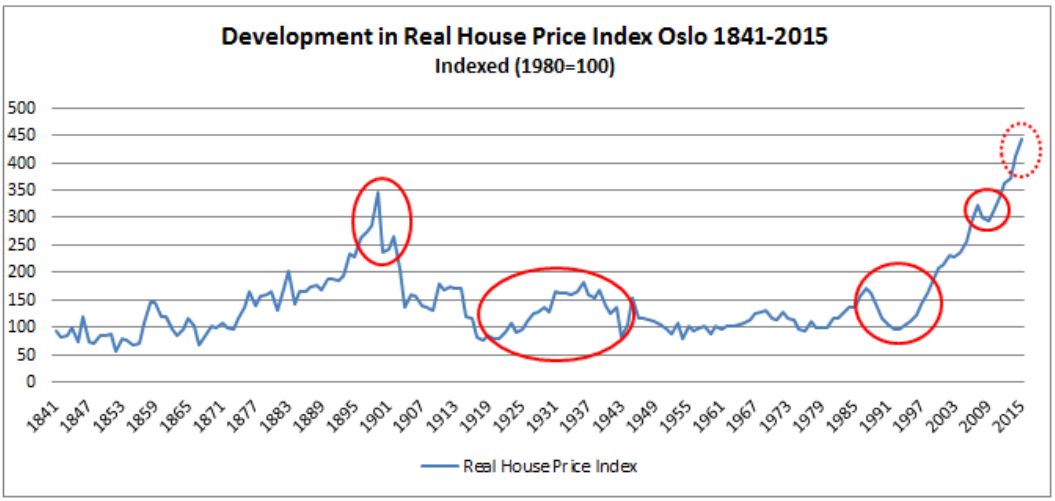
Figure 5.1 Development in Nominal House Price Index 1841-2015



Source: NCB (2015a), Eiendom Norge (2015a), Appendix 1

As the figure illustrates, the nominal house prices remained fairly stable until around 1980 where the prices started to increase rapidly. The turning point can mainly be attributed to the change in the strict government regulations and credit restraint, which opened up for a free housing market (Sørvoll, 2011). The growth in nominal house prices has been very large over the past three decades. However, this illustration of the nominal house price index in Oslo does not provide the entire picture of the house price development. It is also difficult to show price changes from 1841 until approximately 1960 due to the scale factor. In order to show a more correct picture of the development in the house prices in Oslo, the real house price indices are shown in figure 5.2 below.

Figure 5.2 Development in Real House Price Index 1841-2015



Source: NCB (2015a), Eiendom Norge (2015a), Appendix 1

Figure 5.2 highlights four historical events where real house prices have severely dropped after a rapid increase, marked by red circles. We will analyze each highlighted crisis and identify what factors where present before the crises, thus enlighten what fundamental factors to analyze further.

The Kristiania Crisis was the first notable crash in Norway's history and took place around 1899. Growth in underlying factors in the years before 1899, mainly wages and immigration, resulted in an increased demand for housing, clearly illustrated in the figure above. The increased demand led to an excessive building boom, mainly financed by share issues (Grytten, 2012). However, eventually the supply of housing surpassed the demand, causing many houses left empty. In addition, several new banks were established, all with relatively liberal lending policies, which further increased the credit supply. The bank's loans probably doubled from 1895 to 1900, indicating a great credit bubble (Grytten, 2012). As a result of high loan defaults and speculation investments "gone bad", both the housing- and credit bubble eventually burst in 1899, with especially high effect on the housing market in Oslo (previously named Kristiania) (Søbye, 1999).

The next important crash followed as a result of the Post-War Depression in the 1920's, which ended in a crash in the market in the end of the 1930's. During the war, several countries lead an expansive money- and credit policy to be able to finance it. At the same time there was a shortage of consumer goods as almost everything was forwarded to the warfare. The combination of shortage of goods and the expansive monetary policy led to a quadrupled money supply. When the war ended in 1918 the rationalization ended, the access to goods increased and the surplus of demand could thereby be unleashed. This lead to an economic upturn, as seen in the figure, where the expectations of earnings increased and the monetary policy further expanded, consequently creating a financial bubble without real economic coverage (Grytten, 2003). Accordingly, NCB changed to a contradictory monetary policy, and Norway experienced a strong crisis, including a steep interest rate increase, increased debt and reduced income for the industries, leading to another economic downturn in the mid-1930s (Skre, 2005).

The next substantial crash occurred from 1988 to 1992 and was seen in relation to the Norwegian Banking Crisis. The deregulation of bank's lending policies and removal of the cap on interest rates in the early 1980s, resulted in a bank lending boom. Further, it was accompanied by a boom in real estate and private consumption. This led to a strong increase in the money-and credit level, eventually leading to an overpricing of goods. When the oil prices significantly fell in 1985, the bubble dramatically burst. The Norwegian parliament introduced economic austerity and the stock prices and housing prices collapsed, ultimately leading to a debt crisis (Grytten, 2003). This is clearly illustrated in Figure 5.2, which shows that after the rapid price increase before 1987, the prices fell dramatically, thus making it easy to identify the housing bubble. During 1988-1990 many banks were

in danger of closing, but most were however saved by support from the Norwegian authorities. The Bank Crisis was the worst in Norway since the crisis in the 1920s. Production fell, the confidence in the Norwegian economy weakened and investments were severely deteriorated. The banks tightened their mortgage regulations, which made it difficult for households to borrow for housing, further decreasing the demand for housing (Vale, 2006).

The latest drop in house prices in 2007-2008 was related to the Financial Crisis. The reason for the financial crisis was mainly the subprime mortgage crisis in the US, creating ripple effects in the rest of the global economy, leading to a recession (The Economist, 2013). The effect on the Norwegian economy and more specifically the housing market, were however limited compared to the rest of the OECD countries. The house prices in Norway had increased strongly before 2007 because of low interest rates, changed taxation on houses, new lending policies, at the same time as we experienced a strong income growth. Therefore, NCB gradually started to increase the interest rates in order to amongst other cool down the housing market. The prices were of that reason already declining before the Financial Crisis hit, leading to the prices only being slightly corrected. House prices started rising again already in early 2009 and have continued since then (Juel, 2011). The rather quick recovery in Norway after the financial crisis is related to the oil, which is discussed in chapter 8.1.1.

Conclusively, figure 5.2 illustrates a relatively normal development in the real housing market and clearly shows discrepancies where there has been financial crisis' in the economy. Based on theory and empirical data, Minsky and Kindleberg's describes the trends for typical financial crashes and crisis' (Grytten, 2003). They state that macroeconomic shocks often lead to the aggregated product supply curve having a persistent positive shift. This shift leads to overtrading and monetary expansion, which eventually ends in overexpansion. When the expansion lacks support in real economic coverage, it turns into speculation, leading to a financial bubble and a crisis arises. During the crisis, pessimism is often spread around, further decreasing the GDP below its normal level (Grytten, 2003). Looking at the before mentioned crisis and financial bubbles, Minsky and Kindleberg's framework can describe most of the historical financial crisis' in the history of Norway.

However, the most striking is the excessive growth in real house prices from 1992 until 2007. The fact that the real house prices more than triples over a 15 year period generally do not reflect a sustainable development. After a small correction between 2007 and 2009 the prices has continued to increase, and is now significantly higher than in 2008. Although high growth historically has led to a significant drop, it can be questioned if the market will behave in the same manner as before.

We see from this short analysis of the previous bubbles, that there often are shifts in fundamental factors being the cause of the crisis. We see that some of the common features are changes in interest rate, disposable income,

lending policies, population growth, credit supply, taxation and the oil price. Both the market and the fundamental factors are constantly changing, making it difficult to foresee whether the current situation in Oslo can be classified into the same category as earlier crises. We will therefore look closer at the fundamental factors affecting the housing market in Oslo in chapter 8.

6. Empirical Analysis

6.1 Hodrick-Prescott Filter

The historical development of the house prices in Oslo was discussed in chapter 5. Grytten (2009b) argues that in the long-term, real house prices have an equilibrium price founded in fundamental values. When identifying possible housing bubbles, it can thus be appropriate to analyze the deviation between the long-term equilibrium and the real housing prices. The equilibrium can be calculated using a HP-filter.

Theoretical Framework

The HP-filter is a mathematical algorithm used to estimate the long-term trend component of a time-series (Hodrick and Prescott, 1997). The model was originally developed by Hodrick and Prescott (1981) to promote the analysis of fluctuations in economic activity. The model is used in order to obtain a smoothed-curve representation by decomposing a data series into trend and cycle components. It calculates the trend component in a time-series by removing the cyclical component of the series from raw data. The method sought to find the value of the trend t_t that will minimize the deviation c_t between the observed value and the trend. When using the model in relation to the housing market, the values of the cycle component can indicate if the housing prices are under- or overestimated. If there is great deviation from the underlying trend, this could give a signal that there are bubble tendencies in the housing market. The model is fairly simple to use and are widely applied in economic literature, among them SSB and NCB (Gerdrup, Kvinlog and Schaanning, 2013; Benedictow and Johansen, 2005).

The conceptual framework of the model is that a given time series, y_t is the sum of a trend component t_t and a cyclical component c_t (Hodrick and Prescott, 1997):

(6.1) $$y_t = t_t + c_t \qquad for\ t = 1, \dots, T$$

Their measure of the smoothness of the $\{t_t\}$ is the sum of the squares of its second difference. Further, the c_t is deviations from t_t, which they assume averages to zero over long time periods. These considerations lead them to the following equation for determining the trend component:

$$(6.2) \qquad Min_{\{t_t\}_{t=-1}^{T}}\{\sum_{t=1}^{T} c_t^2 + \lambda \sum_{t=1}^{T}[(t_t - t_{t-1}) - (t_{t-1} - t_{t-2})]^2\},$$

where $c_t = y_t - t_t$. The first part is the squared cycle component, i.e. the squared deviation between the observed value and the trend. This is squared in order to give equal weight to both negative and positive deviations from the given time series, y_t, as both positive and negative bubbles can occur. To minimize the expression it is thus desirable that the trend follows the observed value as close as possible. Thus, a cycle effect of $c_t \neq 0$ can indicate possible bubbles and crashes.

The second part describes the squared value of the change in trend from one period to the next, and is weighted by the smoothing parameter λ. The λ determines to what extent deviations are allowed in the trend, and is a value between 0 and infinity. The smoothness of the curve increases as the λ increases, while it disappears with $\lambda = 0$ (Gerdrup et al., 2013). When $\lambda = 0$, the trend will be equal to the observed time series as the second part of the equation disappears. Hence, only the deviation between the observed value and trend are minimized (Benedictow and Johansen, 2005). The optimal relationship would be that the deviation between the factors is equal to zero, i.e. $c_t = 0$, however this is highly unlikely as it implies that there are no business cycles. On the other hand, if one allows λ to go towards infinity, the last part of the equation will have all the weight, and the trend will be estimated to be linear, i.e. a constant growth rate (Benedictow and Johansen, 2005).

Model Limitations

Because of the simplicity of the method, there are some weaknesses related to the model. These limitations need to be taken into consideration before reaching a conclusion about the analysis. The shortcomings we find most important are presented below.

- *The Smoothing Parameter, λ:* The chosen value for λ will affect the results of the model to a great extent. This can be problematic as the λ-value is subjectively set, and one can thus chose values that supports the desired results. One can therefore not be completely sure whether the result of the model produces the actual trend of the time series.

- *The Cycle Component Values are Given Equal Weights:* Positive and negative cycle component values, hence up- and downturns in the economy, are given equal weights when using the HP-filter. The model thus makes an assumption that up and downturns last for an equal amount of time. However, research by Cristina D. Romer (1999) contradicts this assumption. Romer states that lifecycle of upturns are longer than downturns, thus using equal weights can give misleading results.
- *End-point Errors:* The HP-filter uses previous, current and future observations in order to calculate the trend in a time series, and can thus be seen as a two-sided model (Gerdrup et al., 2013). This can be seen in the second part of the equation 6.2. As the method is two-sided, this creates problems for the end point values. At the beginning (end) of the time series, only future (previous) values will be available, which can be a challenge, especially if the first or last observations are uncertain (Bjørnland, Brubakk and Jore, 2004). The consequence of this end-point error is that the first and last part of the time series will be more affected by the current observations, and the method thus goes from being a two-sided model to be a one-sided model.
- *Problem Regarding Long Cycles:* If there is a long-term negative deviation from the trend in the data set, the HP-filter can make a wrong conclusion. The deviation from the trend will be observed as a declining trend in the model. Hence, the longevity of the cycles will impact the results from the HP-filter.
- *Real-time Issues:* In relation to the end point errors, there are some real-time issues. The most recent observations are often more uncertain than other observations, and this can be magnified because of the end point errors. One of the main criticisms against the HP-filter is in fact that it assigns most weight to most recent observations.
- *Lack of Fundamental Strength:* Another problem with the HP-filter is that it lacks fundamental strength. It only looks at a trend of observations without any economic rationale for the trend. Should there be big fundamental changes in the market, the HP-filter will indicate that there is an over-/underpricing, even though the price is fundamentally correct. The HP-filter will not be able to account for this and will incorrectly show that the prices are over-/underpriced (Furuseth 2012).

The Choice of Lambda

We have added an HP-filter on the real house prices from 1980-2015. By doing this we hope to identify whether historical bubbles in Oslo are captured by the HP-filter. The smoothing parameter is set to different values on the basis of whether the data is monthly, quarterly or annually. Most researchers have used the HP-filter for quarterly data; however this analysis applies annual data (Ravn and Uhlig, 2001). This raises the question for how to adjust the HP-filter in order to adjust for the frequency of observations. Kydland and Prescott (1990)

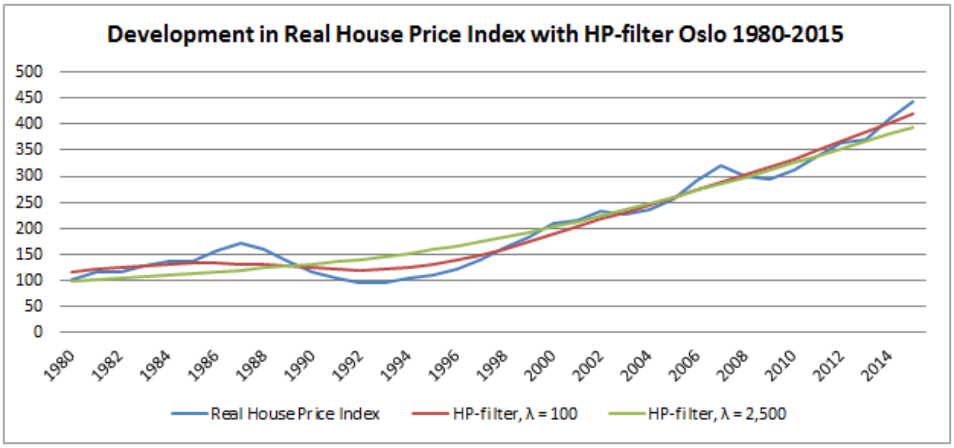
suggest a value of 1,600 for λ for quarterly data, and although most researchers use this value, there are discussions about the correct value for annual data.

Backus and Kehoe (1992) suggest using a λ = 100 for annual data, while Ravn and Uhlig (2001) suggest a λ of 6.25. It could be argued that a λ of 100 can be too low in the analysis of housing prices. The considerable growth in house prices in Oslo the later years can cause the end-point errors to be substantial if applying a low λ. By using a λ = 100, the trend will put great emphasis on the extreme values at the end of the time-series, which in turn can result in underestimating a potential bubble. It is therefore chosen to include substantially higher λ-values than the regular 100. It is argued by SSB that the quarterly smoothing constant for Norwegian GDP should be 40,000 (SSB). This is 25 times higher than the value of 1,600 that Hodrick and Prescott (1997) suggest for the American market. The HP-filter will therefore be based on both the standard λ-value of 100 and a constant that is 25 times higher than the regular value of 100, i.e. 2,500. We believe that these λ-values are relevant for Oslo, although SSB's quarterly suggestion is for Norway.

Development of Real House Prices with HP-filter

Figure 6.1 and 6.2 illustrates the development of real house prices and the trend component with both λ of 100 and 2,500 from 1980-2015.

Figure 6.1 Development in Real House Price Index with HP-filter Oslo 1980-2015



Source: NCB (2015a), Eiendom Norge (2015a), excel add-in for HP-filter, Appendix 2

With a smoothing parameter of 100, the trend moves relatively close to the real house price. There are only minor periods where the house price index seems to be over-/underpriced and deviates from the trend. The trend line seems to struggle with clearly defining the historical bubbles identified in chapter 5. The figure shows that in the period from 1985-1989 the house prices were overpriced, especially in 1987, which was also the peak

before the house prices drastically fell. According to the trend line, after the housing bubble burst in 1987, the prices seem to be undervalued from 1990-1998.

The same occurred after the housing bubble in 2008, where the prices appeared to be overvalued from 2006 until the correction in 2007 and the burst in 2008, leading to undervalued housing prices until 2012. Since 2012 the prices seems to be slightly overpriced relative to the HP-trend, with prices deviating more and more from the trend throughout the years. Conclusively, according to the smoothing parameter of 100, there seems to be a modest overpricing of house prices in the housing market in Oslo. However, this conclusion might not be completely reliable. There might be end-point errors due to the rapid growth in the housing market in Oslo, contributing to possible underestimated values. Hence, the market can be characterized by a higher overpricing than what the trend line with λ of 100 shows.

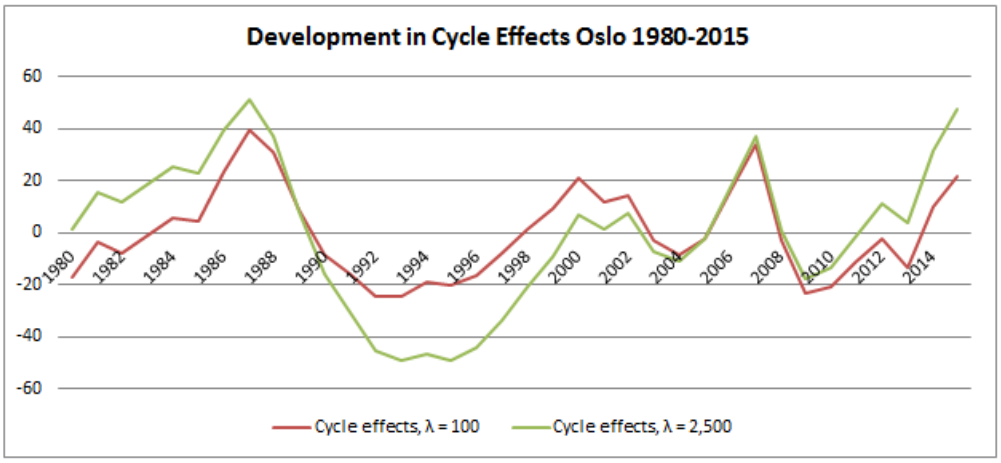
Whether the prices are more overpriced than first implied can be seen better by using a trend line with a λ of 2,500. This trend line clearly recognizes the historical bubbles identified earlier. Figure 6.1 illustrates that the house prices have been overvalued from 2005, with a small correction by the financial crisis in 2008. The trend shows that from 2011, the house prices are once again overvalued, with the deviation in 2015 being higher than before the financial crisis in 2007. Accordingly, with a trend line with $\lambda = 2{,}500$ it can be concluded that there exist bubble tendencies in the housing market in Oslo. Nevertheless, it has to be taken into consideration that although a higher λ reduces endpoint errors, it could also provide more fluctuations. Hence, the results can be moderately overestimated.

In order to obtain a more thorough understanding of the house prices' deviations from the trend, it can be interesting to look at the cycle deviations in the time period. The cycle deviation is found by calculating the house price indices' deviation from the trend line. The cycle effects from 1980-2015 are illustrated below as it more clearly shows the overall fluctuation from the trend.

Figure 6.2 illustrates the calculated cycle effects, using both $\lambda = 100$ and $\lambda = 2{,}500$. Generally, the housing prices have fluctuated around the calculated trend, however around the identified bubbles there have been great deviation from the trend. During our chosen time period, the positive (overvalued) deviation is especially apparent in 1987 and 2007, while the negative (undervalued) deviation is present from around 1992. The recession after the crisis in 1987 caused house prices to decline until 1992. So even though we observe a strong growth from 1992, it will be seen as a negative deviation from the trend (until meeting the trend again). However, we observe a steeper growth in the trend line after 1992, likely due to the strong increase. The size of

the deviation, i.e. the bubbles, varies with the size of λ, where a higher value makes the trend more linear and therefore more clearly illustrates the deviation. However, as mentioned, both trend lines do indicate that the current house prices are somewhat overpriced.

Figure 6.2 Development in Cycle Effects 1980-2015



Source: Appendix 2

In conclusion, the model has been able to point out the previous bubbles in Oslo. The current real house prices are above that of the estimated HP-trend, for both λ-values of 100 and 2,500. Looking at previous housing bubbles one can see that this level of deviation usually have been meet with a drop in house prices. As mentioned, the level of deviation from trend is above the level before the Banking Crisis in 1987 and the Financial Crisis in 2008, indicating that there might be bubble tendencies in the housing market in Oslo. However, the model does not take changes in fundamental factors into account, which can cause the model to conclude wrongfully. As the HP-filter method has several limitations, more models should be assessed before reaching any conclusions about the housing market.

6.2 P/E and P/R-Ratios

Another method to evaluate the housing market and potential bubbles is the P/R-ratio. Poterba (1984) developed the model to estimate the house prices by looking at the relationship between the cost of owning and renting housing. The model assumes that a rational home buyer compares the price of a house with the present discounted value of its future profit stream.

This model is a modified version of the well-known Price/Earnings-model (P/E), which is central in the determination of a stock's value. The P/E-model was first introduced by Gordon and Shapiro in 1956 and was further developed by Miller and Modigliani in 1961. The P/E-model is a popular approach among stock analysts,

where the current stock price is weighted against the expected future cash flow. Any bubble tendencies in the stock market are measured if the real P/E-value exceeds the fundamental P/E-value (Grytten, 2009a).

Intuitively, this approach can seem applicable for pure financial investments only, and not for consumer goods, such as housing. However, as housing can be rented out for a given annual rental income, the P/E-approach can be used when analyzing development in the housing prices. In this model the rental income represents the earnings. Thus, the long-term fundamental value is expressed through the expected present value of future earnings of owning a home. The P/R-ratio is stated in the following equation:

(6.3) $$\frac{P}{R} = \frac{Housing\ Market\ Price}{Annual\ Rent\ Income}$$

Poterba (1992) referred to the user cost of owning housing as:

(6.4) $$User\ Cost\ of\ Owning\ Housing = P(i^a + \tau + f - \pi)$$

Where P is the house price index, i^a is the nominal interest rate after tax, τ is the property tax, f is the other cost of owning a property (such as maintenance, risk premium, depreciation) and π is the expected return on the housing (i.e. capital gain).

If the cost of owning housing is lower than the cost of renting, it will be more profitable to own than to rent. If this occurs, it will increase the demand for owning housing. This can give imbalances in the housing market in the short-term. However, theory states that in the long-term, the renting prices will decrease, and the price of owning will be pushed upwards or remain unchanged. Consequently, in a long-term equilibrium, the expected user cost of owning a house will be equal to the rent (R), illustrated in equation 6.5:

(6.5) $$R = P(i^a + \tau + f - \pi)$$

The fundamental P/R-ratio is calculated by rearranging the formula:

(6.6) $$\frac{P}{E} = \frac{P}{R} = \frac{1}{i^a + \tau + f - \pi}$$

The ratio states a long-term fundamental equilibrium between the sale price and rent price of housing. The equilibrium is dependent on several key economic explanatory factors, namely the nominal interest rate, tax rate, property tax and other costs related to housing, as well as expected capital gain. The model assumes that house prices increase with inflation, thus the capital gain is equal to the inflation rate. Higher interest rates, decreased tax rate or increased property taxes will decrease the fundamental P/R-ratio. In such a situation, the cost of owning housing will increase and more people will rent rather than own, which again will reduce the house price. The fundamental P/R-ratio will increase in the opposite case, giving incentive to invest in the housing market, with pushing the prices up as a consequence.

When Does the P/R-Ratio Indicate Bubble Tendencies in the Market?

If the P/R-ratio increases rapidly and exceeds the long-term trend, it can indicate bubble tendencies in the analyzed market (Grytten, 2009a). An increase in the P/R-ratio means that there is an increasing difference between the house price and rent of housing. Hence, a rapid increase of housing prices combined with a flat or slowly rising renting market can signal the onset of a bubble. Based on equation 6.6, we see that the fundamental level of the P/R is not a constant value over time, but will change in line with the explanatory factors on the right side of the equation. Fluctuations in the economic activity will be the greatest determinant of changes in these variables. Increasing P/R-ratios does therefore not necessarily indicate that there is a bubble formation. The fundamental P/R-ratios must be compared to the real P/R-ratio in order to determine if there is a bubble formation in the market. The fundamental P/R-ratio expresses what the ratio should be based on the fundamental factors, where deviations from this measure needs to be explained. If the fundamental P/R-ratio follows the real P/R-ratio closely this means that the increase in real P/R is supported by fundamental factors, and tendencies of a bubble are thus not present.

The level of the P/R-ratio indicates whether it is financially beneficial to rent or to own housing. A P/R-ratio below 15 indicates that buying housing is better, while rent is beneficial if the ratio is above 20. With a ratio between 15 and 20, it is more dependent on personal preferences and how long the buyer intends to live in the dwelling. If there are few substitutes to owning and the buyer intends to live there for a long time, buying makes more sense. A value far above the long-term trend can also indicate bubble tendencies, as the ratio tends to return to the average value (Morrissey, 2010).

A study of the historical development in the P/R-ratio can show whether the values are significantly high and differ from its long-term value. As long as the ratio between the house prices and the rents are rooted in fundamental market conditions, changes will be perceived as a natural development. If the house prices are very

high or rapidly rising relative to the rent, it may indicate an imbalance in the equilibrium between house price and rental price. The prices can then be believed to be driven by irrational expectations of future price movements and not grounded in fundamental factors. These irrational expectations can evolve into a bubble in the housing market (Shiller, 1990). Deviations between the real and fundamental P/R-ratio will have to be analyzed in each situation, based on the fundamental factors at the time, in order to determine the possibility of a bubble. The empirical testing in this chapter will analyze this deviation.

Model Assumptions

There are several assumptions and weaknesses related to the calculation of the P/R-ratio, which have to be taken into account when conducting the analysis. The different assumptions are presented below (Bertelsen and Bremnes, 2007).

- *It is assumed that all housing is homogenous, and that there exists a corresponding rent for each housing*: Implicitly it is also an assumption that localization does not have any impact on the house price and rent. These assumptions clearly contradict with reality as mostly all housing is unique with respect to size, location, quality and type of building. Røed Larsen and Sommervoll (2004) state that housing in central areas has a higher level of house price increase compared to the less central areas. An analysis based on the P/R-ratio will thus be simplified, and aggregate numbers applied for all types of housing (apartments, houses etc.) and rents will be utilized.
- *Renting and owning is assumed to be perfect substitutes*: One assumes that a price increase in one of them directly will lead to increased demand for the other. As there are different preferences regarding whether to rent or own, this assumption conflicts with reality in the housing market. Røed Larsen (2013) emphasizes a consideration peculiar to the Norwegian market. The share of households owning their housing is extremely high in Norway; 84 percent (SSB, 2015a). This implies that the rental market is relatively small, whereas rental units are limited in type and location. Accordingly, in Norway (and Oslo), renting will not always be an adequate substitute for owning.
- *Zero transaction costs*: It is assumed to be zero transaction costs when buying and selling housing, which is not true. There is among others often a document duty of 2.5 percent, often being a noticeable cost (Kartverket, 2016). In addition, the model assumes the cost of searching for housing to be insignificant. These are costs that can sustain an imbalance in the P/R-ratio.

Data Material

The data applied in the calculation of the real and fundamental P/R-ratios is collected from various sources and thoroughly elaborated in this section. Although real numbers are used throughout the thesis, we have applied nominal measures in this analysis as the fundamental P/R-ratio is based on nominal interest rate.

Data Used in the Real P/R-Ratio

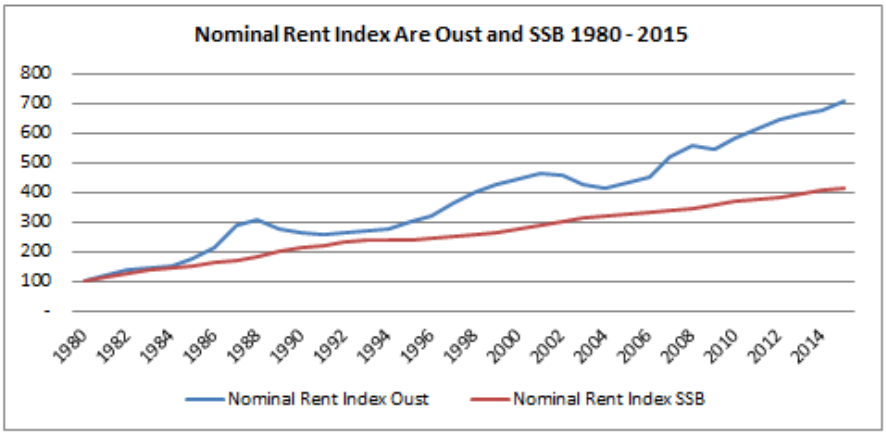
Market Price for Housing (P): The nominal price per square meter for all housing in Oslo from 1980-2014 is retrieved NCB's statistics, while the price for 2015 is calculated based on growth measures provided by Eiendom Norge (Eiendom Norge, 2015a).

Annual Rent (R): Historically, statistical databases have not provided a direct historical measure of annual rent. Earlier calculations of the P/R-ratio, by among Røed Larsen (2013), are based on a rental market survey from SSB, where rental statistics per square meter from 2006-2015 is presented. These prices have been based on the paid rent index from SSB, multiplied with the average rent in 2015 (SSB, 2015b). This measure is however not realistic or sufficient for the rental market in Oslo (Oust, 2013). In 2013, Are Oust therefore developed a new set of rent indices based on housing for rent advertisement from the newspaper Aftenposten[3] between 1970 and 2008.

The rents in our thesis for Oslo are retrieved from two sources; Oust's rent indices between 1980 and 2008 and from Boligbygg Oslo KF between 2009 and 2015 (Boligbygg Oslo KF, 2015). Both measures base the indices on rent advertisements and are adjusted for location, type of dwelling and size (Krakstad and Oust, 2015). Opinion Perduco presents quarterly square meter prices, which are first aggregated to yearly prices and then converted into indices using the change from year to year as a measure to continue the indices presented by Oust. Next, the indices are converted into actual numbers based on the average rent in 2015, multiplied with the indices (Appendix 3). These new data are likely to provide some new insight on the rental market in Oslo, as there are substantial differences between the rental statistics provided by SSB and Oust (2013), as showed in Figure 6.3. Limitations to the rental statistics will shortly be presented later, however, for further elaboration it is referred to the article by Oust (2013).

[3] Aftenposten is the biggest newspaper in Norway

Figure 6.3 Nominal Rent Indices by Are Oust and SSB 1980-2015



Source: Oust (2013), Boligbygg Oslo KF (2015), SSB (2015b), Appendix 3

Data Applied in the Fundamental P/R-Ratio

OECD calculated the fundamental P/R-ratios for several countries for the period 1990-2006 (Girouard, Kennedy, Noord and André, 2006). We will in our analysis base our variables on the same sources as OECD, but for the time period 1980-2015:

- *Capital gain*: As the P/R-model assumes that house prices grow in accordance with CPI, the CPI is chosen as the parameter for capital gain (NCB, 2014; SSB, 2015c)
- *Nominal Mortgage Rate*: SSB provides historical statistics (SSB, 2015d)
- *After Tax Mortgage Rate*: (i) *(1-tax rate in given year). Although the tax rate before 1992 was equal to the individual taxpayer's marginal tax, we have assumed a constant rate of 28 percent from 1980-2013, while the tax rate in 2014 and 2015 is 27 percent (Regjeringen, 2014a, SNL, 2014).
- *Recurring Holding Cost*: OECD assumes a constant cost at 4 percent (Girouard et al., 2006)
- *Property Tax Rate*: There is no property tax rate in Oslo in the period between 1980 and 2015, and this is therefore set equal to 0. However, a property tax of 2 ‰ will be introduced in 2016 (Oslo Kommune, 2016a).

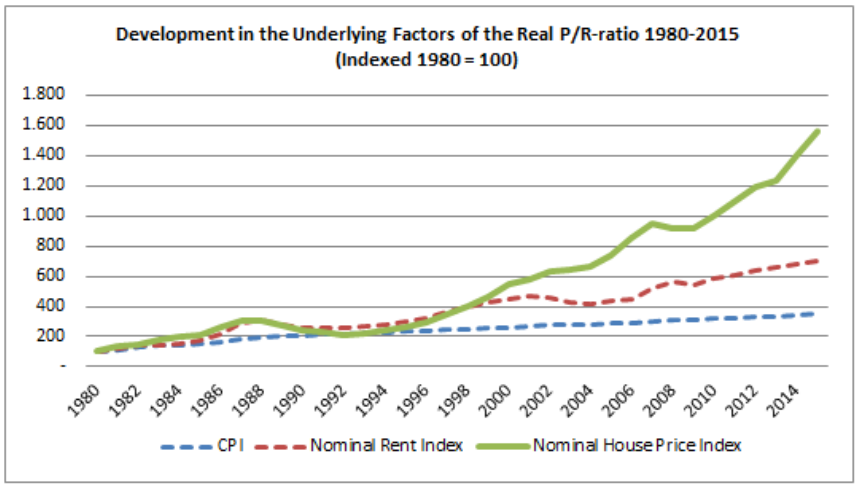
Empirical Testing

This section will assess the development in the housing market in Oslo by looking at the changes in the real and fundamental P/R-ratios. First, there will be an analysis of the underlying factors of the real P/R-ratio and the historical development in the real P/R-ratio, both over time and relative to the trend. Then, a comparison of the

real and fundamental P/R-ratio will be presented. It is important to bear in mind that the real P/R-ratio will take all aspects of the housing market into account, including a possible expectation element.

Figure 6.4 illustrates the development of each underlying factor for the real P/R-ratio; rent and nominal house price, from 1980 to 2015. In addition, as the model assumes that house prices grows with CPI, we have added the CPI in the graph to illustrate the growth in nominal house prices and rent compared to the growth in CPI. The price of housing has increased more than other prices. From 1980, the nominal house prices have increased by 641 percent, while CPI only has increased by 126 percent. In comparison, the rent has increased by 304 percent over the time period. We see that rent and CPI follows each other closely until around 1995. Here, the rent is increasing at a faster pace than CPI. After the bubble burst in 1988, the housing prices fell both in real and nominal terms until 1992. The housing prices fell more than rent making it relatively cheaper to own than to rent in this period, causing a lower P/R-ratio. The house prices have increased significantly the last 20 years, which provide a high P/R-ratio in these years, illustrated later.

Figure 6.4 Development in the Underlying Factors of the Nominal Real P/R-Ratio



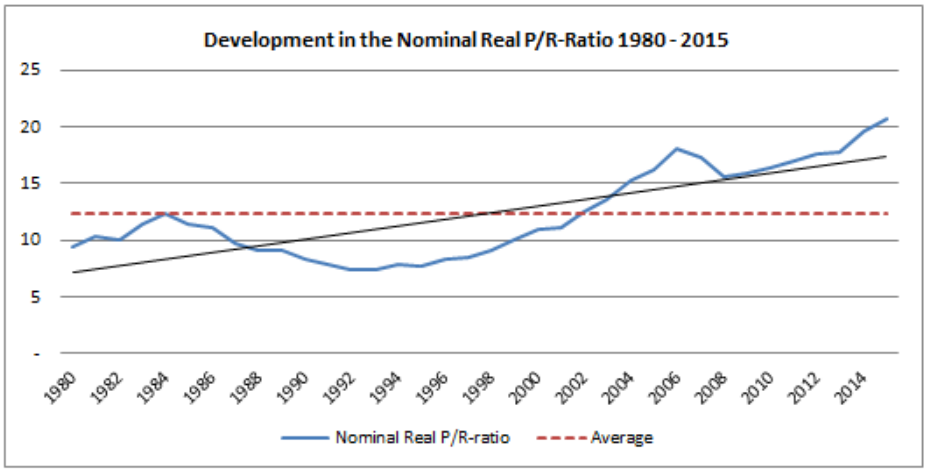
Source: NCB (2015a), Eiendom Norge (2015a), Oust (2013), Boligbygg Oslo KF (2015), Appendix 4

The price of renting has had a relatively moderate and steady increase, but has developed faster the last decade. Rental is regulated by the Norwegian Tenancy Act (Norske Husleieloven) (1999), where a number of requirements regulate the lease contract. Chapter 4 in this act restricts the landlord to increase the rent more than the general price level, given by CPI. However, when initiating a rent contract with new tenants, the rent can be set to the fair market price (Lovdata, 2016a). Related to the current situation in the market, it tends to be cheaper to rent housing as a result of this regulation.

The Level and Development in the Real P/R-Ratio

Figure 6.5 presents the development of the real P/R-ratio measured in nominal terms, relative to the average and linear trend, between 1980 and 2015.

Figure 6.5 Development in the Nominal Real P/R-Ratio 1980-2015



Source: NCB (2015a), Eiendom Norge (2015a), Oust (2013), Boligbygg Oslo KF (2015), Appendix 5

From the graph, we see that the real P/R-ratio for the housing market in Oslo has an overall increasing trend. As observed in the underlying factors of the real P/R-ratio above (Figure 6.4), the house prices have increased substantially more than the rent, making the development in the house prices the main focus of the analysis. The ratio has been between 7.33 and 20.7, having an average of 12.3 in the time period. According to theory, it was beneficial to own housing in Oslo between 1980 and 2003, as the values are below 15. The ratios in the years after 2003 have had ratios below 20 until 2015, meaning that the benefit of owning is a subjective assessment based on preferences. The housing bubble in the late 1980s is illustrated in the figure. However, the ratio started to decline in 1984, as the rent increased more than the price of housing in the years before the crisis. We see an increase before 1984 followed by a rapidly declining P/R-ratio until hitting the bottom level in 1992, with a 25 percent decline from 1987 and 41 percent from 1984. In the period after the crisis, the rent was above the house prices, indicating that the fall in house prices were the reason for the decline in the P/R-ratio. From 1996 the real P/R-ratio has increased rapidly, but had a modest drop between 2006 and 2008. The drop is a result of declining house prices due to increased interest rates in 2007/2008 and the global Financial Crisis, at the same time as the rent prices increased in the time period. In this relation, it is important to emphasize that the Norwegian

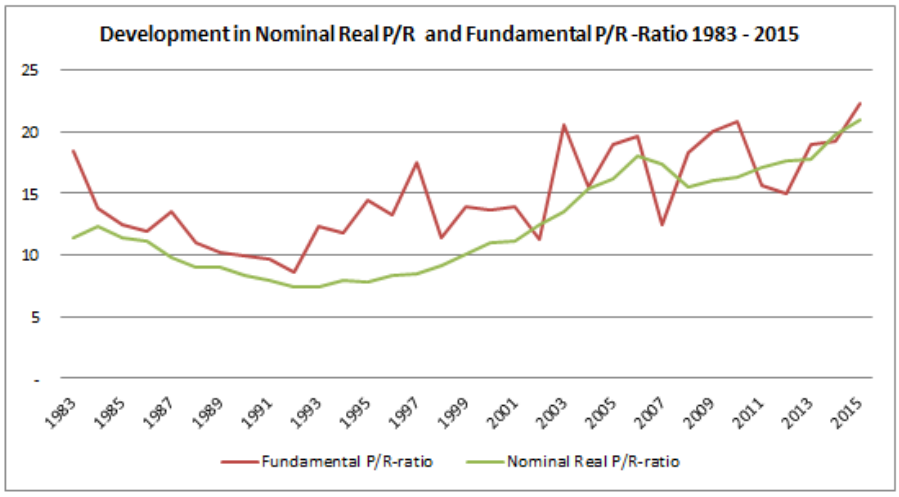
Government started to regulate the housing market by increasing the interest rates, after a strong growth before 2007, meaning that house prices were already declining before the Financial Crisis hit (cf. ch. 5).

The ratio of house prices to rents has risen sharply since the Financial Crisis, and is now (2015) at a historically high level of 20.7, about 40 percent above the average in the time period. Also, the ratio has been above the linear trend from 2010, especially since 2012, indicating bubble tendencies. As the theory states that the price and rent should be close to equal in the long-term, both the rapid increase and the high level of the P/R-ratio compared to the average P/R-ratio, can indicate a possible housing bubble in the market. In order to evaluate whether there are bubble tendencies in the market or if the growth is supported by fundamental factors, a comparison with the fundamental P/R-ratio will be conducted.

Does the Deviation Between the Fundamental and Real P/R-Ratios Indicate a Bubble?

In order to provide a stronger conclusion of this analysis, key fundamental factors affecting the housing market in Oslo need to be taken into consideration. The economic factors applied in the formula for the fundamental P/R-ratio are however all national factors, as there is no property tax in Oslo. The fundamental P/R-ratio will thus be equal for Oslo and Norway as a whole. The difference between the two measures indicates whether over- or undervaluation is present. A real P/R-ratio above the fundamental indicates overvaluation, while the opposite relationship implies undervaluation. As mentioned, if the P/R-ratio is rooted in fundamental market conditions, it is perceived as a natural development. Figure 6.6 presents the real and fundamental P/R-ratios from 1983-2015. The ratios from 1980-1982 are not included, as the extremely high expected capital gain (inflation) caused the ratios to be abnormally high and makes the graphs unreadable (Appendix 6a).

Figure 6.6 Development in Nominal Real P/R and Fundamental P/R-Ratio 1983-2015



Source: NCB (2014), Girouard et al. (2006), Are Oust (2013), Boligbygg Oslo KF (2016), Appendix 6b

Evident from the graph, there are deviations between the real and fundamental P/R-ratio over the time period. The fundamental P/R-ratio has been a lot more volatile than the development in real P/R. Some of these deviations can be explained by the development in underlying factors, such as the interest rate (i^a) and the expected capital gain (π).

While the real P/R-ratio started to decrease in 1984, the fundamental ratio had decreased since before 1983. The earlier decline in the fundamental P/R-ratio was probably due to a quite high reduction in expected capital gain from the year before. The rather sharp increase indicated by the fundamental P/R-ratio from 1986 to 1987 can be due to the high capital gain of 8.7 percent in 1987. After the Banking Crisis in 1988, the real and fundamental P/R-ratios are at similar levels, illustrating that the decline in the real P/R-ratio was grounded in fundamental factors and thus a natural development. From 1992-2001, the fundamental P/R-ratio exceeded the real P/R-ratio greatly, indicating that the P/R-ratio was undervalued. This can illustrate that the real P/R-ratio is not as dependent on the factors included in the fundamental P/R-ratio. In addition, the pessimism during the crisis among households, created by low productivity, high inflation and high unemployment, might have caused people to have negative expectations about the economic growth in Norway, thus keeping the prices down (Ravnaas, 2012). This can also be seen in that the deviation is smaller from 1998 where people might began to believe in an economic upturn again. The period from 2002 until the Financial Crisis is characterized by more volatile fundamental ratios, mainly being above the real P/R-ratio.

Fundamental factors indicated that the real P/R-ratio should have declined more than it did after the financial crisis. From 2006 to 2007, the fundamental P/R-ratio shows a much sharper decline in the ratio, than the real P/R-ratio does for the same time period. As the real P/R-ratio is rather stable it indicates that the changes in fundamental values are not the only factors reflected in the house prices. Positive expectations of the housing market can also be an explanation for the increase in the real P/R-ratio, which is not considered in the fundamental ratio.

The fundamental ratio supported an increase in the real P/R-ratio from 2007, whereas the real P/R-ratio did not show an increase until 2008. The actual increase was lower than indicated, likely due to increasing rent-prices. As the rental-prices have been relatively stable from 2008 compared to the house prices, the change in the P/R-ratio can mainly be attributed to increasing house prices. Further, the underlying fundamental factors implied a rather sharp decline in the P/R-ratio from 2010 until 2012, whereas the real P/R-ratio actually continued to increase. This can illustrate the pressured housing market in Oslo, causing the real P/R-ratio to not be as affected by changes in the underlying factors. Nevertheless, the fundamental P/R-ratio today exceeds the real P/R-ratio,

indicating that the level of the real R/P-ratio is rooted in underlying factors, disproving bubbles in the market. However, as the ratios are above average and the ratio indicates that renting is cheaper than buying, bubble tendencies cannot be ruled out completely. The period from 2012 until today shows an increasing fundamental P/R-ratio, above the real P/R-ratio from 2013. This is the same period Case and Shiller has predicted a housing bubble in the market in Norway. A discussion of possible reasons will be elaborated upon in chapter 9.2.

Conclusively, based on this analysis, we see that the high real P/R-ratios and the deviations from the fundamental P/R-ratio have indicated a housing bubble in Oslo at several occasions. The real P/R-ratio experienced a drop in the ratio around both the Banking Crisis in 1988 and around the Financial Crisis. The fundamental P/R-ratio only indicated an overvaluation around the Financial Crisis in 2007/08 and between 2011 and 2013, as the increase was not grounded in fundamental factors. However, the overvaluation between 2011 and 2013 did not result in a drop in the P/R-ratio, instead the ratio started to rapidly increase. The deviation between the ratios mostly indicates undervaluation and thus not bubble tendencies in the housing market. However, as both P/R-ratios are above 20, and above the linear trend-line, it can imply a greater risk for a housing bubble, especially as housing prices has increased even further in 2016 (Eiendom Norge, 2016).

Data Criticism

When evaluating the differences in the level of the P/R-ratios, there are many factors to consider, especially related to how the prices and rents are estimated and the assumptions taken. It is important to take into account the limitations of the model, and the data collected to apply in the model. First of all, as tax on property is not relevant for Oslo, the model only takes three explanatory variables, namely the interest rate, the expected capital gain and recurring holding cost, into account. Although the fundamental P/R-ratio includes some important underlying factors explaining the development in housing prices, several other factors are excluded. These are factors such as unemployment rate, disposable income, site costs etc. In order to evaluate the deviation, an investigation of these and other fundamental factors should be conducted. Underlying factors are analyzed more thoroughly in chapter 8.

There are limitations to both the rent estimates used in the real P/R-ratio and the capital gain parameter. First, the rent indices are a combination of two different measures, although based on similar methods; they might not be exactly compatible. Advertised properties are believed to comprise about one third of the rental market in Norway, and should therefore represent the market sufficiently. Housing found through other methods, such as friends, family, organizations and employment is not considered (Oust, 2013). Second, the house prices are proven to grow faster than CPI (Røed Larsen, 2005). Accordingly, the fundamental P/R-ratio will likely be

underestimated. With a higher capital-gain parameter or additional fundamental factors, the fundamental P/R-value could illustrate a more accurate picture of the relationship.

Further, the different assumptions of the model are important to bear in mind. The assumption regarding a homogeneous market gives equal weight to all types of housing regardless of quality, standard and location. However, as we only analyze Oslo, the differences regarding location is reduced, although there are geographical differences also within Oslo.

6.3 Tobin's Q

In addition to the HP-filter and the P/R-ratio, Tobin's Q can also be a useful ratio to look at in order to analyze the house price development in Oslo. The theory was introduced in 1968 by James Tobin and William C. Brainard, as an alternative to the neoclassical investment theory. Weintraub states that neoclassical theory is built on the assumption that the market players are rational and thus will continue to invest as long as the net present value is positive (Weintraub, 2002). The theory is widely used in finance and economic literature and its theoretical fundament has been formally laid out by Hayashi (1982).

Tobin's Q is often seen as a theoretical framework for deciding the long term equilibrium of house prices. The theory says that the price of existing housing should, in the long term, follow the costs of building new housing. If the prices on the existing housing are higher than the total cost of construction, this will lead to an increase in new construction, making the prices of existing housing closer to the construction costs (Heinig, 2013). Tobin thus argued that when the market price of a house exceeds the construction cost, it is beneficial to invest in construction, and the other way around (Pirounakis, 2013).

Originally, Tobin's Q was the ratio between a physical asset's market value and its replacement value, often related to the value of stocks, but later also used on the housing market (Brainard and Tobin, 1968). In the original case, the company's investment decision is based on the possible arbitrage opportunity, while in the housing market it is determined by the possible arbitrage from building a new house. The theory investigates whether the market prices of existing housing have fundamental support from the corresponding replacement cost. The ratio can be seen as an expression of the profit for the developers. In the formula for Tobin's Q the construction cost of new housing is used as a proxy for the replacement cost. The relationship is presented in equation 6.7:

$$Tobin's\ Q = \frac{Market\ Price}{Replacement\ Cost} \tag{6.7}$$

Although Tobin takes basis in marginal Q (q_m), the equation above represents the average Q, as the marginal Q is not directly observable in the market (Hayashi, 1982). The marginal and average Q will however, under certain conditions, be equal. We have not elaborated further on the difference between the marginal and average Q. When Q > 1, the invested capital placed in housing will be worth more than the capital not invested. This will incentivize suppliers to invest in construction of more housing. Hence, related to neoclassical theory, rational investors will continue to invest as long as Q is above 1. This will, in the long-term, mean that the marginal Q will move towards 1, and thus create the optimal investment level.

Tobin's Q in Relation to the Housing Market

As mentioned, the Q-theory was originally used as a tool to analyze the stock market, but is also possible to use in relation to the housing market. The market price in the equation represents the observed value the house is sold for, i.e. the market price of existing housing. The proxy for replacement cost, i.e. the cost of construction, typically includes costs of material, labor and site costs. It is common to use numbers for square meter for both market price and replacement costs, as housing has different sizes.

We will use Tobin's Q-ratio in order to determine whether it has correctly captured historical housing bubbles in Oslo, by measuring the deviation from equilibrium (Q = 1). When Q = 1, it means that the price per square meter for pre-owned housing is equal to the replacement cost per square meter for an equal new housing. Further, we want to determine whether there exist tendencies of a bubble in the housing market in Oslo today.

When the Q-level is high, the supply of housing will increase as more will invest in the construction of new housing. Consequently, the relationship between supply and demand will be more balanced, causing the market prices for existing housing to decrease. A Q-value above 1 over a long period of time can indicate an imbalance in the market, signaling prices above fundamental values. This situation supports bubble tendencies in the market. When investing in new housing, there can however be some entry barriers that may slow down the adjustment in the housing market. These barriers can among others be time-consuming procedures for approving building permits, regulations, available sites, access to capital and the time between starting and finishing a new building (ECB, 2013).

Data

The data for Tobin's Q consists of yearly observations from 1980 to 2015. The market values of housing obtained from NCB include the site costs, where it is not possible to separate the value of the site and the value of the building, according to a representative from NCB (Andersen, 2016). The data for building costs is

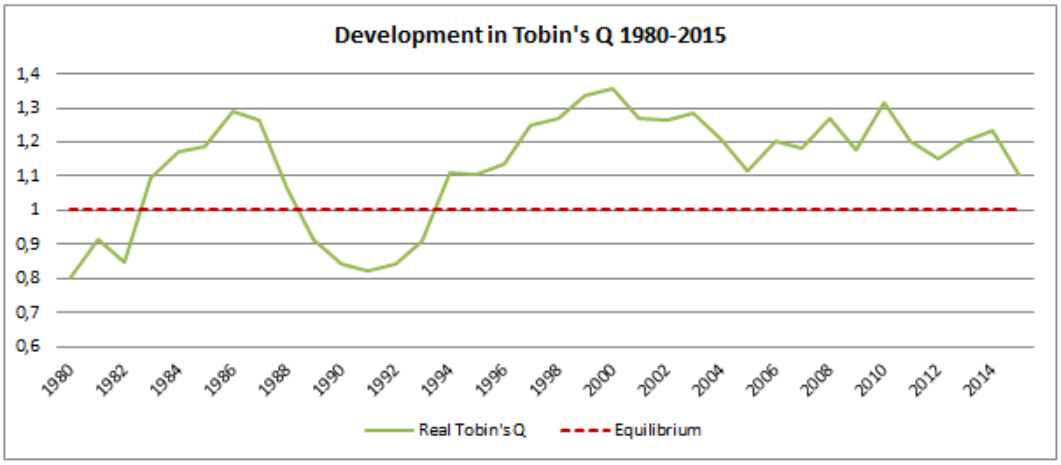
collected from the Norwegian State Housing Bank (NSHB), but only sufficient data for Norway as a whole is available. However, Kjell Senneset from Prognosesenteret AS stated that the building costs are about the same for the whole country; hence we see these numbers as representative for Oslo as well. Senneset further states that the difference in replacement costs in Oslo and the rest of the country mainly come from differences in site costs (Senneset, 2016). There are also differences in site costs within and around Oslo, varying from NOK 3-4,000 per square meter building permit in some parts of Oslo and up to NOK 25,000 per square meter in the most prestigious and expensive parts of Oslo (Hadrian Eiendom, 2016).

The data from NSHB is based on numbers from approved applications for housing projects, both construction of new housing and improvement of existing housing. The data is gathered at the beginning of the project and can thus differ from the end costs. Moreover, it should be noted that the data from NSHB does not contain site costs, but only the cost of materials, cost of labor, commission to entrepreneurs and construction loans. The site cost will normally increase in areas where there is shortage of vacant land, which is the case in Oslo. We have acquired access to numbers from two real estate agencies in Oslo, Akershus Eiendom (Akershus) and Hadrian Eiendom AS (Hadrian), regarding site costs in Oslo (cf. ch. 8.3.2). These numbers are uniquely created for this dissertation. The numbers are from 1997 until 2015, where we have made proxies for the site cost for the period from 1980-1996. The calculation of proxies and a more thorough explanation of construction costs are conducted in section 8.3.2. As stated by Senneset (2016), the site cost in parts of Oslo is at a historically high level, emphasizing the importance of including them in the Q-ratio. Even though we optimally should have the numbers for site costs from several sources, we believe that the received numbers are representative, as Akershus and Hadrian are real estate agents having the majority of transactions to professional buyers of land for housing in the Oslo area. In order to calculate the replacement costs, the construction cost from NSHB and site cost are added together.

Empirical testing

The calculated Q-values for the housing market in Oslo are presented in Figure 6.7.

Figure 6.7 Development in Tobin's Q 1980-2015

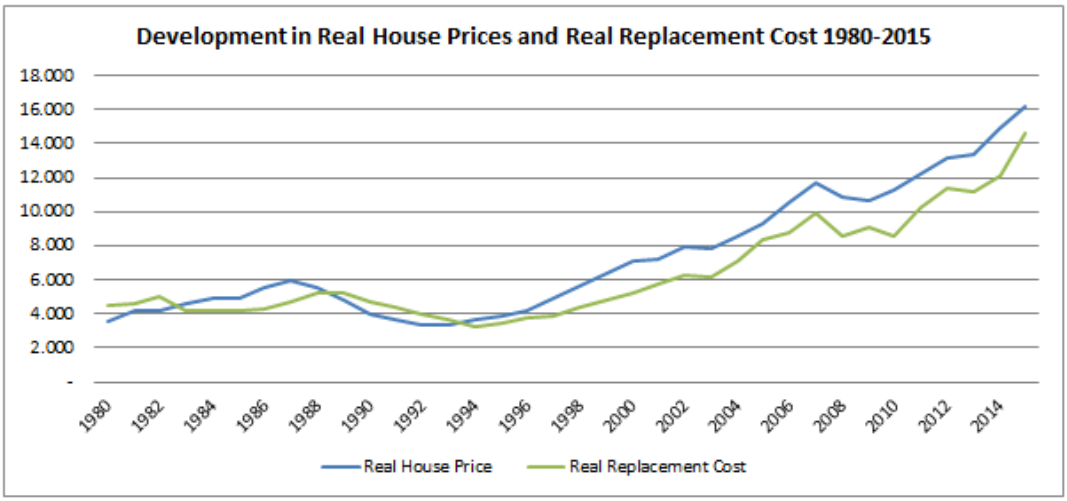


Source: NCB (2015a), Eiendom Norge (2015a), Hadrian (2016), Akershus (2016), NSHB (2015), Appendix 7

As Figure 6.7 illustrates the Q-value has fluctuated between 0.80, finding place in 1980, presenting the bottom level in the time period and a maximum of 1.35 in 2000. There have been some fluctuations in the Q-value throughout the analyzed time period, however the Q-value has been around the same level the last 21 years. One can observe that the deviation between the Q-value and the equilibrium were greater earlier in the time series than in the later years.

It can be difficult to determine whether the fluctuations in the Q-value are because of changes in housing prices or changes in replacement costs. Therefore the drivers of the Q-value, the housing prices and the replacement cost, are presented below (Figure 6.8). The housing bubble that burst in 1987/88 is illustrated with a steep increase in Q-value before a sharp decline. As a result of the deregulation of price regulations and low rates, the house prices increased rapidly in the period from 1970 to 1986. Before the crisis the Q-value had a peak of 1.29, being the highest so far. After the bubble burst, the Q-value was as low as 0.82 in 1991. The crisis pressured the house prices to a level below the construction costs from 1987 to 1994, indicating that it was not profitable to construct new housing in this period. This is also seen in Figure 6.8 where the cost of building new housing is higher than the price it was possible to sell for in the market. Although some developers could make a small profit during these years, one of the main constructors in Norway, Skanska AS (called Selmer AS at that time), almost went bankrupt with a deficit of about NOK 1 billion in 1991, mostly on housing projects (Hadrian, 2016).

Figure 6.8 Development in Real House Prices and Replacement Cost 1980-2015



Source: NCB (2015a), Eiendom Norge (2015a), Hadrian (2016), Akershus (2016), Appendix 7

The Q-values were characterized by an increase until around 2000, where it reached a new high of 1.35. This growth can be explained by a strong Norwegian economy, causing an increased demand for housing and thus higher house prices. It can be seen in Figure 6.8 that there is a steeper growth in house prices before 2000 than the growth in replacement cost. The drop after 2000 can be explained by the replacement cost growing even faster than the housing prices, consequently moving the Q-value closer to equilibrium. Although the Q-value was higher than what it was before the crisis in 1988, there was not a significant fall in house prices.

The Q-value stabilized between 1.1 and 1.3 in the period from 2001 to 2015. The house prices and replacement cost had a stable deviation the same period, resulting in a rather stable Q-value. The Financial Crisis and the following bubble burst are consistent with the development in the Q-value with the increase before 2008 and the following low in 2009. As seen in Figure 6.8, the Financial Crisis caused both the house prices and replacement cost to fall, thus increasing the deviation between the factors. The following years both factors had a quite steady growth, until the replacement cost increased more than the housing prices in 2011, resulting in a reduced Q-value. The Q-value quickly started rising again as the factors were closer, however the latest two years the deviation is reduced. The last ten years (2005-2015) one can see that the Q-value is closer to the equilibrium value than it has been the previous period, with an average Q-value of about 1.19. The Q-value should, according to theory, in the long-term be equal to 1. When the Q-value is close to equilibrium, the cost of building new houses is about the same as buying existing housing, thus indicating the optimal investment level is reached and the housing prices are theoretically in equilibrium.

As mentioned, the theory states that any Q-value higher than 1 should imply that it is profitable to invest in housing. According to the analyzed numbers this means that the last 21 years it has been profitable to invest in construction of new housing, as the cost of construction have been lower than the market price of housing. The deviation between the cost of construction and the market price of housing is thus the available profit margin for the developers. However, the last 5 years, the deviation between the price of existing and new housing have decreased (Bjørklund, 2015). This is also shown in the analysis in that the Q-value is lower the latest years, indicating that the possible profit margin for the developers is reduced. This can be because of even higher pressure on the existing housing, as there is a lack of housing supply in Oslo, in combination with a high population growth, which pushes the prices on the existing housing up. Moreover, especially the increase of site costs lowers the profit margins for the developers, making it less attractive, but still profitable, to invest in construction. Before making a conclusion based on this analysis it is important to look at the actual development in the market.

From the media and statements from experts, the price of new housing historically have been about 20 percent higher than the price of existing housing (Akershus, 2016). This means that the profit margin for developers is actually higher than the deviation shown in Figure 6.8, thus the premium price is not shown to the full extent in Tobin's Q theory. However, this difference has been reduced the last years as more and more newly used housing are resold in the market (Hadrian, 2016). New housing can be sold at a higher price because the life-time and standard of the building presumably are much higher than for existing housing.

However, there are some practical limitations with the theory behind Tobin's Q. First, new construction projects are often sold at a set price when signing the contract, with delivery two years later. Assuming a similar growth in house prices as have been present the last years, the price on existing housing will exceed the price of new housing with the delivery time about two years later. Hence, the price of new housing is compared with existing housing with two years price increase, which can give the picture that existing housing is more expensive than new ones. Second, many house buyers wish to buy a house now, and not a project that is finished in two years. Many are therefore willing to pay more for existing housing where it is possible to move in short after the purchase is made. This leads to new housing being compared with existing housing that is part of a bidding process which can push the prices above the actual value of the house. This will also give the impression that price of new housing is lower than for existing housing.

Third, the gathered data might not be representable, in that prices on existing housing can be based on one type of housing, while replacement costs are based on another type. According to the Q-theory, assets are homogenous, however, as no housing in the market is entirely equal, this is not true for the housing market

(Pirounakis, 2013). Fourth, as mentioned earlier, the supply side in Oslo has not been able to keep up with the increasing demand for housing, making the price of existing housing even more expensive. The topic of supply is widely discussed in chapter 8.3.1.

Conclusively, the analysis of the housing market in Oslo through Tobin's Q-theory shows that the Q-value has been above the equilibrium value of 1 since 1994, indicating an imbalance in the market. According to theory, this signals that prices are above fundamental values, supporting bubble tendencies in the housing market in Oslo. However, several limitations to the model are presented below. Conclusions about the housing market in Oslo should therefore not be based on this analysis alone.

Model Limitations

In addition to the limitations of the applied data mentioned above, there are some limitations to the model as well. Several of the assumptions of the original Q-theory are not satisfied by the conditions in the housing market. Numerous researchers have pointed out some of the conditions that make the theory less applicable to the housing market.

- It is argued by the theory that in the long-term the equilibrium value will be equal to 1. However, as the housing market is complex, it can be discussed whether this is actually obtainable.
- There is a lag between the time the construction starts until the housing is ready for sale, which means that the change in supply happen with delays. This lead to possible changes in demand and thus overinvestment in the housing market (Rosenthal, 1999).
- The Q-theory further assumes that there is unlimited supply, which is not the case in the housing market. Especially in larger cities such as Oslo, Bergen, Trondheim and Stavanger there are often a lack of available building sites due to regulations and restrictions from the government. This issue is addressed in the analysis of the Q-value above. Lack of available sites can affect the overall Q-level as the replacement cost can significantly increase, thus decreasing the Q-value. This will be elaborated further in chapter 8.3.

In the calculations of the Q-value, the last limitation regarding unlimited supply can affect the end result, as it can create large deviations between the Q-value in a short- and long-term perspective. Under the assumption that most households want to own housing in larger cities, investments in housing needs to be built in these areas (Røed Larsen, 2005). The combination of high demand and lack of sites in the bigger cities pressures the site costs and consequently the house prices up.

6.4 Conclusion Empirical Analysis

In order to determine whether existing house price models have been able to detect historical housing bubbles, the three house price models, HP-filter, P/R-ratio and Tobin's Q have been tested on the housing market in Oslo. The findings of the three models have been somewhat contradicting. The HP-filter has been able to capture the historical housing bubbles and according to the current deviation from the trend line, there are for the time being bubble tendencies in the housing market in Oslo. Tobin's Q supports the findings of the HP-filter, in that it also suggests bubble tendencies in the current housing market, as the Q-value has been above 1 for a long time, meaning that house prices are not entirely supported by fundamental factors. Tobin's Q managed to capture the Norwegian Banking Crisis in 1987, in that the Q-values were below 1 for the period after the crisis. The model did not capture the Financial Crisis in 2007/08 as clearly, but that might be because the Financial Crisis did not affect Oslo as much as in other places. The P/R-ratio shows a somewhat different picture in that the deviation between the real and fundamental P/R-ratios mostly indicates undervaluation and thus not bubble tendencies in the housing market.

The contradictive results are probably because of limitations to both the gathered data and general limitations of each model. In addition, the models are supposed to be used on a national market, and thus do not take local factors into account. The inconsistent results through the empirical analysis shows that several additional factors need to be addressed in order to give a stronger conclusion regarding the current housing market in Oslo. It is hard to determine whether the house prices in Oslo is overvalued or not, as no model have been able to capture all relevant fundamental factors for the development in house prices. Also, the results greatly rely on what fundamental factors one choses to emphasize in the model. The next section will therefore present well-known house price models that use fundamental drivers believed to be important to the housing market in Oslo. The selected factors will then be thoroughly analyzed in a fundamental factor analysis.

6.5 Other House Price Models

There are several different fundamental factors to be taken into consideration when building a model for calculating house prices. This chapter will briefly present explanatory factors identified in the model of Jacobsen and Naug, in addition to three other models; MODAG/KVARTS, RIMINI and BUMOD. The models are often used by Norwegian institutions like SSB, NCB and the Ministry of Finance (Finansdepartementet). It is however important to point out that these models are not presented because of the models themselves, but because of the explanatory factors they have included. We will thus only focus on the explanatory factors and have therefore not included the mathematical expressions of the models. These models, in addition to Jacobsen and Naug's model will form the basis of our analysis of fundamental factors, and which we select to include in our model.

Jacobsen and Naug's House Price Model

This section is based on chapter 4, containing the explanation of Jacobsen and Naug's house price model. Jacobsen and Naug include several different factors that they believe drives the development of the house prices, both in the short- and the long term. Some of these factors were disposable income, interest rate after tax, investment in new construction, housing stock, gross debt, unemployment rate, demographic factors, rent, expectations and cost of construction. Jacobsen and Naug found that the interest rate, new construction, unemployment level and disposable income are the most important factors affecting the housing prices. Several of the other factors examined by Jacobsen and Naug were not included due to the lack of significance and multicollinearity (Jacobsen and Naug, 2004).

MODAG/KVARTS

MODAG (MODell of AGgregate type) is a macro econometric model developed by SSB, in order to apply on the Norwegian market. The model is used as a forecasting tool for macroeconomic factors and political analysis on both short- and medium-term. The main user of the model is the Department of Finance, but it is also used by SSB for their own analysis or on behalf of others.

There is a separate model included in MODAG for the variation in house prices. The dependent variable is the change in the price of existing owner-occupied housing, modified by the deflator for private consumption. According to MODAG, explanatory factors such as disposable income, nominal interest rate, tax rate for capital income and consumer price index are central in the short-term development of house prices. The long-term solution shows that only the real rate after tax (and thus also nominal rate and tax level), real disposable income and the housing capital determines the house price level. MODAG differs from Jacobsen and Naug's model in that it does not take unemployment rate into account.

KVARTS is as MODAG, an economical model developed by SSB. There are no significant differences between these two models, besides the fact that MODAG is based on annual data, while KVARTS is quarterly based. The above description of MODAG will thus be valid for KVARTS as well, and there will therefore not be any further elaboration on this model (Boug and Dyvi 2008).

RIMINI

RIMINI is a macroeconomic model developed by the research department at NCB. It is designed to make projections about the Norwegian economy for both the short- and medium-term, with a specific focus on the interest rate effect. The model takes into account the most important relationships in the Norwegian economy

and analyses the interaction between them (Olsen and Wulfsberg, 2001). As opposed to MODAG, the RIMINI model includes the unemployment rate. Eitrheim (1993) argues that the unemployment rate can put pressure in the work market and thus affect the expectations of future income level. The RIMINI model is based on quarterly data and among others, tries to analyze what forces were behind the large fluctuations in the Norwegian house prices in the 1980s and early 1990s.

In the short-term, Eitrheim (1993) found that some of the variables will only give a short-term effect on the house prices in this model, such as the nominal lending rate, the tax rate on capital income and the proportion of unemployed. The variables that have both a short- and long-term impact on the house price level are the household's real disposable income, real value of gross debt and the housing stock. In the empirical model the factors with long-term effect are presented as two ratios*; income/housing capital* and *debt/housing capital.* The ratios are supposed to act as error-correction mechanisms drawing the house prices to a long-term equilibrium level (Eitrheim, 1993). The RIMINI model is however no longer used by NCB, nevertheless it is included because of its explanatory factors.

BUMOD

The BUMOD model is a dynamic equilibrium model that is used to predict the development in the housing market over a long period of time. The model is developed by Norway's Building Research Institute (Norges Byggforskningsinstitutt) and Social Economic Institute (Sosialøkonomisk Institutt) and is most commonly used by the Ministry of Finance and the Ministry of Municipals. The specifications of the model are not publically available, and we will therefore only describe the main features of the model based on the article "Do We Understand the Price Formation in the Housing Market?[4] by Kongsrud (2000).

BUMOD looks at the housing market at a micro level and divides the housing market into different categories based on type and needs. In the short-term it is the demand that influences the house-prices, mainly through changes in disposable income after taxes and the cost of housing and savings. In BUMOD, the house price level in the long-term will be determined by the cost of construction, minus house price subsidies (start-up loans) from NSHB. The model is to a higher degree than the other models based on economic theory rather than empirical relationships.

The model differs from the other models in that it develops several house prices for the different types of housing. An aggregated house price index based on the BUMOD-results can be formed as a weighted average of the different housing prices at the end of the year, with the number of homes in each category used as a weight.

[4] Forstår vi prisdannelsen i boligmarkedet?

In addition, the BUMOD model is not based on actual historical numbers and any model simulation is based on the base year 1980. Therefore, the predictions for the years ahead are based on somewhat different grounds than the results for MODAG and RIMINI (Kongsrud, 2000).

Summary of House Price Models

Several house price models have been presented to identify what factors are included in the different models. The various models show that there are several ways of calculating house prices. Table 6.1 below illustrates the factors present in each model and clarifies the similarities and differences between the models. In all the presented models, the interest rate is an important factor both in the short and long term. Further, the table identifies disposable income and housing stock as important value drivers for the house prices. Both Jacobsen and Naug and RIMINI include the unemployment rate as an important factor.

Apart from disposable income, interest rate, unemployment and housing stock, other factors seem to have a short-term effect on the house price. Both Jacobsen and Naug and RIMINI consider the households debt in the assessment of the drivers of house prices, however only RIMINI states that it is of importance. In addition, Jacobsen and Naug is the only model taking expectations into account. This factor can also be an important for the house price development. This can be supported by the studies of Case and Shiller, which will be further elaborated in chapter 9.2. Several factors not considered in these models can also be of great importance. Some might not have been included because of difficulty related to modelling them separately and lack of explanatory power by individual factors.

Figure 6.9 Summary of House Price Models

Variables/Model	Jacobsen & Naug	MODAG/ KVARTS	RIMINI	BUMOD
Disposable Income	X	X	X	X
Interest Rate After Tax	X	X	X	X
Housing Capital		X		
Price on New Housing (Ex. Site cost)	X	X		
Consumer Price Index	X	X	X	X
Gross Debt	X		X	
Housing Stock	X		X	
Unemployment Rate	X		X	
Tax Rate on Capital Income	X	X	X	
Cost of Construction	X			X
User Cost	X			X
Rent	X			
Demographic Changes	X			
Expectations	X			

Selected Fundamental Macroeconomic Factors

Based on the analysis above, the analysis of historical development of house prices and an assessment of articles related to the housing market in Oslo, we have chosen the factors we believe is of great importance when it comes to drivers of the housing prices in Oslo. We have decided to divide the factors into two main categories; demand and supply, whereas demand is divided into directly measurable data affecting the demand and "supporting" data affecting demand. Regarding directly measurable data we have chosen GDP including oil, disposable income, unemployment rate, key and interest rate development and population growth. The supporting data consist of the credit market in Norway, bank's lending policies and housing taxation. Within the category of the supply of housing, we have included housing stock, the costs of housing construction and turnover-time. The mentioned factors will be examined in the fundamental factor analysis in chapter 8.

7. Theoretical Framework for the "X-Factor"

Why We Wanted to Develop the "X-Factor"

After evaluating, assessing and analyzing the specter of different house price models, we were left with an impression that there was not a single model which included enough fundamental factors to indicate the correct development of prices of housing in Oslo. Several of the models indicated housing bubbles in the market, especially in the later years, without a burst of a bubble being present. As the actual house price development was not in compliance with what underlying factors in (some of) the models indicated, we believe something is missing from the models.

We found that some of the limitations of several of the models can be reduced. We found the house price model based on the P/R-ratio to be a good starting point for our model as it includes several of the factors we want to reflect in our model. In addition, Jacobsen and Naug's model (2004) was a great source of inspiration as they have included an X-factor to capture other conditions in a housing market. We have thus chosen to base our further analysis on the PR-ratio. The original formula for the P/R-ratio is the following:

(7.1) $$\frac{P}{R} = \left(\frac{1}{i_a + \tau + f - \pi}\right)$$

Although the fundamental P/R-ratio includes some important underlying factors, other explanatory factors that affect the house price development are excluded. In addition, the growth in house prices are proven to grow more than the growth in CPI, increasing the need to include more factors when evaluating the house price

development (cf. Figure 6.4). Therefore, we have developed an extension of the P/R-ratio model, an additional X-factor, enabling us to include more fundamental factors, which can better present the characteristics of the Oslo market and the development in house prices. Thus, in order to test whether including more fundamental factors will have an impact on the fundamental P/R-value, we will apply this model on historical numbers in Oslo.

The choice of fundamental factors to include is derived from a thorough assessment of other house price models and an analysis of the impact factors have on the house prices, in our case Oslo. By including more underlying fundamental factors, we believe the new fundamental P/R-values will reflect the condition in the housing market better, enhancing the possibility to evaluate whether housing is fairly priced. The X-factor will be a part of the denominator and can increase (decrease) the denominator, causing the fundamental value to increase (decrease). The new formula will be the following:

$$\frac{P}{R} = \left(\frac{1}{i_a + \tau + f - \pi - X}\right), where\ X = the\ fundamental\ factor\ addition \tag{7.2}$$

The original fundamental P/R-ratio's denominator is the user cost of owning housing. The additional factor we present is not directly an additional element of user cost, but a part we believe should be considered in addition to the other factors included. The new denominator in the fundamental P/R-ratio formula can thus not directly be applied as the user cost of owning housing.

Theoretical Framework

We wanted to develop a universal framework to be able to utilize across borders, and not needing to create a new model for each city or country to be evaluated. Therefore, the additional factor includes local, national and international factors, which can be adapted to the city or country being analyzed. An assessment of the most influential factors within each category has to be done in order to see which factors are affecting the housing prices the most. We will test the new X-factor in the formula on the housing market in Oslo and thus evaluate whether the effects from the additional fundamental factors will make the fundamental P/R-ratio better. We will evaluate historical data, with a focus on the last decade, in order to examine if our new model would indicate more accurate fundamental house prices. The fundamental factors we apply will be the ones we find to be most influential in chapter 8.

The theoretical framework of the model is based on an integrated risk-analysis by Dahl, Hansen, Hoff and Kinserdal (2010), used in a different context. House prices are often determined based on both measurable numbers as well as psychological factors. Our model will take the quantifiable factors into account to a greater

extent than other models to capture the characteristics of the analyzed housing market. After being divided into local, national and international factors, they will be classified based on the size of the change in the factor from year to year, and then weighted based on the degree of importance to the housing market. These steps will be averaged and result in a corresponding X- factor, which will be applied in the new fundamental P/R-ratio. In the following, a presentation of the theoretical framework of this model and how it will be applied will be presented.

In order to apply this model universally, we will look at the percentage change in the chosen fundamental factors from year to year. As for example population and GDP can vary substantially from country to country, it will be beneficial to use a percentage instead of actual changes. The classification is based on a rating scale from -5 to 5, where -5 gives a very negative impact on housing prices (reduction), whereas 5 gives a highly positive impact on housing prices (increase). Further, the classifications made in this model are based on the results retrieved from the data material on the analyzed market. The changes in the fundamental factor are divided into bins based on intervals and presented in a histogram to see the number of values falling into each interval. The classification intervals are made based on this distribution. All factors are weighted on a scale between 1 and 3, based on the importance related to the housing prices. An example of how the classification is done is shown in the table below:

Table 7.1 Classification and Weight of Fundamental Factors

Fundamental Factors	Classification	Weight	Score
Local			
Factor 1	1	3	
Factor 2	3	2	
Mean	**2**	**2,5**	**5**
National			
Factor 3	3	2	
Factor 4	4	2	
Mean	**3,5**	**2**	**7**
International			
Factor 5	1	1	
Mean	**1**	**1**	**1**
Total		**5,5**	**13**

The weighted fundamental factor classification is: 13/5.5 = 2.36

This number will then give the fundamental factor addition:

Table7.2 Factor Classification and Additional X-Factor

Additional factor		
Impact on House Prices	**Factor Classification**	**Additional Factor**
Very High Negative Impact	<-2.5	-1,25%
High Negative Impact	-2.5;-2	-1,00%
Medium Negative Impact	-2;-1,5	-0,75%
Moderate Negative Impact	-1,5;–1	-0,50%
Small Negative Impact	-1;-0,5	-0,25%
Neutral Impact	-0,5;0,5	0,00%
Small Positive Impact	0,5;1	0,25%
Moderate Positive Impact	1;1,5	0,50%
Medium Positive Impact	1,5;2	0,75%
High Positive Impact	2;2.5	1,00%
Very High Positive Impact	>2,5	1,25%

The additional factor will be a percentage, which, as mentioned, will affect the size of the denominator and thus change the fundamental value in the extended model. A positive additional factor will give a higher fundamental P/R-ratio, while a negative additional factor will give a lower fundamental P/R-ratio.

As our model is an extension of the fundamental P/R-ratio, which consists of the nominal interest rate (after tax), we have applied all data in nominal terms. Although real terms often show a more accurate picture of a situation, there has to be consistency between the use of real and nominal terms. Limitations of this approach will be discussed later.

8. Fundamental Factor Analysis

Based on the historical development and section 6.5, we will go through several different factors that are possible to use in our model. We will base the review on what factors we believe impact the house prices in Oslo the most. The analysis will also determine whether fundamental factors support the growth in house prices in Oslo.

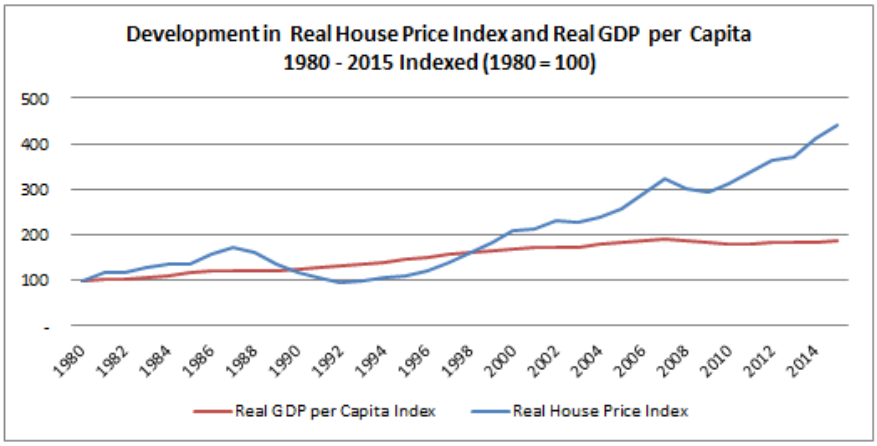
8.1. Directly Measurable Factors Affecting Demand

8.1.1 Gross Domestic Product (GDP)

GDP is one of the main indicators for the health of a country's economy as it is a measure of the total value creation in the country (Regjeringen, 2014b). As house prices often follow the cyclical development in the economy, it can be interesting to compare these two factors. The development in real GDP and the real house price index from 1980-2015 is presented below (Figure 8.1), as well as the percentage change in real GDP in the same time period (Figure 8.2). The GDP-numbers are on a national level per capita and are deflated with a GDP-

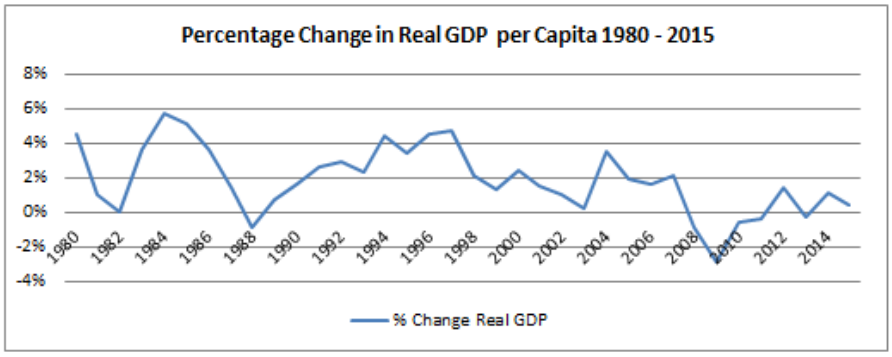
deflator, retrieved from OECD's statistics, in order to obtain real numbers. The GDP-deflator is different from CPI in that it takes into account changes in consumption and investment patterns (Boundless, 2016). The applied data for GDP is a total of mainland Norway, the petroleum industry and shipping. In 2015, the GDP for mainland Norway accounted for about 83 percent of the total GDP (Finansdepartementet, 2016). We apply the total GDP, as the petroleum industry and shipping is of great importance to the Norwegian consumption and economy.

Figure 8.1 Development in Real House Price Index and Real GDP per Capita 1980-2015



Source: NCB (2015a), Eiendom Norge (2015a), OECD (2016), Appendix 8

Figure 8.2 Percentage Change in Real GDP per Capita 1980-2015



From Figure 8.1, we see that the GDP of Norway has had an overall positive trend over the time period. The growth from year to year are however more volatile. We can especially see a decline in the growth of GDP between 1980 and 1982, between 1984 and 1988 and after the Financial Crisis. Between 1973 and the end of 1985, the labor costs in Norway were pushed up due to spillover effects from the petroleum sector, which caused the Norwegian foreign sector to be less competitive. In addition, the price of oil fell in 1985 (Grytten, 2008).

This was likely the reason for the decline in GDP growth, further enhanced by the Banking Crisis in 1988. A sharp decline in growth rate is observed in 2008, followed by a negative growth rate also in 2009, due to the impact of the global Financial Crisis. These observations are consistent with the house price development in Oslo, whereas we can see a drop in the house prices in the years after 1987 and after 2007. After 2004, we observe that the development in house prices has increased at a much faster pace than the GDP, indicating that the growth in GDP is not the only reason for the price increase of housing in Oslo. The quick recovery of the GDP after the Financial Crisis was due to income from the petroleum sector. The use of oil-money was particularly strong in 2009 because of the specific measures to mitigate the effects of the international crisis (Regjeringen, 2015).

Conclusively, the increase in GDP over the time period has increased the general price level and purchasing power in Norway. Hence, the growth in GDP provides support to the house price development, but is not the only factor. The Norwegian GDP is highly dependent on the income from the petroleum sector as it accounts for approximately a quarter of the total GDP (Oil & Gas, 2015). Therefore, the development in the Norwegian petroleum sector will be elaborated upon.

The Norwegian Petroleum Sector and Norwegian Competitiveness

Oil production has been an essential part of the Norwegian economy since findings were made in 1969, whereas Norway is one of the leading oil- and gas nations in Europe today (EIA, 2015). Without the petroleum revenues, Norway would have a budget deficit the last decade, assuming all else equal (Regjeringen, 2015). Consequently, the income from oil and gas has provided Norway with great economic flexibility, and a welfare society few other countries can relate to. As the GDP is highly dependent on the oil industry, and house prices often follow the economic cycles of a country, changes in the oil prices can eventually influence the house prices.

The Norwegian government is restricted by the fiscal rule (Handlingsregelen) when phasing oil-money into the Norwegian economy. Thus, the various cash inflows from the petroleum sector are all transferred in its entirety to the Global Government Pension Fund, whereas withdrawal is based on the fiscal rule. The emphasis is on stabilizing fluctuations in the economy to ensure good capacity utilization and a low unemployment rate. As a result, the government budget and mainland-economy will not be affected by short-term movements in the oil-price (Regjeringen, 2014c).

The petroleum sector has caused a great revenue stream (through taxes) to the Norwegian state, in addition to numerous jobs directly and indirectly created by the sector. In 2015, widely about 350,000 employees worked in relation to the petroleum sector (NTB, 2015). The high employment in the sector has for a long time contributed

to keep the unemployment rate low, the income level high and has enabled Norway to maintain and develop a good welfare system for its inhabitants. The economic development caused by the sector has increased the income level and consequently increased the overall price level. This effect is called the Balassa Samuelson–effect (Égert et al., 2002). Røed Larsen argues that this effect can be extended to the housing market, as the higher price level eventually will find its way into the bidding rounds on housing, causing the house prices to increase (Røed Larsen, 2013). Consequently, declining oil prices can cause the income growth to fall, contributing to decreasing house prices. The consequences of the rapid decline in oil-prices will be discussed later in the chapter.

In June 2014, the petroleum sector in Norway experienced the first great decline in the oil-prices since 1985, from approximately $115 a barrel to approximately $40 a barrel in March 2016 (Grytten, 2008; Mohsin and Holter, 2016). One of the greatest oil-counties in Norway, Rogaland, has experienced rapid decline in house prices, as well as an increasing unemployment rate the last two years. Almost 30,000 employed has either lost their job or been told that they will be redundant in 2015/16, many of these situated in Rogaland (Oil & Gas, 2015). The massive downsizing has made the county account for half the growth in unemployment rate in 2015 (Larsen, 2015). The situation is however somewhat different for the housing market in Oslo compared to other parts of Norway. As discussed in chapter 8.1.3, the unemployment rate in Oslo has only had a slight increase the last couple of years, however with a small decrease in 2015. Thus, Oslo is not affected to the same extent as Rogaland. A reason can be the diverse businesses in Oslo, with a lower share of employed people in the petroleum related sector, compared to Rogaland (Oil & Gas, 2015).

There are signs that the increasing unemployment rate is moving towards the eastern part of Norway (Oslo), but it has not yet showed signs of affecting the housing market (NTB, 2015). According to Eiendom Norge, the house prices in Oslo have increased by 9.9 percent from March 2015 to March 2016, while Stavanger has declined by almost 7 percent, further enhancing the differences (Eiendom Norge, 2016). Akershus Eiendom believes the regional differences will increase further, with cities and regions exposed to the oil and gas sector expecting further layoffs, and thus slower residential sales (Akershus Eiendom, 2016). Although the oil-prices have not affected the market in Oslo to a great extent, it can still create uncertainties in the overall market.

This discussion emphasize that the oil price has a great influence on the Norwegian economy overall, but that it however will affect counties differently. With the rapid decline in oil prices, the NCB has decided to lower the key rate in order to become more competitive in other industries. This action will stimulate the Norwegian economy, but can cause prices of housing to increase disproportionately, especially in some regions. Carl Geving, CEO in NEF (The Norwegian Association of Real Estate), states that the low key rate in combination

with cheap and easily available credit and high purchasing power contributes to a strong price growth in the regions not affected by the oil crisis (Havnes, 2016a).

Kjersti Haugland in NCB states that the oil price drop has not influenced the Norwegian economy as much as expected. In addition, the low exchange rate of the Norwegian Krone has had a positive impact on the mainland economy (Havnes, 2016b). Finance Minister in Norway, Siv Jensen, said that *"The Norwegian Krone is often correlated with the oil price, and even though a lower oil price represents a problem to the oil and gas industry, the krone now represents improved competitiveness for the rest of the Norwegian industry"* (Mohsin and Holter, 2016). Hence, the negative effect of the oil price has been somewhat offset by the increased competitiveness of Norwegian companies.

In relation to the oil-crisis, the Financial Supervisory Authority of Norway (FSA) (Finanstilsynet) actually wanted to increase the key rate in order to cool down the housing market. However, the suggestion was not accepted by NCB as an increased rate would have increased the value of the Norwegian Krone and thus weakened the competitiveness. Hence, NCB have decided to consider the Norwegian competitiveness as more important relative to the possible growth in housing prices (Bjørnestad, 2015).

Conclusively, the petroleum sector has provided Norway with a high GDP and a high level of disposable income, given the opportunity to buy housing. Therefore, the historically high oil (and gas) prices support the high house price level in the Norwegian market and are seen as a factor that influences the house price level. As the petroleum industry highly influence the GDP of Norway, the oil-price will not be evaluated as an individual international factor affecting the housing market in Oslo. The importance of oil will however be taken into consideration in our evaluation of the GDP.

8.1.2. Disposable Income

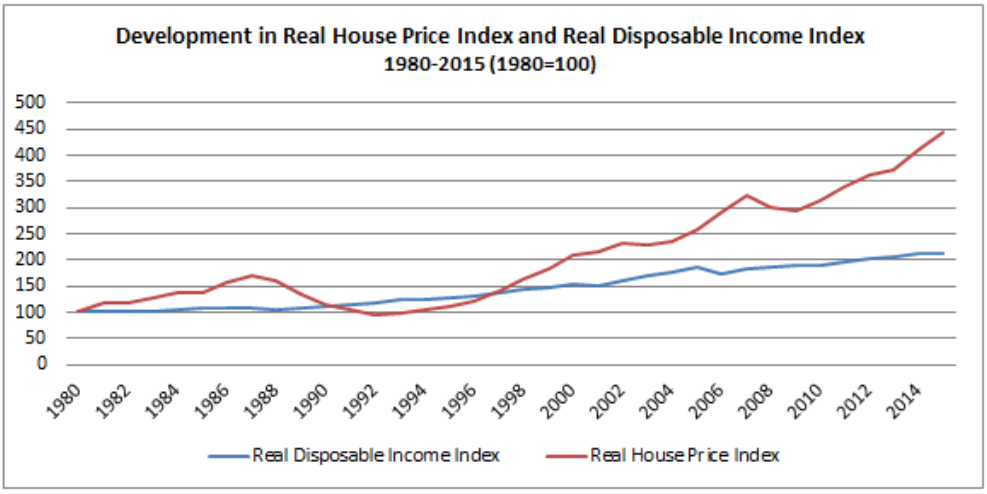
The development in disposable income can be a candidate for the increasing house prices in Oslo. The amount a household can spend on consumption and savings (investment) is defined as their disposable income. The disposable income consists of the sum of earned salary, benefits and transfers (pension, social security) and capital income (interest, dividends) minus the taxes on income and property expenses (interest expenses). The investment in housing is primarily financed by loans that are served through paying interest and instalments from a household's income. It is thus clear that if the costs of housing, such as interest expenses and instalments increase more than the disposable income, this could be a problem for the households (Røed Larsen, 2005).

A high growth in disposable income strengthens household's ability to increase their borrowing and thus buy more expensive housing. More capital available will consequently result in a higher demand for housing, which

in turn will stimulate to higher house prices. However, if growth in disposable income is the only factor causing the housing prices to increase, prices on other consumer goods would also increase with a higher demand (Røed Larsen, 2013).

Figure 8.3 describes the development in real disposable income per capita (indexed) and real house price index from year 1980-2015 (SSB, 2015f, g, h). We have used real house price indices from Oslo, while the data for the real disposable income is on a national basis. National numbers for real disposable income is chosen as the whole population can buy housing in Oslo, not only the inhabitants of Oslo. However, the disposable income level in Oslo is at a higher level than the national average, and could indicate that they can sustain a higher debt-level/interest burden (SSB, 2015e).

Figure 8.3 Development in Real House Price Index and Real Disposable Income per Capita 1980-2015



Source: NCB (2015a), Eiendom Norge (2015a), SSB (2015f, g, h), Appendix 9

Apart from a small drop in 2005, the disposable income has grown substantially since 1980 and is now at a historical high level. This can probably be explained with the low unemployment rates and the high economic growth due to the oil-industry (cf. ch. 8.1.1 and 8.1.3). However, even though disposable income has grown, it has not kept up with the growth in house prices since 1998. The gap between the two factors was somewhat reduced in 2008 and 2009 after the Financial Crisis, but quickly rose again in 2010, and the gap is now at its all-time highest. While the real house prices have more than tripled from 1993 to 2015, the disposable income is only 1.7 times higher.

The gap can indicate a reduction in the household's purchasing power in the market. Households being unable to purchase housing can make an essential impact on the demand for housing, which indicate that the current house prices are not sustainable in the long-run. This is supported by Krakstad and Ousts (2015) assumption that there is a long-term relationship between house prices and disposable income.

Moreover, in accordance with Case and Shiller (2004), the growth in disposable income can have created expectations of increased future income in the same way that expectations of high house prices can create increased prices. Hence, expectations of increased disposable income might have increased the house price level. The effect of expectations as such is, however, difficult to isolate. Consequently, the historical development of the two factors shows that the increase in disposable income to some degree supports the increase in house prices. However, as mentioned, the escalation in house prices has been much steeper than for the disposable income, so this cannot be the only factor.

8.1.3 Unemployment Rate in Oslo

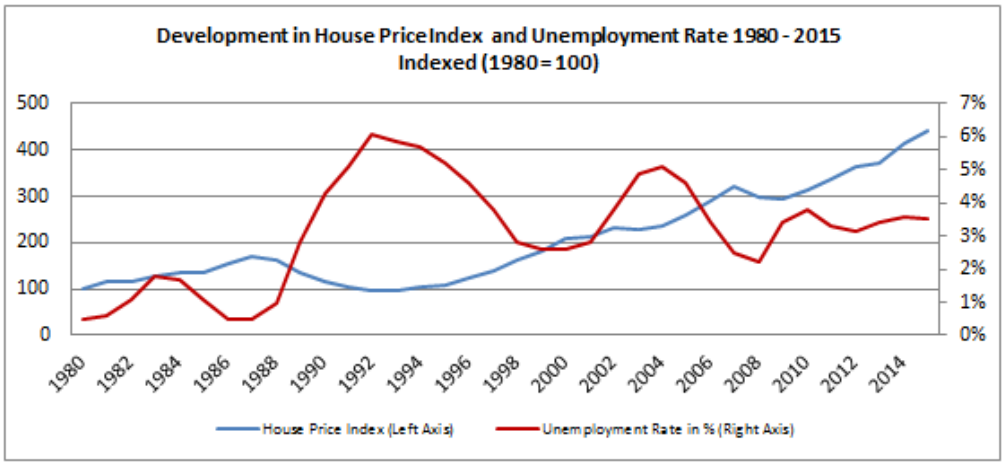
An analysis of the unemployment rate is important as it in turn will affect the demand and price of housing. The level of unemployment can affect people's future expectations regarding their ability to service their debt, and thus their mortgages and housing costs. In Norway, the unemployment rate is at a low level relative to the OECD average, at 4.1 percent and 7 percent respectively (OECD, 2015). There are mainly two different measures of the unemployment rate in Norway, one by SSB, who publishes the "Labor Force Survey" (AKU), while the other is issued by the Employment and Welfare Department (NAV). As the number of actually registered unemployed usually is lower than the number published by SSB, it is important to bear this in mind when conducting the analysis (Bø and Næsheim, 2015)[5].

A low (high) unemployment rate can lead to expectations of a high (low) future income and solvency. If households expect their income to increase (decrease), they are also more willing (reluctant) to invest in housing as they are better (less) able to service their debt. The unemployment rate can also give an indication of the business cycle in Norway and more specifically Oslo, as the rate tend to rise during a recession and fall during economic growth. House price levels are often a reflection of the current economic situation, making the unemployment rate an important indicator for the house price development. Figure 8.4 displays the development in unemployment rate (right axis) and real house prices (left axis) from 1980-2015, where house prices are

[5] Unemployed in the AKU-measure reflects the number of people considering themselves as unemployed, which can include people studying or are on financial aid. Unemployed in NAV is the number includes everyone seeking to be gainfully employed and has registered as a jobseeker (Sjøberg and Østgårdsgjelten, 2016).

indexed with a basis from 1980, while the unemployment rate is presented in percent. Data on unemployment in percent of the working force is retrieved from NAV's database (NAV, 2016a).

Figure 8.4 Development in Real House Price Index and Unemployment Rate 1980-2015



Source: NCB (2015a), Eiendom Norge (2015a), NAV (2016), Appendix 10

From the figure we see that the unemployment rate in Oslo has, on a general basis, been at a level between 2 and 5 percent. However, we observe some rapid increases, especially from 1988 to 1992, from 2001 to 2004, as well as after the Financial Crisis in 2008. This is consistent with the theory that the unemployment rate often increases in recessions. The Norwegian Banking Crisis in 1988 was the main cause that the unemployment rate increased fivefold from 1 percent to 6.08 percent between 1988 and 1992. The real estate business, especially the contractors, experienced a heavy reduction in number of employees in this period (Hadrian, 2016). From 2004 to 2008 we see a decline in the rate, followed by an increase in 2008-2010. The former was likely due to strong economic growth after a weak competitiveness of the Norwegian companies (export) in the beginning of 2000, while the global Financial Crisis caused the unemployment rate to rise (SSB, 2002; Realfsen, 2006).

According to a new and comprehensive report from OECD about the Norwegian labor market, it is claimed that Norway is preening their unemployment rate. The report states that Norway is the country in Europe with the highest proportion of disabled people in working age. Hence, it is believed that a lot of the unemployed people are categorized as disabled, keeping the unemployment rate low. Moreover, it has in the same time period been a rapid growth in the number of disabled people registered in Norway. Other OECD-countries would likely have categorized a great portion of the people receiving welfare in Norway as unemployed, and not disabled (Aftenposten, 2011; OECD, 2015). If this is true, the unemployment rate in Oslo could be higher, which means that without the comprehensive welfare system, the housing prices naturally should have decreased more.

Generally, from the figure we see that the development in real house prices and unemployment rate move in opposite directions. This is consistent with the underlying macroeconomic theory, saying that house prices increase with a low unemployment rate. For instance was the low unemployment rate before the Financial Crisis probably a contributor to the increased house prices, as people had high expectations of future income. However, around 2007 to 2010, this relationship is not true. Here, first the house prices fell even though the unemployment rate decreased, followed by an increase in house prices and unemployment rate, contradicting theory. One reason for the parallel increase can be that Oslo constitutes of around 34 percent immigrants, often being the first to lose their job in an economic downturn (Thorenfeldt, 2009; Høydahl, 2015). Further, due to the deficit on the supply side, the increase in the unemployment rate might not give an effect in the housing market. We observe that the continuous urbanization and inflow of immigrants enhance the need for housing (which Oslo has not been able to fulfil, cf. ch. 8.3). As this is a relatively short time period, it can merely be a short-term imbalance in the market.

At the same time, the overall rise in unemployment rate in Oslo was likely more modest than expected, causing households to maintain a positive stimulus related to the housing market. The last years, the house prices have risen even though the unemployment rate has had small increases. In 2015, a small decrease in unemployment is observed. This can indicate that house prices in Oslo are not affected to a great extent by small changes in the unemployment rate, due to the great supply deficit of housing.

Conclusively, the unemployment level in Oslo is quite low, and there are tendencies that house prices increase even though the increasing unemployment rate theoretically should imply a decrease. The reason may be that the unemployment rate is quite low as such. This also indicates that there are other more important fundamental factors explaining the house prices in Oslo. However, the unemployment rate mostly indicate the economic condition in Norway/Oslo and further the natural development in house prices, and are therefore important to include in our model.

8.1.4 Key Rate and Interest Rate Development

David Miles and Vladimir Pillonca (2007) state that the level of the interest rate is one of the most powerful drivers for house prices. A low lending rate can enable people to borrow more, while a higher interest rate will make it more expensive to finance housing and can subsequently lower the demand. The lending rate consists of the key rate set by NCB, with an additional margin set by the individual banks. It is essential that the lending rate follows the changes in the key rate, because if the key rate is decreased and the lending rate does not change, the intended purchasing power of the households will not be changed (Holberg Fondene, 2013). The lending rate represents the price you pay to be able to finance your housing (Bolius, 2014). The installments, together with

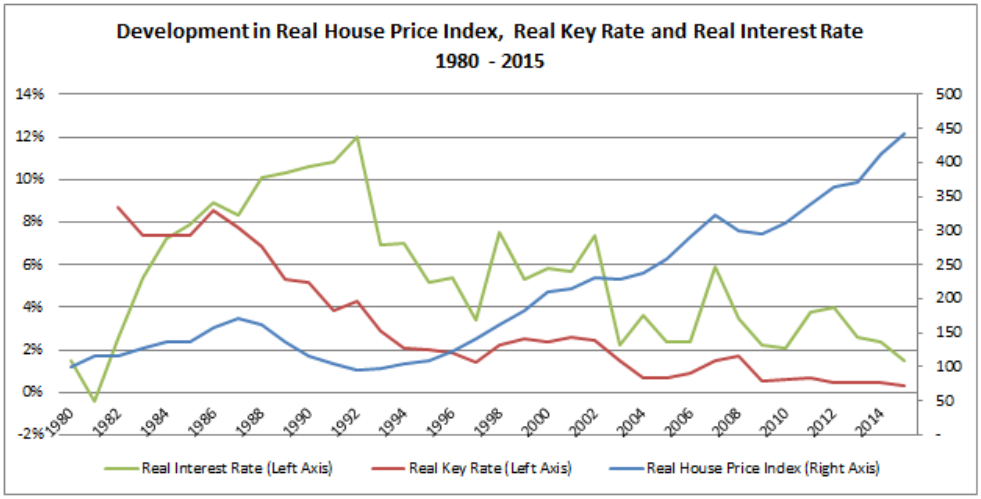
interest, determine the amount of the monthly income needed to service the household debt. The lending rate is thus affecting household's opportunity to invest in housing.

A country's monetary policy decisions thus have a great impact on the housing market. Through the monetary policy the central bank use the key rate as an instrument to regulate the money supply. NCB states that *"NCB's implementation of the monetary policy, in accordance with the first paragraph, shall be oriented towards low and stable inflation. The operational target of monetary policy shall be annual consumer price inflation over time close to 2.5 percent"*. Hence, we see that Norway has a policy that evolves around adjusting the key rate with regards to the country's inflation target (NCB, 2004). A change from an expansionary monetary policy (decreasing the rate) to a contractionary monetary policy (increasing the rate) can influence the house price development. The impact on the house prices is both directly and indirectly. A change in the official interest rates (key rate) directly affects the money-market interest rates and indirectly the lending and deposit rates to bank customers (ECB, 2016).

The lending rate is also closely related to the debt-level of households, increasing the importance of changes in the rate. Consequently, if the interest is high, the overall economy will be sensitive to cyclical changes and external shocks. Hence, with an increase in the interest rate, together with a high debt-to-income ratio, households are more exposed. Changes in the interest rate will generally affect more households than a rise in the unemployment rate will do (Debelle, 2004).

In Figure 8.5 the development of the real house price index in Oslo is compared with the key- and real interest rate for the same period. The interest rates are obtained from SSB and consist of average numbers from several banks. It is however important to be aware that lending rates are set by the individual banks, leading to possible deviations between the rates. The average numbers can therefore be somewhat misleading and not be fully representable for the actual lending rate development. The key rate is retrieved from NCB, and are available from 1982-2015.

Figure 8.5 Development in Real House Price Index, Real Key Rate and Real Interest Rate 1980-2015



Source: NCB (2015a), Eiendom Norge (2015a), SSB (2015d), Appendix 11

Up to the summer of 1993 the interest rate on the bank's overnight loans (D-loans) was NCB's key rate, while after 1993 the key rate has been the folio rate (NCB, 2015b). We see that the key rate and consequently the lending rate, has had an overall decreasing trend. The increasing real interest rates in the end of 1980's and start of 1990's impacted the price of housing negatively. However, from 1987 until 1992 the key rate and real interest rate moved in opposite directions. This can be explained by the Banking Crisis in 1988, which caused the banks to increase their lending rate, and thereby affected the demand for housing in a negative way. NCB lowered the key rate in order to stimulate economic growth, which resulted in the significant change in 1992. When the Norwegian economy stabilized after the Banking Crisis, the interest rate declined rapidly, with increased demand for housing and pressured prices as a consequence.

The extremely low interest rate in the last 10-15 years seems to have had a great impact on the substantial growth in house prices and will in all probability continue to do so. Analysts have spiking speculations as to how the interest rate level will develop and if the current development is sustainable in the long haul. Most economists believe the lending rate will continue to decline in the coming years, but some believe the possible decline is limited based on the level we have today (Langberg, 2015). In 2015 Norway had an average key rate of 1.05 percent, which is the lowest it has ever been in the time period. At the last monetary policy meeting in March 2016, the key rate was lowered to 0.5 percent (NCB, 2016a). The European Crisis contributes to keeping the key rate unusually low, although Norway's economic growth has been good, which isolated should indicate a higher key rate. The fall in oil-prices in Norway has caused the NCB to lower the key rate, in order to increase competitiveness internationally, causing lower lending rates in banks (cf. ch. 8.1.1). As Norway is not unaffected

by the development in the rest of the world, the key rate is kept artificially low (Qvigstad, 2013). The implications of changes in interest rates will be elaborated further in the next section.

The Effects of a Changed Lending Rate

We generally distinguish between short- and long-term interest rates when we evaluate mortgages with security in housing. Often the current economic situation in the country is a major determinant of the short-term interest rate, where the central bank's monetary policy has a great impact. The long-term interest rate reflects the expectations in important macroeconomic factors, such as inflation and growth. A positive growth expectation will typically increase the interest rate, while the rate will normally decline if the economy is crawling or standing still. To which extent the rate will increase or decrease, is depended on whether a change is expected or not (Bolius, 2014).

As households in Norway are more indebted than ever (cf. ch. 8.2.1), they are more exposed to interest rate risk, especially if the prevalent mortgage rate are variable (floating) (Debelle, 2004). According to SSB, more than 9 out of 10 have floating interest on their loans in 2014 (SSB, 2014a). The majority of households in Norway are thereby affected by short-term interest changes, which consequently can affect the demand for housing. Further, a lending rate below the expected inflation, as some predict in Norway in the coming years, can cause the demand for housing to increase substantially. Consequently, the level of house prices can be pressured to long-term unsustainable prices which can collapse when the interest level is normalized (Beim, 2015). Grytten (2016) further emphasize this problem in Norway. The increasing inflation, together with low interest rates can cause a negative real interest rate, leading people to borrow more than they are able to pay back.

An increased lending rate can cause problems to service the loan, with a forced sale of the housing as a consequence. This will result in a higher supply of housing, whereas less people are able to buy because of more expensive financing. Hence, it will have a negative effect on demand and prices, which can create turbulence in the housing market as well as in the overall economy. It is however important to emphasize that most banks in Norway does not grant loans unless the lender is able to service an increase in the lending rate of 5 percent (cf. ch. 8.2.2). In the case of a continuing declining lending rate, as most analysts predict, more people will be able to buy housing, increasing the demand for housing and therefore increasing prices.

On the other hand, there has been a strong development in the disposable income in Norway (cf. ch. 8.1.2), and margins of most households are greater than in the past. However, there is a limit to how much the lending rate can increase before it will affect the households more than they can handle.

Conclusively, for the Norwegian housing market, and consequently the housing market in Oslo, we consider the low lending rates to be a very important fundamental factor for the house price development. A low lending rate supports high house prices, as more households are able to service a higher mortgage when investing in housing and subsequently increase demand and press the prices upwards. Grytten (2016) believes that Norwegian banks will follow the key rate from NCB and maintain the low lending rates of today in the future. In addition, banks offer a 10-year fixed lending rate of around 2.8-3.5 percent, indicating an expectation of a low rate for a long time (Norskfamilie, 2016). Only taking this sole factor into account means that the housing price level will likely continue its increasing trend. However, in the worst case, if the lending rate increases, the house prices might fall considerably. At the same time, we see that both the disposable income of households and household margins has increased.

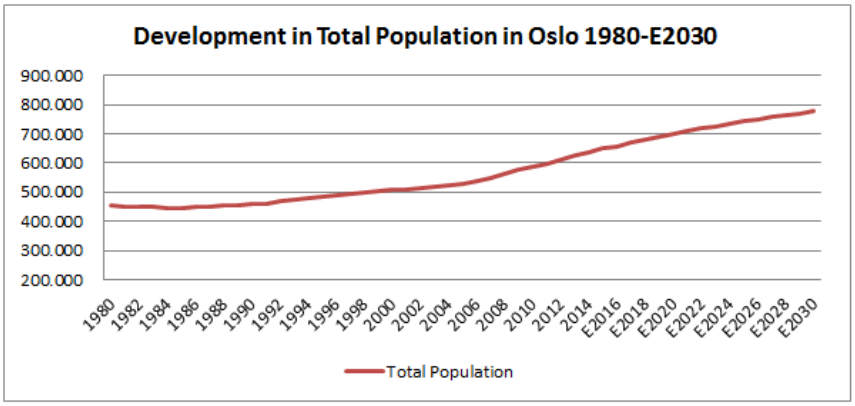
8.1.5 Population Growth

There has been historically high population growth in Oslo the recent years (SSB, 2015h). A high population growth signals that demand for housing also will increase, which consequently can put pressure on the house prices. We will therefore look at the relationship between the development in population growth and house prices. This is done in order to determine to what extent the growth in population impacts the house prices and thus if and to what degree this factor should be a part of our house price model.

As Figure 8.6 below shows, the population in Oslo has grown with approximately 28 percent the last 15 years (2000-2015). The increase in population is mainly caused by both increased immigration and urbanization, but also increased excess of birth in Oslo. The figure also includes the estimated population growth in Oslo until 2030. According to average numbers from SSB an increase of approximately 147,000 is expected from 2016 until 2030 (SSB, 2016a). With the assumption of 1.88 persons per household this indicates a demand for more than 5,600 new housing each year for the next 14 years (SSB, 2014b)[6]. In order to get a more nuanced picture of the Oslo house market we want to look into the trends more thoroughly.

[6] Need for New Housing = (147,000/1.88)/14 years ≈ 5,600

Figure 8.6 Development and Estimation of Population Growth in Oslo 1980-E2030

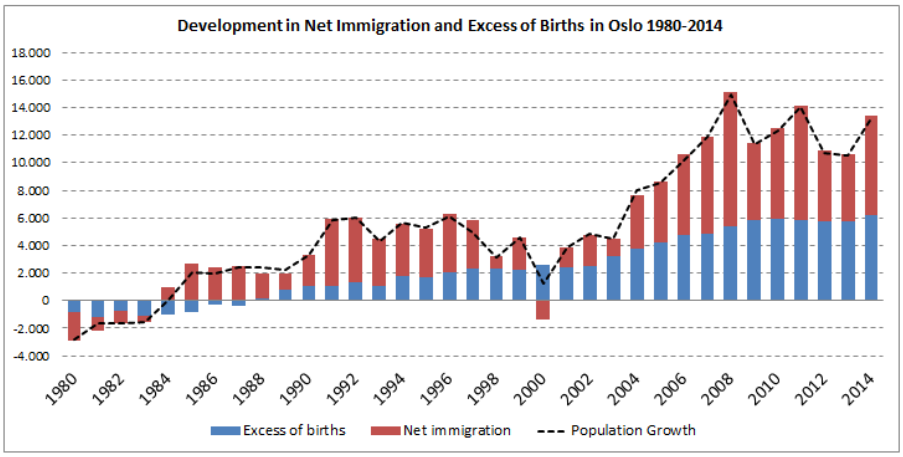


Source: SSB (2015h), Appendix 12

Immigration

In Norway the economic growth has been rather good, with a considerable growth in demand for labor and high wage growth. Norway has therefore been an attractive place for foreign jobseekers. Since the summer of 2006 the population growth in Norway has been almost 526,000 people (SSB, 2016b), whereas 18 percent of them have moved to Oslo. Figure 8.7 below illustrates what part of the population growth is due to excess of births and what part is net immigration (SSB, 2014c). One can clearly see that immigration has significantly increased after 2004, which can be seen in relation to the EU-expansion in 2004 and 2007 that made it easier for inhabitants of the new EU-countries to come to Norway (Hagelund, Nordbø and Wulfsberg, 2011). High immigration has thus contributed to the high population growth in Oslo. Moreover, immigrants tend to move to areas that are multicultural, for example Tøyen and Grønland in Oslo, further pushing the prices up (Røed Larsen and Sommervoll, 2003).

Figure 8.7 Net Immigration and Net Birth in Oslo 1980-2014



Source: SSB (2014c), Appendix 13

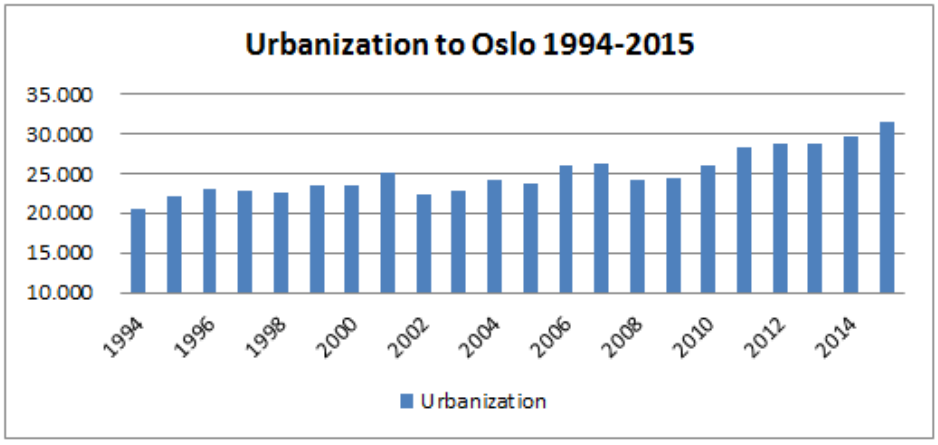
Hagelund et al. (2011) states that the housing market is highly influenced by changes in immigration, thus the high immigration in Oslo supports the high house prices. However, often immigrants move to countries or regions with high demand for labor and high wages, which could indicate that it is also these factors that contribute to the increased house prices, not solely immigration by itself.

Urbanization and Change in Households

More and more people tend to move to more central areas of Norway, hence the urbanization is increasing (Røed Larsen and Sommervoll, 2004). Figure 8.8 illustrates the development in inhabitants relocating to Oslo from other areas in Norway, showing a growth of about 43 percent from 1994 to 2015 (SSB, 2015i). Since 1994, averagely 24,000 people each year have moved to Oslo from other parts of Norway. Lately, especially job seekers from the oil-city Stavanger has been "forced" to move to Oslo in order to get a job after the major cut in employees in the oil industry (Mikalsen, 2016a).

The desire to live in central areas, here Oslo, is especially present among the age group between 20-29 years, which represents 55 percent of the relocations on average (73 percent in age group 20-39) (SSB, 2015i). The relocation of this age group has been termed the "latte factor", meaning that "hot-spots", cool areas and proximity to work are increasingly important. Size and design is less emphasized by this age group (Røed Larsen 2005). Moreover, according to Røed Larsen and Sommervoll (2003) the willingness to pay seems to be higher when buying housing in urban areas, contributing to press the prices up in larger cities, such as Oslo.

Figure 8.8 Urbanization to Oslo 1994 - 2015



Source: SSB (2015i), Appendix 13

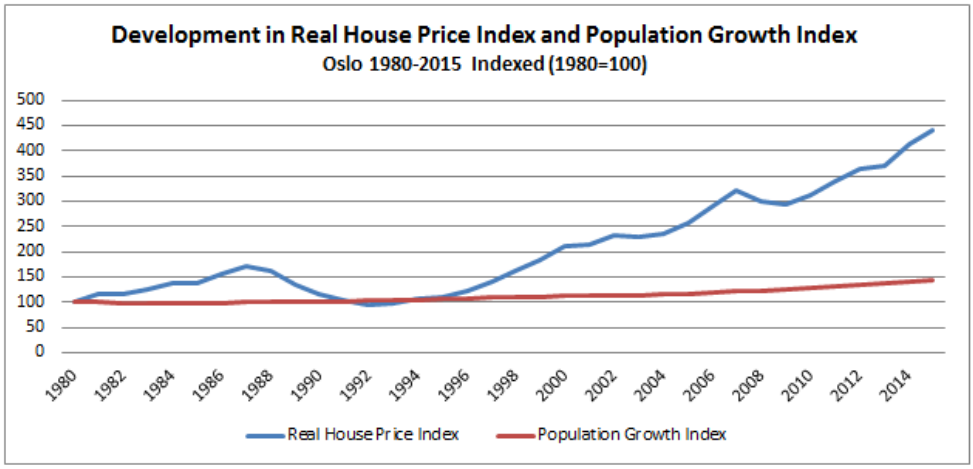
In parallel with the increasing urbanization, the change in composition of households has significantly changed. There is an increasing trend of smaller households, resulting in a greater need for small housing. This is most likely because of increased student population, change in lifestyle and change in the family establishing age (Røed Larsen and Sommervoll, 2004). In addition, couples living outside of a big city that splits up tend to move to larger cities, increasing the demand for housing (Røed Larsen and Sommervoll, 2003). Appendix 14 shows the composition of households in Oslo in 2001 and 2011. The most common is that the households consists of 1 or 2 persons, and is increasingly more common in 2011 than in 2001 (SSB, 2011).

Both the increasing trend for urbanization and the desire for 1/2-person housing put pressure on the supply of housing in Oslo, and also create disparities in the development of the various submarkets of the housing market. The price of small apartments in Oslo is rising at a faster pace than larger apartments (Rosa and Horjen, 2012). This is supported by a report from OBOS (2011), stating that the small apartments often are the only option for singles and people with low income. In addition, the report emphasizes that the increased house prices also forces couples and bigger households to look for smaller apartments as well, which reinforce the demand for small housing. OBOS (2011) further states that one-room apartments have had the strongest price increase over the years. Studies by SSB highlights the trend of wanting small housing, as the size of households has decreased throughout the years (SSB, 2014b) (Appendix 14). In conclusion, the combination of immigration and urbanization are socio-economic and sociological factors that impact the housing market.

Population Growth and House Prices

The graph below illustrates the relationship between the population growth in Oslo and the development of the house prices. In Oslo, the age group of 20-39 accounts for approximately 36 percent of the total population (33 percent in 1986) (SSB, 2015h). This age group is most active in the housing market as they are first-time buyers or they might look for bigger housing as they are expanding their families (Vosgraff, 2016; Blaker, 2014). The high proportion of young establishers puts pressure on the demand for housing. The relationship shows that there has been a growth in both factors. The graph shows that the house prices have increased more rapidly than the growth in population since 1997, especially after 2004, even though the population growth also increased more after 2004.

Figure 8.9 Development in Real House Price Index and Population Growth Index 1980-2015



Source: NCB (2014), Eiendom Norge (2015), SSB (2015h), Appendix 15

Conclusively, the demand for housing in Oslo is pressured due to the high population growth and the increase in smaller households, which supports the higher house prices. The population growth therefore seems to be an important factor to include in our model.

8.2 Indirect Factors Affecting Demand

8.2.1 The Credit Market

The housing market and the credit market should be seen in close connection, as the development in a country's credit market can be an indicator to identify movements within the housing market. Also, households are dependent on a well-functioning credit market in order to be able to finance their housing investments. Banks and other financial institutions have the ability to change the supply of credit and thus affect the demand and price level of housing. If these institutions (private and public banks and some pension funds etc.), limit (increase) the loans granted to customers, the demand for housing will decline (rise), causing the housing market to cool down (fire up). Political conditions can also be a reason for such changes in the supply of credit. This chapter will discuss the development in credit growth and debt ratios.

Credit Growth in Norway

Borio et al. (1994) state that there is a positive relationship between the credit growth and the house prices. Housing is deeply embedded and influenced by credit markets, as credit often is required for most households when investing in housing (Wachter, 2016). Hence, as most housing is financed through mortgages, a high credit level supports high housing prices. The credit growth in a country can indicate how fast household's debt is increasing. If the debt is increasing more than what is reasonable compared to other fundamental macroeconomic

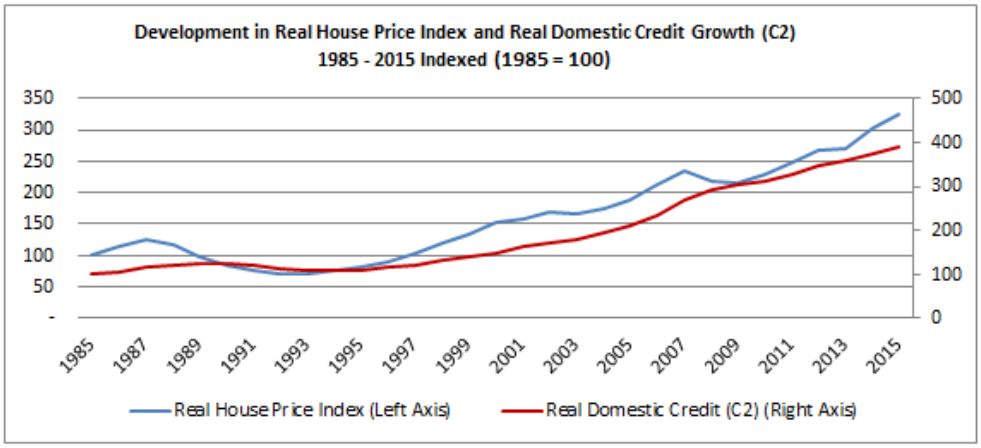
factors, it may indicate an unstable economic development. An unfortunate development in the credit growth can lead banks to implement more conservative lending policies, limiting the credit supply, which can lead to a drop in the house prices (cf. ch. 8.2.2).

The credit growth can be distinguished in two different measures, C2 and C3. The C2 indicator represents the domestic credit, and is part of the credit indicator C3, which presents an overview of both domestic and international debt (foreign currency) in Norway. The data material reflects Norwegians public total gross debt[7], not for Oslo specifically. The difference between the two measures can tell how exposed Norwegian households are towards currency fluctuations. Turbulence in the economy in other countries can affect the Norwegian economy if a great part of the credit source is foreign. The deviation between the C2 and C3 credit indicator has increased after 1998, indicating that households are taking on more foreign debt than earlier (Appendix 16). However, as Norwegian households only hold a small portion of debt through foreign sources, it will not be elaborated further.

By examining the growth in the domestic debt (C2), we can evaluate whether more debt is taken on in order to finance housing (SSB, 2015j). Adding up the total debt of the Norwegian state, companies, the financial sector and households, Norway has a debt-ratio of 244 percent of GDP, emphasizing the strong acceleration (Ravnaas, 2015). The main reason for this development is likely the growth in disposable income over time, higher house prices, as well as more favorable lending policies and terms. In addition, debt is tax-deductible, incentivizing taking on more debt (cf. ch. 8.2.3). Domestic credit (C2) reached an historical level in 2015, with a 290 percent increase since 1985 in real terms. CEO, Morten Baltzersen, in FSA, states that although the growth in income is declining and more is unemployed the later years, the debt is increasing, which is concerning (Sættem and Heyerdahl, 2016). The high credit growth (C2) in the Norwegian market makes it interesting to analyze the relationship between the domestic credit growth and the development in real house prices.

[7] Not included mainland Norway and petroleum activity and ocean transport

Figure 8.10 Development in Real House Price Index and Real Domestic Credit Growth 1980-2015



Source: NCB (2015a), Eiendom Norge (2015a) SSB (2015j), Appendix 16

Figure 8.10 presents the development in domestic credit growth (C2) and house prices in Oslo between 1985 – 2015, as numbers before 1985 were not retrievable. From the graph we observe an increasing trend in both factors, whereas the growth in house prices has exceeded the growth in credit in almost all years. The credit growth and house prices follow each other closely, indicating a relationship between the two measures. However, the credit growth is not able to explain the entire increase in house prices. The main reasons can be that banks require a certain amount of equity when lending out capital (cf. ch. 8.2.2). After the Financial Crisis in 2007, the development in credit growth and house price growth were at the same level, indicating that the fall in housing prices affected household's equity negatively. While the house prices experienced a drop after the crisis, the credit growth continued to increase. As lending rates are believed to maintain low or decrease (cf. ch. 8.1.4), it can be assumed that the credit growth will grow further as it is less expensive to borrow.

However, the credit growth seems to follow the house price development with some lag. As only a small fraction of housing is sold each year, the credit growth can continue long after a house price increase. This is evident in both the crisis in 1987 and after the Financial Crisis. As seen in 1987, the house prices decreased dramatically (44 percent) until 1992, while the credit growth continued to rise, but had a decline from 1991. In 2007-2009 this development is clearer, whereas the credit growth increased sharply even though house prices declined (Borgersen, Hungnes and Jansen, 2009). Here, we also see the growth stabilizing in the years after, before continuing the growth.

Often, positive outlooks alone can increase the demand for housing and credit, whereas it is hard to determine what affects the other the most. The higher level of house prices lead to better security for the banks and

increased credit growth, which in turn can result in even further growth in house prices and credit in a self-reinforcing spiral (Hole, 2015). Because of this spiral, a high credit growth can lead to an imbalance in the economy and increased risk of a bubble formation in the housing market (Regjeringen, 2013). Conclusively, the high credit growth in the market supports the high housing prices in Oslo (and Norway). Hence, the high supply of credit combined with low interest enables more households to invest in housing, increasing the demand and subsequently house prices.

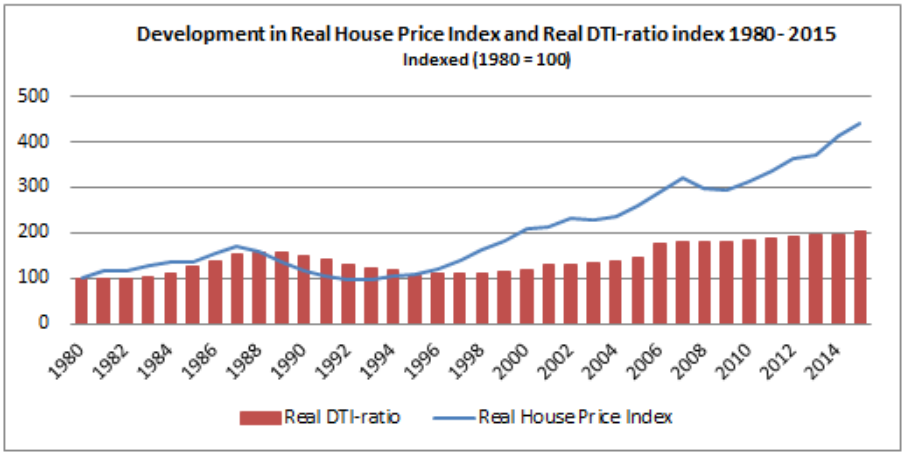
As housing being the main component of household's wealth and is often financed through mortgages with security in dwellings, the debt-ratios of households are interesting to examine. The two debt-ratios *debt/disposable income* and *interest burden/disposable income* will be presented in order to evaluate whether the level of debt is sustainable.

Debt in Percent of Disposable Income

The debt over disposable income ratio (DTI-ratio) indicates the household's ability to service its debt. A high DTI-ratio means that the household has a relatively high debt burden compared to their disposable income and is therefore exposed to changes in interest rate, unemployment, taxes etc. The level of debt households are able to handle is dependent on their wages, whereas changes in these aforementioned factors can affect their ability to finance housing. An increasing interest rate or unemployment rate can also mean that households have less to spend on daily purchases.

Data for the DTI-ratio is only available for Norway and not for Oslo specifically (Aale, 2015; SSB, 2015k). It still gives a good picture of the development in the ratio and should provide some indications to consider on the development of the debt burden. The DTI-ratio is converted into indices to better see the relationship with the real house price development. The indices from 1980-2015 are presented in Figure 8.11 below:

Figure 8.11 Development in Real House Price Index and the Real DTI-Ratio Index 1980-2015



Source: NCB (2015a), Eiendom Norge (2015a) Finansdepartementet (2015), SSB (2015k), Appendix 17

From Figure 8.11 we can observe the increasing DTI-ratio before the crisis and a decrease in 1989 until 1993, followed by a period of rather stable ratios until around 2000, where the DTI-ratio starts a steady growth towards today. The increase before the crisis in 1988 can be compared to the increase we have seen the latest 15 years. The level the last decade (2006-2015) is actually higher than before the crisis in 1988, which could be a reason for concern. On the other hand, the rate of interest is much lower in this period than before the crisis in 1988, enabling households to better finance the mortgage. Looking at the level right before the bubble burst in 1988 and today, we see that the DTI-ratio was about 180 percent compared to a record high level of 230 percent in 2015. The 2015-level means Norwegian households hold debt more than twice the size of their disposable income. From the lowest DTI-ratio in 1995 until 2015, the ratio has increased by about 105 percent, whereas the last decade has been rather stable, but increasing. This development illustrates that the growth in debt has exceeded the growth in income considerably.

According to Reiakvam and Solheim (2013) housing-related debt makes up the largest part of a household's debt. As about 84 percent of Norway's population own housing, it is reasonable to assume that this will result in a high total debt. However, according to their studies there is an absence of a relationship between the two factors, contradicting Borio et al. (1994). This is supported by the development in the two factors (Figure 8.11), where the house price index has increased considerably more than the credit growth index since 1996. This can imply that households underlying wealth has increased. However, factors such as a strong growth in GDP, growth in disposable income, low interest rates, low unemployment and positive future expectations supports the DTI-ratio development in the time period. The increased borrowing can also be a result of changes in the credit market over the past years. The range of loan products has increased to include home equity line of credit and starting loans, interest-only loans, as well as a longer maturity of debt (NCB, 2006). These developments enabled more Norwegian households to increase their borrowings without increasing the monthly cost considerably in the short-term, which in turn resulted in a debt burden higher than earlier.

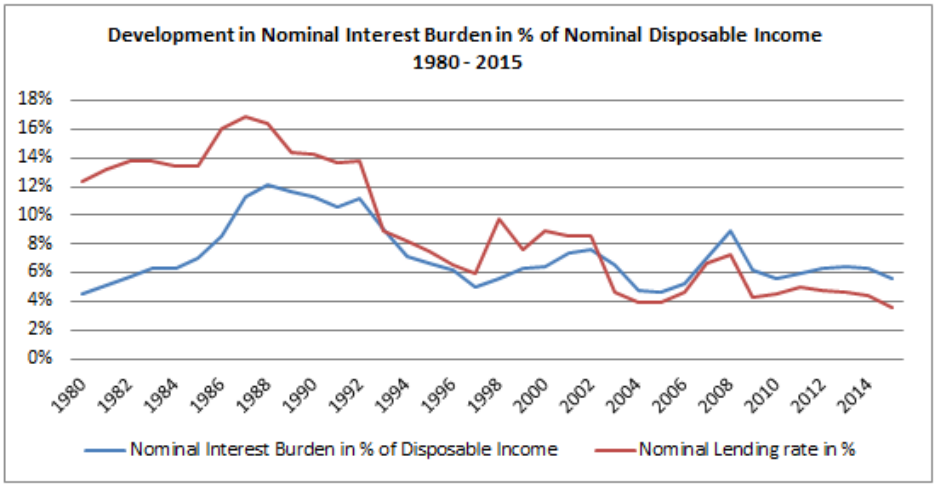
Conclusively, the development in DTI-ratio and house prices follows each other to a certain degree. As the growth in house prices has been considerably greater than the growth in the DTI-ratio, there are other explanatory variables for the increase in house prices in Oslo.

Interest Burden in Percent of Disposable Income

The interest rate is, as discussed earlier and in chapter 8.1.4, one of the most important factors affecting the development in the credit market. In total, a change in the interest rate will to a greater extent affect households than a change in unemployment rate, as interest together with installments account for a great part of household's disposable income. It is interesting to evaluate whether household debt is sustainable compared to

the interest burden, as it can indicate whether households are able to service their loans. Therefore, a discussion of the interest burden development will be conducted (NCB, 2016b).

Figure 8.12 Development in Nominal Interest Burden in Percent of Nominal Disposable Income 1980-2015



Source: NCB (2016b), Appendix 18

From Figure 8.12 we see that the interest rate burden has had a declining trend over time, except some periods with increasing interest rates. Especially the high interest burden before the Banking Crisis in 1987 and the hike after the Financial Crisis in 2008 stands out. In 2003, we see a shift, where the interest burden exceeded the nominal lending rate. The risk that the interest burden is hard to bear increases when the interest burden in percentage of disposable income is at such high levels, even though the rate is at historically low levels. The figure displays the interest burden after taxes, making the burden lower, where the tax deduction further enhances the price pressure, as buyers are able to take on greater loans. Moreover, a lower share of disposable income is bound to service debt the last years, due to the low interest rates. This means that more households are able to service a higher debt burden, enabling them to finance more expensive housing.

Even though the possibility of an increased interest rate seems unlikely in the short-term, Norway has, as seen in the figure, experienced unexpected hikes in the interest rate historically. NCB newly emphasized that the persistent growth in debt burden has made households more vulnerable for increases in the interest rate (NCB, 2016). Chapter 8.2.2 discusses that banks demand borrowers to be able to service a 5 percent increase in the interest rate. Such an increase could cause the interest burden to be at the same level as in the introduction of the Banking Crisis in 1986/87, and will affect Norwegian households to a great extent (Tekla, 2016). However,

Thorstensen from NCB (2016) also states that Norwegian households have financial buffers greater than earlier, causing them to be better able to meet an increase in interest rate.

Summarized, we see a rather substantial growth in both supply and demand for credit. As mentioned, the house prices and credit growth mutually influence each other, making it hard to separate which of them having the greatest effect. Nonetheless, the historically high DTI-ratio and credit growth both increase the risk of bubble formation in the housing market. Both NCB and FSA have for a long time warned about the consequences of this development. If the development in the housing market turn or the interest rate increases, the risk of a significant fall in housing prices is present. This can cause negative ripple effects in the economy as households will have to reduce spending and consequently cause a lower demand in the economy. In turn, this can give increasing unemployment rates and lower income growth (Tekla, 2016).

The Norwegian households have one of the world's highest debts to disposable income ratios, being above 200 percent the last decade. In comparison, the average DTI-ratio in the United States before the housing market crash in 2007 was 128 percent. On the other side, DNB, the largest bank in Norway, states that there are several factors contradicting bubble formations in Norway/Oslo. In Norway, a great fraction of households own their housing, as opposed to renting, naturally giving a higher debt-ratio. The high tax rate on income gives on one hand a lower disposable income compared to other countries, but on the other hand, the interest on loans is tax-deductible. In addition, the welfare society in Norway allows a higher tolerance for debt burden as unemployed seeking for a new job can claim unemployment benefits for 1-2 years based on their earned income the last calendar years (NAV, 2016b). In addition, compared to the United States, the increasing housing prices are mainly built on the basis of increased income of Norwegian households over time, and not only increased supply of credit as experienced in the US (Sparre, 2014).

8.2.2 Bank's Lending Policy

As housing is primarily financed by mortgages by banks and other financial institutions, the price of housing is likely affected by banks' lending policies. Earlier crisis in Norwegian history have had changes in lending policies as a contributing factor for both economic upturn and downturn, making it an interesting area to investigate. The lending policy is equal nationally, whereas the analysis will be based on Norway as a whole.

A bank's lending policy is defined as the bank's internal requirements for granting loans to their customers. The last years, the economy of the households has been characterized by a growing debt burden, high loan to value mortgages and more extensive use of interest-only loans (Finanstilsynet, 2011). As discussed in chapter 8.2.1 the relationship between debt and house prices has largely showed a coinciding development. The high debt burden has increased the households' vulnerability to rising interest rates, unemployment and reduced disposable

income. As the development in housing prices and the households' debt burden is of central importance to financial stability, it is essential to have strict lending policies. Hence, having a more restrained lending policy can help to reduce the risk of the households (Finanstilsynet, 2011).

In 2011, the FSA therefore tightened the guidelines for lending practices. These changes broadly contain requirements that banks conduct a more thorough credit assessment among borrowers when calculating the loan-to-value ratio (LTV) on mortgages and credit loans and restrictions on the LTV-level. Moreover, banks should consider a possible interest rate increase when calculating the borrower's solvency and the size of the instalment payments (Finanstilsynet, 2011). The FSA has developed 10 "guidelines", where the two most important are:

i. The mortgage loan should normally not exceed 85 percent of the property's market value (previously 90 percent).
ii. In assessing the solvency of the borrower, the bank must take into account that the interest rate can increase by 5 percent from the current level.

The borrower's capital requirement of 15 percent affects the total obtainable loan, as the borrower will receive less capital for a given amount of equity. The chief of FSA, Morten Baltzersen, claims that the new guidelines have lowered the amount of house buyers taking up high mortgage loans. On the other hand, the new guidelines have also been criticized for creating a higher threshold for entering the housing market and for establishing a class distinction between those who can get help from parents and those who cannot (Bjørnestad, 2012).

However, it is possible to get a mortgage loan even though one does not fulfill the requirements. The NSHB offers start-up loans for those that are struggling in the housing market, both in relation to buying a home or keeping one. In order to give more people the possibility to get a loan, NSHB assists borrowers with the capital that are required as equity by private banks. The loans are however only offered to people that fulfill certain requirements (Husbanken, 2016).

Further on, borrowers can also have a guarantor as security for the loan or establish additional collateral. A guarantor assures that the borrower can pay the instalments and rents. Additional collateral is typically pledged on others (often parents) housing or cottage. Studies have shown that the increased need for equity of 15 percent has increased borrowers needs for guarantors. TNS Gallup reports that one out of three has helped their children into the housing market either by being a guarantor or by providing additional collateral (Staavi, 2016).

Additionally, even though new guidelines are presented, not all banks have actually implemented them into their internal policies. Surveys after the new guidelines show that 17 percent of the loans had equity below the required 15 percent, thereby not fulfilling the requirement of an 85 percent LTV-ratio (Bjørnestad, 2012).

What Does this Mean for the House Prices?

The increased capital requirement can lead to fewer people being able to get loans, consequently reducing the demand for housing. The guidelines will possibly affect the younger segment the most as they might be the group that struggles most to obtain the required equity. The Head of Finance in Sparebank 1 SMN, Endre Jo Reite, states that among the younger segment in 2013, in approximately 42 percent of all loans, the borrower receives help from their parents, in comparison to 35 percent in 2011/2012 (Hammerstad, 2013). The lack of capital may eventually increase the demand for small housing as low-income households will demand cheaper housing. An increased demand for small housing can however push the prices up even further, causing a vicious circle for low-income households (cf. ch. 8.1.5).

Elisabeth Holvik, Chief Economist in Sparebank 1, believes that the banks' restrictions on their lending practices will help to slow down the growth in housing prices. However, Holvik further states that since there exists sufficient capital in the society and historically low rates, the banking policies will probably only have a small effect on the housing market, at least as long as the population growth is high, the unemployment level low, disposable income high and interest rate continue to be low (Mikalsen, 2013).

Moreover, in 2015, FSA proposed new, even stricter lending rules. The main changes are that the borrower should manage a 6 percent increase in the interest rate, opposed to the previously 5 percent and, in addition, stricter rules not to exceed the 85 percent LTV-ratio. The proposed regulation constitutes a clear constriction on individual judgement made by the banks, which is the most important contribution to the tighter lending practices (Baltzersen, 2015). As of today, the new rules have yet to be approved and implemented. The FSA believes it is necessary to introduce such rules even though the weaker prospects of the Norwegian economy due to the drop in oil-prices, will likely contribute to a reduction in the willingness to borrow. There is however a risk that the prolonged low interest rate and the still relatively easy access to credit will cause strong growth in both debt and house prices. The FSA believes that such a development is not sustainable and will increase the possibility of a sharp downturn and financial instability, which is why they consider it necessary to introduce stricter lending regulations (Baltzersen, 2015).

Conclusively, it has become harder for households to be granted a loan for buying housing. However, as mentioned earlier, there are ways to go around the banks' regulations, which lead us to believe that a bank's

lending policies only will have a small effect on households' possibility to obtain financing. According to a report by NCB there has been some reduction in the demand for loans among households. NCB states that it is difficult to say whether the reduction is due to the new lending regulations, or because of other factors in the economy (Knudsen, 2015).

8.2.3 Housing Taxation

Taxation of housing has throughout history been a political instrument to increase the proportion of home owners and influence the development in house prices. Advantageous tax schemes appear to be a strong incentive to invest in housing compared to other financial investments. The most important aspects of the tax scheme in Norway will be presented below.

The Tax Deduction of Interest on Debt

The Tax Administration Act (1999) §6-40 gives deduction of the interest of the taxpayers debt. Although the deduction of debt interests is not made to favorite investment in housing, this is how it works in practice. The deduction in the interest on debt is because of symmetry considerations. As interest income is taxed as capital income (as of 2015 with 27 percent) the interest on debt is deductible (Regjeringen, 2009).

The Tax Value of Housing

The tax costs related to housing is calculated based on the tax value of the house (Skatteetaten, 2016a). As it is of political interest to keep the costs of owning housing down, the tax value of residential property has been lower than the market value of housing. The tax value of primary- and secondary housing is calculated by SSB based on a price per square meter intended to reflect the market value. The data from SSB is based on observations of sold housing, taking type of housing, location and age into consideration. Based on these rates, the Tax Administration calculates official annual rates per square meter to be used. There have been several changes in these rates throughout the years. As of now, the rates for primary houses are 25 percent of the calculated market value per square meter, while for secondary housing they are 80 percent. Hence, the tax value of the housing can be maximum 25 and 80 percent of the market value, respectively (Skatteetaten, 2016a).

Clearly, it is more beneficial to place investment in housing than in other types of investment. This is because when calculating the tax on wealth, the tax value of the house is used as a basis instead of the market value.

Tax on Housing Capital

The main part of the capital of Norwegian households is often placed in housing. The Tax Administration Act (1999) §4-1 states that the taxable wealth should be determined at market value per January 1st of the tax year, with the liable debt deducted for (Lovdata, 2016b).

The current taxation rules for Norwegian residents involve that capital below NOK 1,400,000 are tax-free, while capital above this are taxed with 0.7 percent to the municipality and 0.15 percent to the government, i.e. a total tax of 0.85 percent (Skatteetaten, 2016b.). A wealth of NOK 1,400,000 amounts to a housing worth NOK 5.6 million[8]. If no other fortune is assumed, this means that one can have housing worth NOK 5.6 million without paying taxes. In comparison, a bank deposit of NOK 5.6 million would have resulted in a wealth tax of NOK 35,700[9]. Hence, as mentioned earlier, this gives great incentive to invest in housing rather than other financial assets.

The minimum deduction level related to the tax on fortune has increased rapidly the last years. In 2000 the deduction level for the municipality was at NOK 120,000, hence a lot lower than today (Skatteetaten, 2000). This means that with a taxable value of 25 percent of market value, a property in 2000 could not be worth more than NOK 480,000 (nominal prices) before having to pay taxes[10]. Thus, the advantages of owning housing today is even higher than for 16 years ago, supporting the high amount of Norwegian households wanting to own housing.

Taxation of Housing Sales Profit

The capital gains for housing are more favorable than for many other investment objects. The capital gain when selling a house is in principle taxable, but there are several ways to avoid paying taxes when selling. The capital gain is not taxable if the property is owned for a minimum of one year and the owner has lived in the property for one year within the last two years before the sales take place. If these terms are not fulfilled, the capital gain will be taxed with 27 percent in 2015. A loss will be deductible if a gain should be paid tax for (Skatteetaten, 2016c). In practice, this means that the owner of the property to some extent can avoid paying taxes by adapting the duration of the house ownership.

[8] Tax Value of Housing: 25 % x NOK 5,600,000 = NOK 1,400,000
[9] Wealth Tax: (NOK 5,600,000 – NOK 1,400,000) x 0.85 % = NOK 35,700
[10] Assessed value of housing: 25 % x NOK 480,000 = NOK 120,000

Property tax

The property tax is a tax where the council of each individual municipality can choose whether to impose the tax or not. The rates used for taxation are between 2 ‰ and 7 ‰, after subtracting a minimum deduction from the house value before calculating the property tax to be paid. In 2014, 341 of Norway's 428 municipalities had implemented property tax, resulting in property tax revenue of approximately NOK 9.6 billion (SSB, 2015l). The number of municipalities introducing property tax increases each year, with over 355 municipalities in 2015.

The municipality of Oslo introduced property tax in 2016 with a minimum deduction of NOK 4 million and a tax rate of 2 ‰ (Oslo Kommune, 2016a). Hence, the property tax has not had any impact on the housing prices in previous years, and is thus not a part of the P/R-ratio in chapter 6.2. The Municipality of Oslo expects a tax revenue of approximately NOK 160 million, with an increase in 2017 as commercial properties also will be taxable (Eiendomsskattekontoret, 2016). Moreover, an increase in the tax rate from 2 ‰ to 3 ‰ is planned. In Oslo, with the above mentioned property tax rules, for a house worth NOK 6 million the annual property tax will amount to NOK 3,200[11]. The property tax can reduce the incentive for households to invest in housing, and can thus be used as a tool to try to reduce the high growth in house prices, as well as raising capital to finance the municipality. However, as the minimum deduction is quite high and the tax rates are at a quite low level (for now), we believe it probably would not significantly affect the average household too much.

Tax of Rental Income

Even though rental income in principle is taxable, it can be tax-free in several instances. If the house-owner of a residential home uses more than half of the property, according to the rental value, the rental income is tax free. When renting out more than half of the property, the rental annually income cannot exceed NOK 20,000 without paying tax (Skatteetaten, 2016d). Further, if the rental income is taxable, deductions for costs related to the rental part of the property are given. This taxation rule can incentivize households to invest in larger housing with a possibility to rent out. This makes it more beneficial to invest in larger housing, increasing the investment level of housing rather than other financial objects.

The Taxation Effect on the Housing Market

As the taxable value of housing is lower than the market price, it is advantageous to invest in housing rather than other financial assets. Moreover, with the current rules of taxation on sales profit and rental income, it is quite beneficial to invest in housing. Some state that the tax benefits of owning housing have contributed to an

[11] Annual Property Tax: NOK 6 mill – NOK 4 mill = NOK 2 mill x 0,2 % = NOK 3,200

overinvestment of housing rather than other more economically profitable investments (Regjeringen, 2009). The higher rates on secondary housing are however made in order to reduce the benefits of owning housing one does not live in. Still, the chief of the Taxpayer Association, Rolf Lothe, states that the actual effects of the rules are somewhat difficult to measure (Mikalsen, 2015a). The Chief Economist of Sparebank 1, Elisabeth Holvik, believes that the favorable tax rules does not only make Norwegian households to overinvest in their primary housing, but also investment in secondary housing to avoid tax on wealth. In 2015, about 20 percent of housing is secondary housing, indicating that investors see the benefits of the taxation policy (Dalen, 2015a). Both factors increase the demand for housing in Oslo (Stavrum, 2012). Holvik further states that the unlimited deduction of debt interest is a risky incentive to buy housing and is probably one of the reasons for the high debt burden among Norwegian households (cf. ch. 8.2.1). Although property taxes are mainly a source of income for the municipality, it can also somewhat reduce the incentive to invest in housing.

Conclusively, it can be hard to determine whether taxation rules affect the house price level or not. According to NOU (2009:10) (Regjeringen, 2009), the consequence of the tax favoring of housing is an overinvestment in housing, further giving higher house prices than if housing had been neutrally taxed. The tax favoring of housing can thus have contributed to a deviation between the market prices and the prices that can be explained through fundamental values.

8.3 The Supply of Housing in Oslo

Over time, the housing price development will be affected by the changes in population and the construction of housing. In order to evaluate the supply side of the housing market in Oslo, the housing stock is essential to address. This section will discuss the construction costs, which includes building costs and site costs as the main factors affecting the housing stock in Oslo.

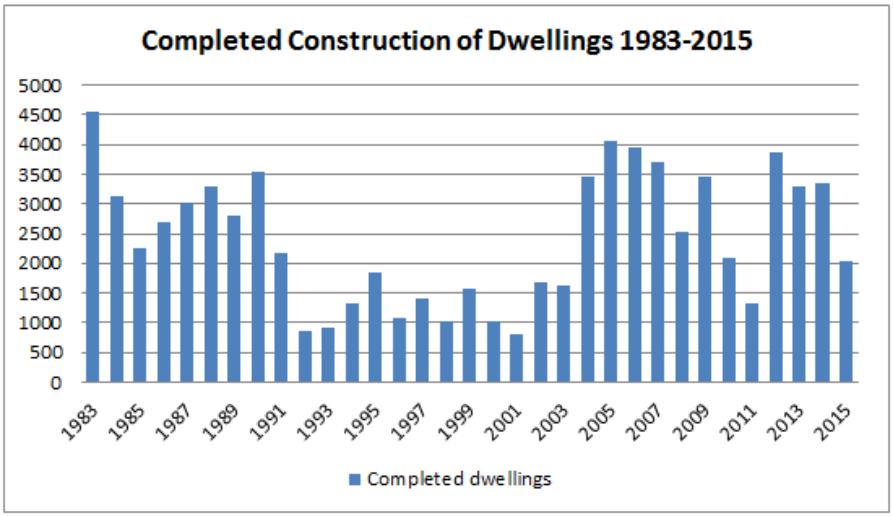
8.3.1 Housing Stock

As earlier discussed in chapter 4, the housing stock in the market is determined by the amount of housing units in the previous period plus the difference between new construction and the reduction of housing (Hendry, 1984). The development in the housing stock over time can give an indication of the current supply level in the housing market in Oslo, making it interesting to investigate. A low (high) housing stock relative to the demand in the market, can contribute to pressure the housing prices up (down) as there will be high (low) competition in the market.

The size of the housing stock is expanded through the construction of new housing. The construction of housing is a long-term process, meaning that the annual growth in the housing stock depends on the time of completion.

This means that if the demand for housing increase more than expected, the house prices will rise in the short term as the supply is constant (inelastic) (Hendry, 1984). In order to examine the housing stock in Oslo, we have gathered information on the number of completed housing in Oslo from 1983-2015, presented in Figure 8.13.

Figure 8.13 Completed Construction of Dwellings 1983-2015



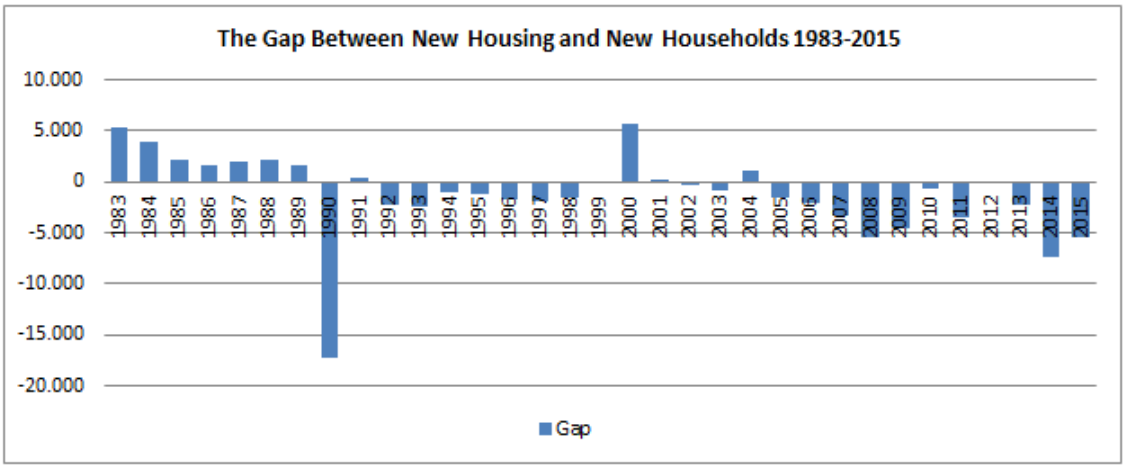
Source: SSB (1999), SSB (2015m), Appendix 19

From the figure, we see that the amount of dwellings completed each year is volatile. The activity in the housing market declined from 1983 to 1985, likely due to that site owners were not willing to sell sites the last years before 1983, as price regulations of sites for housing purposes was deregulated (Andenæs and Fliflet, 1990). Hence, the construction activity was reduced the years after 1983 as there were few sites ready for housing purposes. It grew from 1985 until the end of the eighties, but experienced a sudden drop in activity due to sharp reduction in house prices in general in 1987/88. The level of housing was increasing from 2002 until 2007, likely because of a strong Norwegian economy and high demand for housing after many years of supply deficit from the years 1992 to 2002. Between 2004 and 2006 there was a building boom in Norway, with an especially strong growth in Oslo (SSB, 2015m). We observe a sharp decline from 2007 to 2011, due to high construction activity the last years before 2007, while the last part of the period can be due to the Financial Crises (Seehusen, 2008). However, as the period from starting up a building project (including planning) until finishing normally is 2-4 years, it is not likely that the fall in 2008 was because of the Financial Crisis, but more the high activity level in 2005 and 2006. The bottom low in the later years was hit in 2011 with only 1,362 completed housing, a 64 percent drop from 2007.

After the Financial Crisis, the market may have been concerned about uncertainty in the future, causing the initiation and construction of new buildings to fall. However, from 2011 the construction increased rapidly by 192 percent, and continued on a relatively high level in 2013 and 2014. We observe a lower level of completed housing in 2015.

Further, investigating whether the construction activity, i.e. housing stock, is in line with the housing demand in Oslo could be interesting. Prognosesenteret states that it in order to meet demand in Oslo; it should be built 5,600 new dwellings each year towards 2030, whereas only around 3,000 (each year) have been initiated the last years (cf. ch. 8.1.5; Fjeldstad, 2016). This large gap between the supply (completed housing) and new households (demand), will contribute to press the demand up and increase the prices even further. Figure 8.16 illustrates the gap between supply and demand from 1987-2015. The data is however based on some assumptions. Due to lack of data of persons per household each year, we will in our calculations base the number of households on the number of persons per household for the decade (SSB, 2014b). In the 1980's, the number of people per household was 2.01, which the population in the relevant years between 1980 and 1989 will be divided on. Further calculations will be in appendix 19.

Figure 8.14 The Gap Between New Housing and New Households 1983-2015



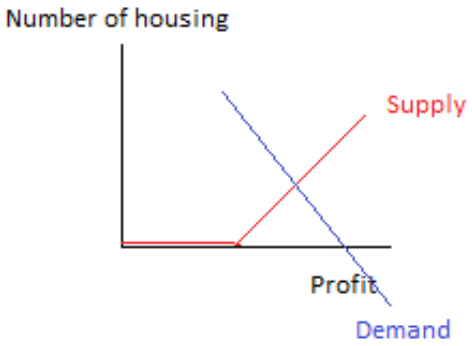
Source: SSB (1999), SSB (2015m, h), SSB (2016a), Appendix 19

As the figure clearly indicates, there has been a supply deficit of housing in Oslo in almost the entire time period after 1990. There has been an average gap of 3,059 completed housing in the last 10 years (2005-2015), meaning that 3,059 new households lack the corresponding new housing each year. Consequently, there is a higher demand than supply in the market, causing the house prices to be pressed up. This is supported by Christian

Vammervold Dreyer, CEO in Eiendom Norge; *"We see that the level of building is too low compared to the population growth in Oslo, and if this level is maintained, it will create a further pressure in the market"* (Dreyer, 2016). The extreme gap in 1990 can be caused by the change in people per household from 2.01 to 1.85, as more single households were registered between 1980 and 1990 (cf. 8.1.5).

As discussed in chapter 8.1.5, there is especially high population growth and urbanization within and around Oslo the years to come. The population growth in the period means that about 78,000 new housing is needed over the next 14 years, whereas 58,074 new housing is built in the last 25 years in Oslo (1990-2015). In addition, based on Prognosesenteret and The Municipality of Oslo, there is already in 2015 a deficit of housing of 20,000 as it is built fewer housing than needed historically (Dalen, 2015a). From both the historical deficit of housing construction and the needed housing in the future, we see that the construction of housing will have to grow at a much faster pace than it has up to now to meet market demand. If the total cost of construction grows at the same pace as today, the pressure on the sales prices of housing have to increase further to avoid an increasing negative gap between supply and demand (cf. ch. 8.3.2). If the market for housing is not ready to accept higher prices, the suppliers of dwellings, due to possible reduced profit margins, will decrease the supply until either the total cost of construction is reduced or the prices are at a level that gives the supplier's acceptable profits. This relationship can be seen in Figure 8.15 and shows that there will not be construction of new housing before the developers meet their profit requirements.

Figure 8.15 Breaking Point of Supply



Source: Hadrian, Own creation

In order to understand the supply side of the housing market more thoroughly, an analysis of the underlying factors affecting housing expansion will be conducted. The analysis may enable us to understand why the supply of housing in Oslo is lower than the demand. We will investigate and evaluate the following factors, which may influence the supply side of the housing market in Oslo.

- Building costs, which mainly consists of material and labor cost
- New technical regulations
- Available land for housing construction
- The process-time from the regulation authority of Oslo to prepare land for building
- Cost of sites

8.3.2 Cost of Housing Construction

The total cost of housing construction is dependent on several variables, such as building cost and site costs. If the total construction cost has increased considerably over a period, and exceeds the price of existing housing, it puts pressure on the demand for existing housing, supporting higher house prices. Higher total cost of construction may reduce the profit margins for contractors, decreasing their incentive to build more housing, cf. Figure 8.15.

It is important to evaluate whether the house price level follows the long-term cost of acquiring site and constructing new building. If the costs of site and construction correspond to the house price level, it indicates that the house prices are priced correctly and therefore will remain high in the long-term. The prices will however decrease over time if there are bottlenecks holding the supply down. The bottlenecks will eventually catch up and increase the supply (Røgeberg, 2012).

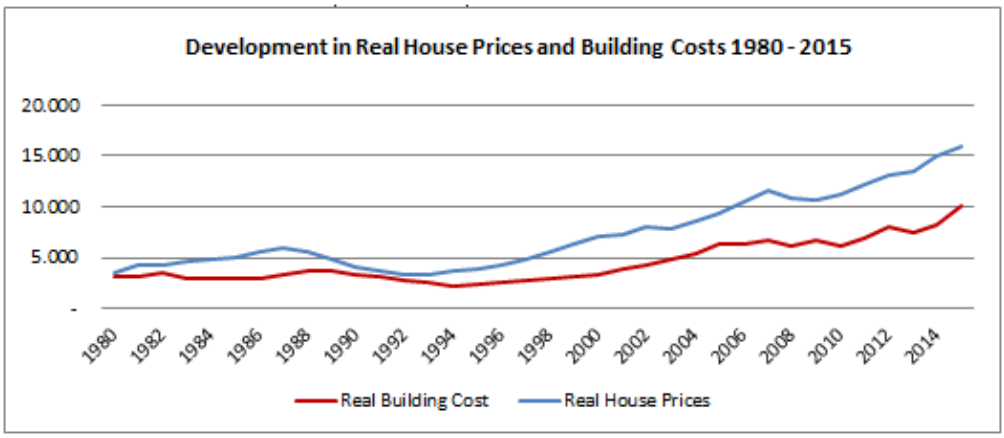
Building Costs

The building cost is often referred to as "normal" when the cost is determined by the underlying fundamental factors and whenever there is sufficient capacity in the industry. The underlying factors are among others the price on labor, materials, the overall productivity in the construction industry, as well as a variety of requirements for the housing. As the construction process is time consuming and often affected by low incentive to build by contractors, this "normal" level is rarely observed in the short-term (NOU, 2002).

NSHB presents a total cost of building nationally and not for the market in Oslo specifically. The building costs consist of cost of labor, material and construction loans. I addition, the suppliers commission often is included in the building cost or in the total cost of construction. As mentioned in section 6.3, Senneset argues that there are minimal differences in building costs (labor and material) in Oslo compared to Norway, while the differences are in the profit margin and site cost. Further, Roger Jensen in SSB supports large regional differences, especially in pressure areas, such as Oslo (Sættem and Reinholdtsen, 2013). In addition, Grytten (2009a) states that it is hard to calculate valid building cost, as both input and quality factors can quickly change. Consequently, most building cost will underestimate the cost associated with the housing construction. On the other side, the cost

development in the long-term is determined by the development in prices of material, labor as well as efficiency. Both productivity improvements and technological progress will contribute to lowering costs, which is not taken into consideration to the full extent in this data (Røgeberg, 2012). It is however believed that the costs will give a decent picture of the price development in the construction industry in the short-term, as long as these limitations are taken into consideration. Figure 8.16 illustrates the development in the real building costs and the real house prices in Oslo from 1980-2015.

Figure 8.16 Development in Real House Prices and Real Building Costs 1980-2015



Source: NCB (2015a), Eiendom Norge (2015a), NSHB (2015), Appendix 20

From the figure we see an increasing trend in both the real house prices and the building costs, but at a different pace. Both the house prices and the cost of building declined after the Banking Crisis in 1988, where the building costs can be observed with some lag. After the TEK 10 regulations were introduced in 2010 we can observe a somewhat steeper growth in the building costs, due to stricter regulations. TEK 10 will be elaborated below. The increased costs have made it more expensive for households to invest in new housing, as the contractors have to increase their prices to maintain the same level of profit margins. However, the increase in building costs and TEK 10 regulations cannot be the only explanation for the increasing house prices, as the real house prices persistently have exceeded the growth in cost of building. This means that it is not necessarily more expensive to invest in new housing compared to existing housing. Conclusively, the increasing cost of building can support the increasing development in housing prices.

Regulations: TEK 10 and TEK 15

TEK 10 is technical regulations introduced in 2010, as an addition to the regulations of 2008 and 1997, in the Norwegian planning- and building act (Plan- og bygningsloven). The regulation applies to all new housing. The regulation has requirements regarding technical necessities, minimum size, a universal design (including handicap adjustments), documents, land utilization, acts of nature, outdoor grounds, and installations (Dibk, 2016). The Norwegian government has notified that from 2015 new energy policies (TEK 15) will be required for new housing, but these are not thoroughly developed and will therefore not be taken into consideration in this analysis (Boligprodusentene, 2015).

Many state that these regulations are increasing the cost of building considerably, especially in the later years. The increasing costs make contractors reluctant to initiate the construction process, whereas the strongest growth in costs has been in Oslo, according to Kvarekvål (Sættem and Reinholdtsen, 2013). The Ministry of Local Government and Modernization (Kommunal- og moderniseringsdepartementet) confirm that the stricter requirements will increase the building cost of new housing. Small housing will have the greatest impact, which can cause the construction of small housing to stagnate, and further increase the pressure on housing in this segment. Existing small housing will likely also experience an increased demand, as there will be few housing in this segment (Garathun, 2015). TEK 10 also affects the number of available sites in Oslo, as there are requirements regarding step-free access, causing some land to be unsuitable. In a market with low supply of sites, this can further increase the prices.

Chief of Analysis in Akershus Eiendom, Ragnar Eggen, states that the site costs is responsible for the main part of the price increase on new housing (DN, 2012). Our next chapter will therefore elaborate different aspects of the cost and availability of new sites for housing.

Available Land for Housing Sites Including Areas Around Oslo

With the municipal borders in the East and West, the sea in the South and the forest boundary (Markaloven) in the North, the development opportunities in Oslo are limited. There are various opinions regarding the availability of sites within and around Oslo. Per Jæger, CEO in Norwegian Home Builders' Association (Boligprodusentenes Forening) expresses concerns regarding the access to sites in Oslo, and believes it will be hard to build enough housing in the future if not more sites are being regulated (Mikalsen, 2015b). Former Prime Minister of Norway, Kåre Willoch, argues that there are more than enough land, if the municipally is willing to open more areas for building houses. As the housing prices are greatly affected by the price of land, more sites will help push the prices down (Lekve, 2013a). The politicians and the regulation authority of Oslo are also

reluctant to accept more than 12 floors in most parts of Oslo, as they do not want the City of Oslo to have a skyline of skyscrapers (Plan- og bygningsetaten, 2015). However, should the proposed expansions be approved, regulations such as Markaloven in Oslo and/or restrictions on building height may have to be breached.

Oslomarka is a nature reserve extending over 19 municipalities in five different counties. It surrounds the capital, and is one of the reasons there are few available sites for new housing in Oslo. Markaloven legislates the boundaries of where building is allowed and therefore protects the area in the long-term (Regjeringen, 2016). As mentioned, there are and have been discussions whether it should be built more on this area to increase the supply and slow down the price growth on housing in Oslo. Over the past decade, people's opinions have shifted in the direction of moving the boundary and build more (Engen and de Rosa, 2012). Former Minister of the Environment, Bård Vegar Solhjell, strongly opposed this solution in 2013, as he believed there was enough room within the city center, and that the areas surrounding Oslo should be kept for hiking and outdoor life. Moreover, Solhjell stated that a more active housing policy from the government should help incentivize contractors to build more on available sites (Lekve, 2013b).

In addition, the process and responsibility of building is threefold. The Norwegian government is first responsible for macroeconomic factors, such as the interest rate, as well as restrictions regarding density of housing and the height. Secondly, the NSHB and Planning and Building Act are in control of regulations, while each municipally is accountable for identifying, regulate and prepare enough sites for building. The regulation authority of Oslo is thus responsible for identifying new sites for housing and to regulate possible sites identified by real estate developers and constructors (Oslo Kommune, 2016b). The regulation authority has over the last years been criticized by real estate developers by not preparing enough sites, which has led to a substantial lack of housing sites ready for building projects (Revfem, 2012; Brun, 2016).

Finally, developers are building. However, the cost of building and site has increased, while at the same time developers will have to compete with prices of existing housing. In addition, many banks demand that at least half of the housing must be sold before starting construction of a housing project. Hence, developers often experience a too high political risk in the municipally before building, making developers reluctant to initiate building (Haakaas, 2012; Hartwig, 2016).

On the other side, the problem is not only grounded in the authorities mentioned above. According to the municipally of Oslo, there is a fully regulated housing reserve of 30,000 housing, not yet utilized, as well as a total of 147,000 regulated and unregulated site reserves meant for housing (OBOS, 2015). Developers also have to take their part of their responsibility, as many tend to postpone initiation to gain on a further expected price increase (Løken, 2012). Developers often do not see the majority of these sites as attractive if public

transportation and infrastructure is not present. This is the case for many of the sites in Oslo, which do not make it profitable to construct new houses in these areas before public transportation is established (Bentzrød, 2014). Nevertheless, these regulated housing are not sufficient to meet the expected increasing demand in Oslo in the future.

It is possible to build in neighboring communities, both to relieve the demand in urban Oslo as well as local demand in the communities. However, these plans are highly dependent on the establishment of public communication in order to lower the travel time and reduce the traffic load in the inner city (Bentzrød, 2014). The development of such public communication is also met by a variety of political opinions. In 1997, a proposal of transportation between Oslo and Fornebu (in Bærum) was given. In 2016, the rails have not yet been started. Moreover, a subway to Ahus (in Lørenskog) was planned, but is now behind schedule (Martinsen, 2013). The transportation between Oslo and Fornebu is expected to start in 2018 but a completion of other projects is likely not reality in the near future (Røed, 2015; Svenningsen, 2015).

Cost of Sites

There exists no official statistics of the price development of sites in Norway or Oslo. In order to obtain data on the site costs in Oslo, we have been in contact with the CEO of Hadrian, Øyvind Solbakken, and the Chief of Analysis, Ragnar Eggen, in Akershus Eiendom. Both are real estate broker companies who are leading in transactions of land sites for commercial development of housing in and around Oslo the last twenty years. Both company's line of business has been to sell large land areas for housing from existing owners to developers[12].

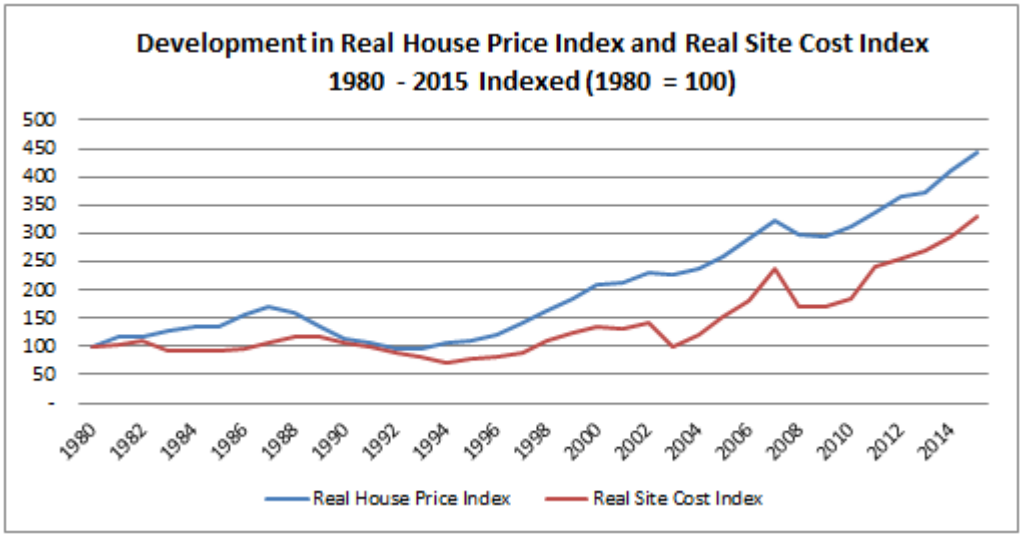
We have received data on nominal site costs from Hadrian and Akershus from 1997-2015. The data will be applied in a graph only, as we have not been given the right to publish the raw data material. Some years are only based on a few observations, which may weaken the reliability of the data. In addition, in order to be able to evaluate the development in site costs for the entire period, we have made some further assumptions from 1980 – 1996. Based on the site costs from Hadrian and Akershus, we have calculated the average fraction of site cost relative to the building costs between 1997 and 2015. A proxy for the site cost from 1980-1996 is therefore made based on these numbers (Appendix 20).

However, as long as these limitations are taken into consideration, the data is believed to provide a decent picture of the development in the cost of sites in Oslo. The development in real site cost index compared to the

[12] See Hadrian Eiendom AS (www.hadrian.no) and Akershus Eiendom AS (www.akershuseiendom.no) for further information.

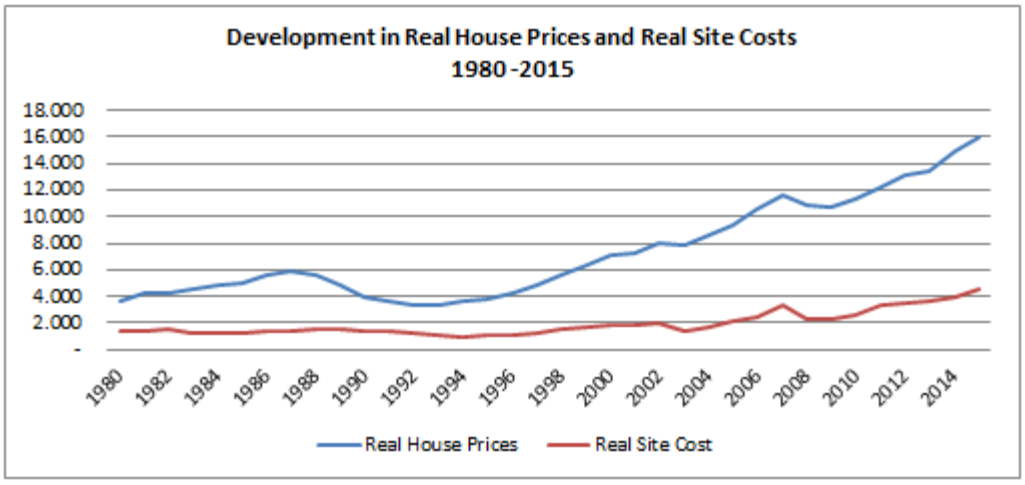
real house price index for Oslo is provided in Figure 8.17, as well as a presentation of the actual values in real terms (based in 1980) (Figure 8.18).

Figure 8.17 Development in Real House Price Index and Real Site Cost Index 1980-2015



Source: Akershus (2016), Hadrian (2016), NCB (2015a), Eiendom Norge (2015a), Appendix 20

Figure 8.18 Development in Real House Prices and Real Site Cost 1980-2015



Source: Akershus (2016), Hadrian (2016), NCB (2015a), Eiendom Norge (2015a), Appendix 20

The graph (8.17) clearly illustrates that there has been an increasing trend in the cost of sites in Oslo over the time period, especially the last decade. We observe a drop in the site costs after the Financial Crisis in 2008, in

addition to a small decline in 2002/03. The drop in 2002/03 was caused by a very low activity in the site market (Hadrian, 2016). We see that the site cost explains an increasingly part of the development in house prices.

The increasing site cost is likely due to a scarcity of regulated land in Oslo, which causes the cost of sites to rise considerably. It is reasonable to assume that the number of sites is constant and that the demand for sites is affected by the same variables as the house prices. Accordingly, increase in house prices will affect both new and existing housing. Existing housing are located on much desired land, and will therefore experience a price increase when the demand for sites increases.

Summarized, we can see from the analysis of the housing supply in Oslo, that there is clearly a lack of supply, especially in the later years. Figure 8.14 displays the great deviation between supply and demand of housing. The large gap both historically and in the future has put an extreme pressure on the market for both new and existing housing, causing fierce competition among buyers in Oslo and resulting in an overall high house price level. Further, the analysis reveals a steady increase in building and site cost over the time period, among others caused by more laws and regulations concerning housing. The site cost in Oslo is at high levels due to scarcity of available land. The lack of incentive for contractors to build more further enhances the problem.

As described, the availability of land is affected by many political decisions, from public communication, willingness to expand beyond the boundaries of forest ("Markagrensa"), as well as the height of buildings and density of properties. The varieties of restrictions cause the lack of supply to be seen as somewhat self-inflicted. In conclusion, the total construction cost of new housing has been below the current market price of existing housing. These results are consistent with the findings in the analysis of Tobins Q. Accordingly; the growth in house prices is thus to a large degree reflected by the fundamental conditions in the construction market, supporting the house price development in Oslo.

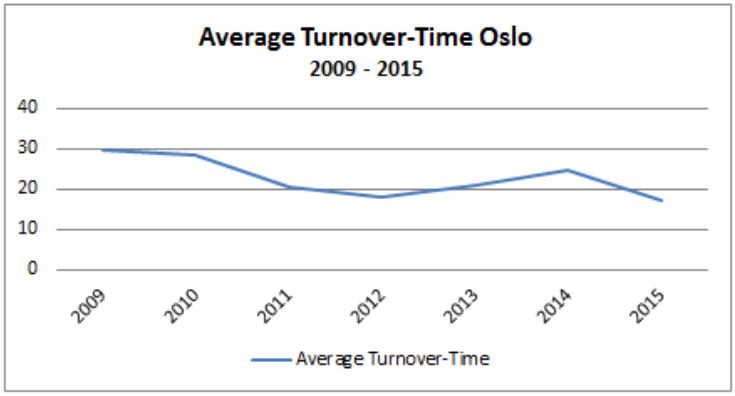
8.3.3 Turnover-Time

The turnover-time of housing provides information about the activity level in the housing market and is therefore widely used by economic experts and realtors. The indicator of activity level is defined as the time from the property is announced on Norway's biggest online marketplace, Finn.no, until it is registered as sold (Parr, 2014). A low turnover-time indicates that there is a high activity level in the housing market as the published houses are sold fast. A trend of low and decreasing turnover-time can contribute to push house prices up as it indicates a high competition for the available properties and vice versa. As comprehensive data for turnover-time for Oslo is not publically available for the entire time period, only an assessment of the recent years will be conducted.

After the Financial Crisis in 2008 the turnover-time in Norway went from 39 days in 2008 to 43 days in 2009, while Oslo had 29 days in 2008 and 28 days in 2009 (Eiendomsmegler1, 2009). The increased turnover-time nationally was probably caused by reluctance among households to invest in and change housing when the economy was perceived as unstable after the Financial Crisis. These numbers indicates that Norway as a whole reacted more to the Financial Crisis than Oslo. It seems like the lack of supply of housing in Oslo to a degree can explain why the Financial Crisis did not hit as hard. Also, the high urbanization and immigration further emphasizes the lack of supply. There seems to be a reduction in turnover-time in Oslo after 2009, probably due to the low interest rate, higher disposable income and optimism in the housing market, in addition to the lack of housing (Eiendomsmegler1, 2009; Eiendomsmegler1, 2014; EFF, 2010).

As seen in Figure 8.19 below, from January 2009 until January 2015, the turnover-time in Oslo has declined by approximately 24 days, which indicates a high activity in the market and increasing demand for housing (Dalseg, 2012; Eiendom Norge, 2015b). The deviation between turnover-time in Oslo and nationally can indicate that there is a higher activity level and pressure on the housing demand in Oslo than in the rest of the country.

Figure 8.19 Average Turnover-time for Oslo 2009-2015



Source: Eiendom Norge (2015b), Eiendomsmegler1 (2009), Eiendomsmegler1 (2014), EFF (2010), Appendix 21

Conclusively, the low and decreasing turnover-time in Oslo show that there is an increased demand and competition between the buyers in the housing market. However, there can be several reasons to a low turnover-rate; among these is a low supply, high demand or a combination of these. It is hard to distinguish which has the greatest impact. As mentioned, the lack of supply in Oslo seems to play an eminent role in the low turnover-time.

Data criticism

The turnover-rate published by finn.no only shows the turnover-time for houses that are actually sold, and does not take unsold housing into account. Also, since the time is measured from the last time the housing ad is published, it does not take into account housing published for the second time. When publishing an ad for the second time it is often placed higher on the list, increasing the attention to the ad. A consequence of these factors is that the turnover-time might show values that are somewhat above their actual value. Still, we believe that the numbers provide a good picture of the situation in the housing market in Oslo.

8.4 Concluding Remarks on Fundamental Factors

The analysis conducted of the fundamental factors has illustrated the main characteristics of the housing market in Oslo. The Norwegian economy has had a great growth the past decades, much due to the income from the petroleum sector. The growth in GDP has increased the overall price-level in the market, which likely has been transferred to the housing market. The consistent growth in disposable income and the low unemployment rate is also greatly connected with the economic cycles, and has enabled people to invest in more expensive housing over the time period. However, we observe that these factors are not able to explain the price increase alone, as the house prices have increased more than each of these factors.

The level of interest rate in Norway, especially in the later years, strongly supports the growth in house prices. The interest rate is one of the most important factors when assessing the development in the housing market, as well as in the evaluation of the credit market and the household's ability to service debt. The credit market has increased considerably the last two decades, and illustrates that households borrow more than ever to invest in more expensive housing. In 2015, the DTI-ratio is above 200 percent, meaning that the growth in debt has exceeded the growth in disposable income considerably. The low interest rate enables more households to service debt with a given disposable income. However, as the debt-burden is high, a greater part of the income is used on housing, making an increase in interest rate affect many households. On the other side, household's margins and financial buffers are better than before the Banking Crisis in the late 1980's, making them more able to service an increased interest rate.

As banks regulate the credit supply and to some extent the lending rate, their role is important for the development in house prices. Stricter rules for lending and equity requirements of 15 percent have been implemented in order to reduce household's risk of default on their loans. The rules are however relatively easy to go around, as parents (or others) can act as collateral/guarantor. In addition, new capital requirements for

banks force them to increase the margin on the lending rate, which in turn increase the rate to some degree. Hence, the current lending policies do not seem to affect the housing market to the desired extent.

The taxation of property incentivizes owning housing rather than investing in other financial assets. This stimulates people to invest in both primary and secondary housing. Consequently, the demand for housing increases, and thus supports the growth in house prices. In addition, urbanization, immigration and an increasing number of small households have increased the population growth, especially since 2004, and have put further pressure on the demand for housing.

The lack of supply of housing seems to be the most prevalent reason for the price increase in the housing market in Oslo. The gap between new households and completed dwellings states that the demand of housing exceeds the supply considerably. The scarcity of available and regulated land has contributed to the rise in site costs, which makes contractors reluctant to initiate building, supporting the house price development in Oslo. Political restrictions (height and density of housing, Markaloven), the time-consuming process and regulations (TEK 10) hold the supply of housing down. Further, the high activity in the market indicates a heated and competitive market, pressuring prices above the assessed value in the market.

The section has analyzed factors believed to affect the development of the housing market in Oslo. The majority of the fundamental factors support the high price growth, while some factors points towards bubble tendencies. However, the factors pointing towards a bubble are often countered by characteristics of the market in Norway/Oslo, such as increased financial buffers to meet an increase in the interest rate. The general findings in this analysis does not indicate bubble tendencies, as the price growth in grounded in fundamental factors, and not solely on expectations of future price growth.

9 Psychological Factors Affecting the Housing Market

9.1 Expectations of Households

Shiller has emphasized that the expectations people hold for future variables are fundamental to their behavior (Shiller, 1990). The development in house prices is often believed to be a result of fundamental factors such as disposable income, interest rates, population and the relationship between supply and demand. However, as the housing market is a long-term market, expectations can be essential for the development in demand and supply, and following the prices, and are therefore important to take into account. Jacobsen and Naug's house price model has included expectations as a separate explanatory variable, supporting that this element should be considered (Jacobsen and Naug, 2004). The focus will be on expectations of households on the demand side of

the market. An analysis of the development of expectations and how it affects the household's perception of future house prices will therefore be conducted.

9.1.1 The Formation of Expectations

The source of expectations is hard to determine as actors in the market are not rational human beings. Rationality implies that all available information and data is utilized when acting in the housing market (Herbert, 1955). The development of the economy is complex and uncertain, which makes expectations rely on a subjective assessment. Most households do not have the necessary knowledge to acquire and process all information, and their expectations are therefore based upon some chosen factors. In addition, many are not able to emphasize what the most important fundamental factors are, or how they are affecting the overall economy. Therefore, it is believed that influence from private conversations and the mass media are contributing to form expectations on future development in the housing market. Mass media often amplify an opinion, affecting households to focus their attention the same place. At the same time, the headlines often change, consequently "confusing" the readers (Koren, 2008). Media's attention towards the housing market in Oslo is elaborated in chapter 9.2.

Shiller (2005) emphasize that communication between people have the greatest influence; *"(...) people who communicate regularly with one another think similarly".* Thus, interactive communication tends to create group thinking, often causing irrational expectations among households. In addition, Case and Shiller point out that households often base their expectations on past development in prices and expectations, called adaptive expectations (Case and Shiller, 1988). This means that a price increase in the previous period would cause expectations of future price growth. The reason for this is believed to be that people are influenced by easily available and observable data, in addition to lack of knowledge of the house market mechanisms. Households buying housing for own use can often make irrational decisions as emotions come into play, making the willingness to pay higher. Also, in a market with high activity, people tend to become more desperate, causing them to make bids far above what the housing is really worth. When this happens, the prices are brought up to a new level, where this level is the starting point for later valuation of the property (or properties in the area) (Wærstad, 2015).

Conclusively, as households do not act rationally, the housing market can be hard to predict for analysts. Psychological factors, the expectations of households, can therefore be said to be important in addition to fundamental factors when determining the house price development.

9.1.2 Measurement of Expectations

There are several ways to measure household's expectations. Here, the survey from Prognosesenteret on behalf of EiendomsMegler1 and the Consumer Confidence Index (CCI) conducted by TNS Gallup in conjunction with

FNO (Finans Norge) will be presented. The first survey assess people's expectations regarding the future development in house prices and their purchasing patterns, while the latter mostly focus on the economic situation for the country. The survey conducted by Prognosesenteret is performed quarterly and presents people's expectations for the next twelve months (Prognosesenteret, 2016). This survey presents some statistics for Oslo alone, while TNS Gallup presents results from Norway as a whole. Even though both surveys only ask between 1,000-2,000 people around the country, the results give a fair and good indication of people's expectations (Trading Economics, 2016).

The average quarterly results from Prognosesenteret's analysis in 2015, showed an indication that households are relatively pessimistic of the development in the Norwegian economy the next twelve months (Prognosesenteret, 2016). Approximately 37 percent of households in Norway expect the economy to be worse, compared to 31 percent in Oslo. The answers concerning their personal economy are however at lower levels, where 10 percent in Norway and 11 percent in Oslo believe their economy will be worse. On a general basis, most households in Oslo and Norway expect a rather stable development in their own economy, with 59 and 64 percent, respectively. Nevertheless, households in Oslo are more optimistic in both measures compared to the national average (Appendix 22).

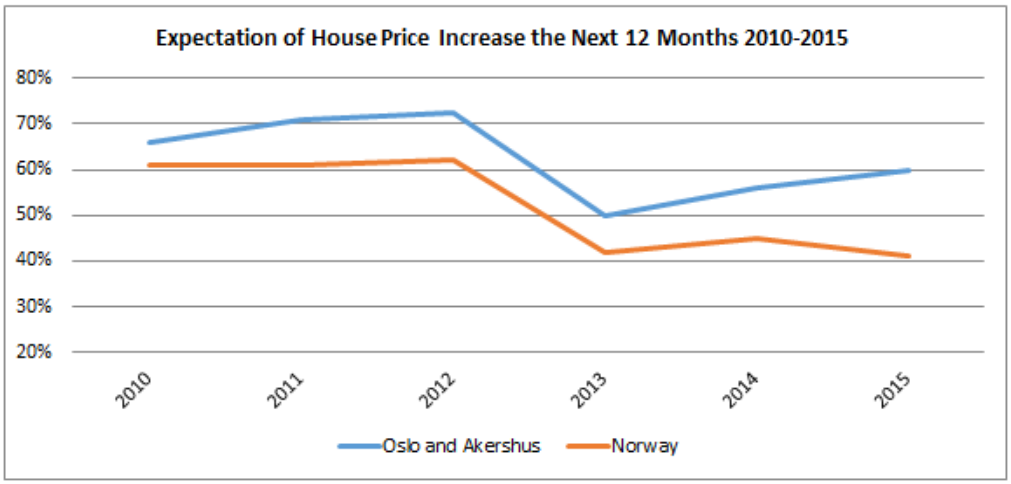
Nationally, in 2015, 41 percent of households expect increasing housing prices where they live the next twelve months, while 16 percent believe they will be lower. There are however large regional differences, whereas 60 percent of the households in Oslo expect a growth in house prices, and only 10 percent expect the house prices to fall (Table 9.1). This deviation shows that the expectation element can have a great impact on the house price development in Oslo. In Figure 9.1, expectations of a house price increase in Norway and Oslo (including Akershus) are presented from 2010 – 2015.

Table 9.1 Expectations House Prices Next 12 Months

OSLO		NORWAY	
	Avg 2015		Avg 2015
Higher	60%	Higher	41%
Lower	10%	Lower	16%
Unchanged	27%	Unchanged	41%
Don't know	3%	Don't know	11%

Source: Prognosesenteret (2016)

Figure 9.1 Expectation of House Price Increase the Next 12 Months 2010-2015

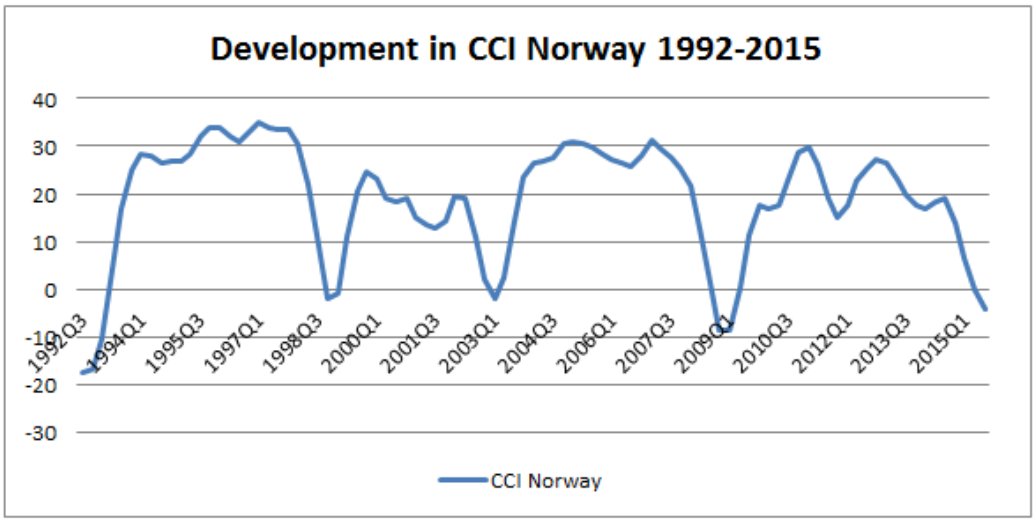


Source: Prognosesenteret (2016), Appendix 22

The measures follow each other closely, with consistently higher expectations in Oslo. The decline in expectations between 2012 and 2013 is likely because several experts promoted a fall in housing prices (Sandø, 2013). In 2014 the deviation increased further, as Norwegian households lowered their expectations, while Oslo citizens expressed an even greater belief of growth in house prices in Oslo. The high expectations from Oslo inhabitants can further reinforce the growth of house prices in Oslo, which in turn can create house prices that deviates from fundamental values. The expectations of a price increase over longer periods of time can contribute to a bubble. As high expectations of price growth have been present in Oslo the last 5 years, the expectations of future growth might have contributed to the price increase in Oslo to some degree.

The internationally applied indicator, CCI, measures the consumer confidence regarding the future economic situation in an analyzed country. The research has five questions, where the indicator is weighted on the basis of the questions and whether there are optimistic or pessimistic responses. The idea is grounded on that future demand is a result of household's expectations of personal and national economy. The questions are thus regarding the future expectations of their own economy, the national economy and whether it is a good time to purchase major households items, such as housing. The indicator further distinguishes between age, gender and wages etc. Generally, consumer confidence is high when the unemployment rate is low and GDP growth is high. TNS Gallup states that the trend indicator has proven to be good at forecasting cyclical fluctuations in the Norwegian economy (Trading Economics, 2015). The quarterly data between 1992 and 2015 from TNS Gallup is presented in Figure 9.2.

Figure 9.2 Development in CCI for Norway 1992-2015



Source: FNO (2015a), Appendix 23

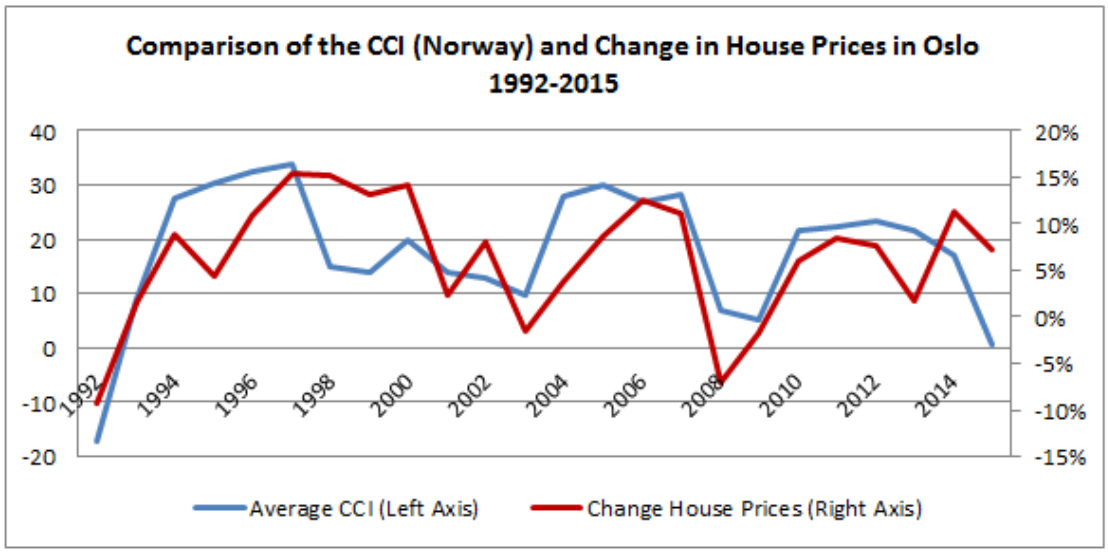
Figure 9.2 clearly shows cyclical fluctuations in people's expectations regarding own and national economy. We observe five significant drops over the time period. The households view on the economy started to increase from the beginning of 1993, likely due to the recession ending in 1992. In 1998, we experienced a fall in the oil price and increasing unemployment, causing NCB to increase the key rate from August to September (FNO, 2015b). These changes probably made people more uncertain about the future development, triggering the indicator to drop. Further, the drop in early 2000s is believed to be because of several factors, such as an increasing interest rate and repercussions from the burst of the dot-com bubble around 2000. From 2003 towards the Financial Crisis in 2007, we see consistent high expectations. The negative effects of the Financial Crisis can explain the following drop. In 2015, we observe a clear negative trend in people's expectations, likely due to the dramatic fall in oil-prices in Norway. Many newspapers post news concerning resignation of employees, especially in Rogaland and other oil-related counties, where this will likely have a great impact on the confidence of the inhabitants in these cities. Here, the regional differences mentioned in Prognosesenterets analysis are important for the evaluation of Oslo, whereas inhabitants in Oslo tended to have more positive expectations.

9.1.3 Relationship Between House Price Development and CCI

A comparison of the development in CCI and change in house prices in Oslo will be investigated, in order to see how closely the two measures follow each other. The analysis will have some limitations as the CCI is an average of the quarterly numbers as well as they are based on national numbers, while the house prices are yearly for Oslo. As expectations in Oslo seemed to be higher than that of the national level (according to

Prognosesenteret), the CCI is likely underestimated compared to the change in house prices. Figure 9.3 illustrates the annual CCI on the left axis and the annual growth in house prices on the right axis.

Figure 9.3 Comparison of the CCI and the Change in Real House Prices in Oslo 1992 – 2015



Source: FNO (2015a), NCB (2015a), Eiendom Norge (2015a), Appendix 23

Based on the figure, we observe a strong positive correlation between the two factors, except a few deviations. The first is evident in 1997/1998 where expectations are declining rather rapidly, whereas house prices are quite stable. However, a small drop in house prices in 1999 is observed, which could be a consequence of the low expectations the years before, probably due to increased interest rates. After 2013, the CCI and actual house prices moved in opposite directions. Experts promoted a fall in the housing prices, highlighted by the media (as shown in Figure 9.5 and 9.6), likely affecting the expectations of households (Sandø, 2013). As the prices continued to increase in Oslo, this can signal that the fundamental factors in Oslo are of greater importance than the expectations. However, a CCI-measure of Oslo would, in compliance with earlier discussion, probably be more optimistic. The fundamental factors in Oslo, characterized with a high demand and low supply, imply that the prices should be at a high level, and not impacted by the pessimistic expectations of the future. In 2015, we see that the house price growth is declining, but not as much as the CCI-measure should indicate. These results indicate that the regional differences in the analysis done by Prognosesenteret are evident. The positive expectations of future price growth in Oslo are likely contributing to the increase in house prices in Oslo and support the argument that expectations among households are reflected in the house prices.

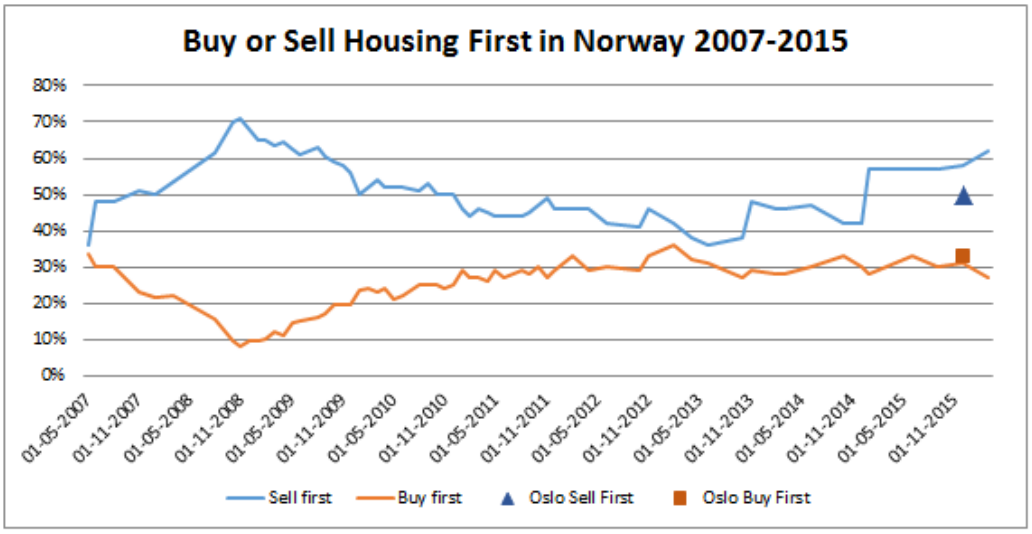
9.1.4 Households Purchasing Patterns

The expectations in the market can also be observed based on the purchasing patterns of households when investing in housing. This process is called sequencing; whereas the sequencing effect arises as housing owners are buyers and sellers in the same market (Røed Larsen, 2016).

The purchasing pattern has to do with uncertainty in the market (Dreyer, 2016). When the housing market is characterized with low activity, most households sell before they buy, as they do not want to risk having a market exposure of two houses. Thus, if the market is regarded as more uncertain, more households will sell first, either as a result of their own initiative or by advice from their bank. During periods with high activity, the risk of unsold housing is much lower, causing many to buy first (Mikalsen, 2016b). They are afraid that there is not enough housing available or that they cannot afford what is available (Røed Larsen, 2016). Consequently, a vacuum is created, whereas the more people waiting, the more prices will be further pushed up (Parr, 2016). This effect can be observed looking at the difference in purchasing pattern and turnover time in Oslo compared to Stavanger. In Stavanger, there is a tendency to sell first as there are much housing available, while in Oslo where the housing supply is low, it is normal to buy first. This is also reflected in the turnover-time of 73 days in Stavanger and 15 days in Oslo (in March 2016), which also indicates a much higher activity level in Oslo compared to Stavanger (Røed Larsen, 2016).

The analysis conducted by Prognosesenteret (2016), also present the purchasing patterns of Norwegian households (Figure 9.4). The graph illustrates the share of households wanting to buy new housing before selling, and the opposite. These data are only available between 2007 and 2015/16, but clearly show how the market is influenced by the activity in the housing market and the overall economy. Between 2007 and 2008, the market is, based on this graph, characterized by uncertainty, whereas most want to sell their housing before buying new. After the Financial Crisis in 2008, the percentage of persons wanting to sell their housing first decreased rapidly, while the opposite happened for the "buy-first" part of the households. The trend was however changing direction in the middle of 2013, with an increasing share of households wanting to sell first.

Figure 9.4 Purchasing Pattern – Buy or Sell First Norway 2007-2015



Source: Prognosesenteret (2016), Appendix 24

At the end of 2015, 31 percent of Norwegian households wanted to buy first, while 58 percent wished to sell first. These results imply that many households believe the market activity is low and therefore want to sell first, which is consistent with the negative expectation towards the development of the Norwegian economy. The results are somewhat different for Oslo, whereas 33 percent want to buy first and 50 percent want to sell first, as showed in the graph. This shows that households in Oslo seem more optimistic about the activity and certainty in the market, compared to Norway as a whole. However, the share of people responding, "Don't know" is greater in Oslo than nationally, with 17 and 11 percent, respectively.

Conclusively, the purchasing pattern, activity level and expectations of future house prices in Oslo supports that prices are pressured up to higher levels, indicating that expectations can impact the house price development. On the other hand, we see that both the CCI indicator for Norway for 2015 is lower and that almost twice as many want to sell before they buy in Oslo, which reflects more uncertainty at the end of 2015 than earlier years.

9.2 Case and Shiller's Criteria's for a Housing Bubble

The seven criteria's for the presence of a housing bubble by Case and Shiller was presented in section 3.2. Case and Shiller have predicted a housing bubble since 2012, although for Norway, not Oslo specifically (Mohsin, 2015). In this section we therefore seek to examine the housing market in Oslo using the same criteria's as Case and Shiller and determine whether the same conclusion is reached.

1. Widespread Expectations of an Increase in House Prices

Larsen (2005) states that the expectations of a house price escalation can in itself drive the house prices upwards. As expectations among households are a psychological factor, it can be hard to determine whether there are expectations of price increases in the housing market or not. However, ways to measure expectations are widely explored in section 9.1. The conclusion from the analysis is that those expectations are present in Oslo. Hence, we evaluate this criterion to be fulfilled for the housing market in Oslo.

2. Increase in House Prices Deviates From the Increase in Disposable Income

The relationship between real house prices and real disposable income is discussed in chapter 8.1.2. The discussion of income and house prices concludes that there is a great deviation between the factors, especially after 2005. This criterion can therefore be seen as fulfilled.

3. Great Interest and Attention to the Housing Market in Both the Media and in Private

The media focus on the historically high house prices in the Oslo market has received substantial coverage the recent years. Databases such as Retriever Research and InterMedium collect statistics on the media's attention around certain topics. Using data from the media archive Retriever Research[13], illustrated in Figure 9.5, the appearance of the word "Boligpris" (housing price) in relation to Oslo, in printed newspapers from 2000 until 2015 is analyzed (Retriever Research, 2016). The numbers show an increasing trend over the last 15 years, however with some fluctuations. Much of the increase in articles came after 2007, which can be explained by an increased interest for (macro) economy and the development in housing prices after the Financial Crisis. The great amount of media-attention in 2012/2013 was likely due to the statement from experts that house prices were to fall (Sandø, 2013). In 2015 alone the term generated almost 1,300 printed articles, reflecting the great focus on the historically high house prices.

Figure 9.6 Media-Attention Based on Results from Retriever Research

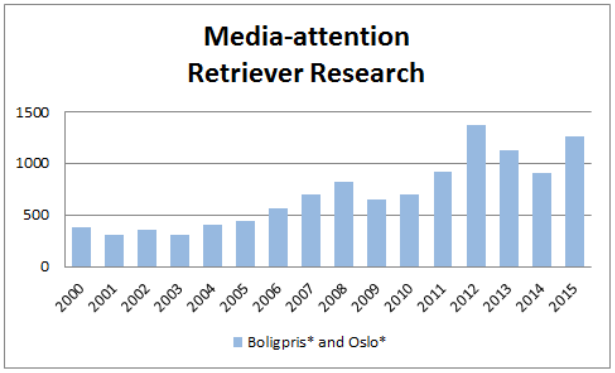
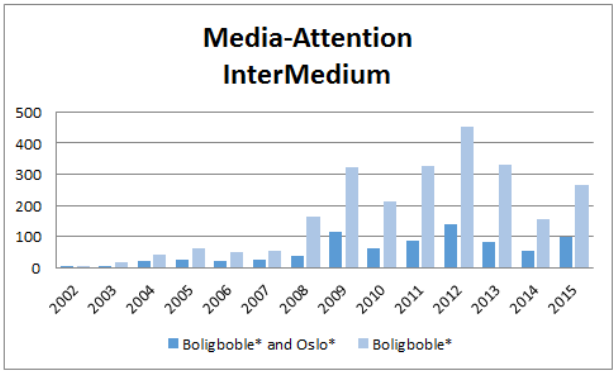


Figure 9.5 Media-Attention Based on Results from InterMedium



Results from InterMedium (Figure 9.6) also show an increase in articles about "boligboble* Oslo*" (housing bubble), however, the search for housing bubble isolated generates far more hits. The results from InterMedium are both printed and online articles, whereas the numbers from early 2000s are based on another source basis and might not be as valid (InterMedium, 2016). It is a clear increase in articles in 2008 and onwards, with the same movements as with Retriever Research. The increased attention and articles about housing bubbles can also be attributed to globalization and increased use of the Internet.

As seen by the data analysis, there is a lot of attention around the topic. The media often shows very different pictures of the same situation, often within short periods of time. An example of this is the two headlines (Figure 9.7 and 9.8) posted from the same newspaper (Dagens Næringsliv) in the end of November 2015, with 1 day in between. As people without economic background may not fully understand the mechanisms of the housing market and thus rely on information from the media, such shifts can cause confusion.

Figure 9.7 "- We Should Not Underestimate the Risks of a Housing Bubble"

Source: DN, 25.11.2015 (Halvorsen, 2015)

Figure 9.8 "- No Reason to Fear a Housing Bubble"

Source: DN, 26.11,2015 (Mikalsen, 2015c)

The attention and interest about the housing market among private households can be difficult to measure. However, it can be reasonable to assume that the media uses resources on topics that are of general interest. As people often discuss topics presented in the media, we believe that this is a highly discussed topic in private conversations as well. Conclusively, it seems as this criteria also is fulfilled.

4. A General Understanding that it is Profitable to Invest in Housing

The expectations of capital gains among homebuyers are closely related to the expectations of increased house prices. Røed Larsen (2005) states that a house has two types of return; rent income and possible capital gain when selling the housing. The first can be continuously estimated, while the latter will be visible only after a sale. This makes the housing market a complex market, as housing is both a consumer good and an investment object. It can be challenging to determine whether the motive for buying housing is for investment purposes or as a consumer need. However, looking at the development of secondary housing can give some indication as to what the motive is.

Figures from the Tax Authority show that in 2013 there were almost 292,000 secondary housing registered in Norway (Sparre, 2013). It is further stated that the main part of the secondary housing is in the bigger cities. According to the Tax Authority, 20 percent of all housing in Oslo is secondary housing, and in some of the most pressured areas it is 30 percent (Dalen, 2015b). NEF argues that the large amount of secondary housing is an important reason for the price development in Oslo. Further, the Chief Executive Officer of NEF states that the numbers shows that it is attractive to buy second and even third housing in Oslo, creating an artificial price pressure (Dalen, 2015b).

Further, it is reasonable to assume that many buy housing in order to achieve capital gains when selling. This assumption can be supported by chief economist Roger Bjørnstad who states *"people believe that housing is a good investment object, which further increases the house prices"*. With the current taxation rules (ref. ch. 8.2.3) it is more profitable to invest in housing, both primary and secondary, rather than other financial assets (Oseid and Tollersrud, 2015). There is however no statistics on whether secondary housing is rented out or if they are empty when the owner is not living there. DNB Eiendom conducted in 2013 a survey regarding buyer's motive for buying a secondary housing. The survey showed that 40 percent wanted to use the housing themselves, 27 percent wished to rent it out, while 24 percent said that the motive was to secure an entry in the housing market for their children (Sparre, 2013). The survey is compiled on households in Norway, and not Oslo specifically, however we believe them to show a certain understanding of the motive of buying secondary housing. Based on the above, it seems reasonable to assume that the criterion of people believing that owning housing is profitable is fulfilled.

5. Limited Understanding of the Risks Associated with the Investment

Many Norwegian households have the perception that owning housing is a safe investment with low risk associated with it (Drogseth, 2015). People assume that prices will not fall because it always has increased,

showing a limited understanding of risk. Case and Shiller (1988) named this adaptive expectation. As discussed in chapter 9.1, 60 percent of households in Oslo expect a house price increase in 2015. Further, a survey from GARANTI Eiendom shows that it is among those under the age of 30 that have the highest expectations of an increase (Drogseth, 2015). Historically, the house prices have however had both up- and downturns, supporting the fact that housing is not always a safe investment.

Moreover, the interest rate has been low for a long time, now being at an all-time low, which should suggest that households would pay higher installments than they can afford when the interest payment is higher. However, as illustrated in Figure 8.12 and 8.13, most people have chosen to increase their debt, as the low rate makes it possible to handle a higher amount of debt. This indicates a simplified perception of risk, and many households can be in trouble should the rates increase. Many might have the perception that the low rates and advantageous tax system (ref. chapter 8.1.4 and 8.2.3, respectively) will continue in the long-term. The CEO of NEF, Carl O. Geving, believes that the media have to some extent created an expectation that the low interest rates will last forever, setting the foundation for a quite risky bet (Parr, 2015). This might have led to people's misapprehension about risks related to housing investment. Based on the above discussion, this criterion seems to be fulfilled.

6. Simplified Perceptions Regarding the Mechanisms of the Housing Market

This criterion is closely related to the criteria on risk related to housing investment. As mentioned above, many households increase their borrowings when the interest rate is low. From an economic point of view this is an irrational behavior as installments should be paid when the rate is low. The day the rates increases, many people will likely have trouble fulfilling their loans. NEF believes an unnecessary vertical drop is created by giving interest-only loans to buyers who already have high debt burdens (Parr, 2015).

As discussed in chapter 9.1.1 people are influenced by the information that is easily observable and available. Statements and newspaper articles about the housing market often illustrate a simplified picture of the economic situation. Statements such as "the most attractive housing will have the highest growth in value" show lack of insight in the area. That a house is expensive does not necessarily mean that the housing will have a higher growth than other less-expensive housing. Based on the above, we believe that this criterion is fulfilled.

7. Widespread Expectations That One Should Buy a House

Whether there is a pressure to become a homeowner is difficult to measure. According to Henning Spets in EiendomsMegler 1, renting is like throwing money out of the window. Spets further states that when renting

prices are as high as they are, buying an apartment and renting out a room is a much better solution than to rent a room (Minsaas, 2014). As mentioned, 84 percent of households in Norway own housing, further underlining the expectation that one should buy a house. Factors such as tax advantages, low lending rates and a pressured renting-market further emphasizes the benefits of investing, which might put more pressure on house-buyers.

Moreover, first-time buyers and others wanting to invest in the housing market might fear that the increasing house prices will make it even more difficult to enter the market at a later stage. This statement is supported by Case and Shiller (1988) who state that there often is a fear of being priced out of an escalating market. This criteria is somewhat difficult to measure, hence whether the criteria is fulfilled cannot be stated with full certainty.

Conclusion

In accordance with Case and Shiller's evaluation of the housing market in Norway, our analysis of the housing market in Oslo also mainly points to the presence of a housing bubble. The expectations of a price increase seem to be high, combined with a limited understanding of risk and market mechanisms. Case and Schiller's framework is basically grounded on psychological factors, without having much attention to fundamental factors that are important drivers of the price in the housing market. Although people's expectations to a certain degree are based on fundamental factors presented to them in the media, the information conveyed is from many sources and can be contradictory.

The prediction of a housing bubble by Case and Shiller since 2012 was also seen in relation to the fundamental and real P/R-ratio in chapter 6.2. The results from this analysis partly support Case and Shiller, as the real P/R-ratio was below the fundamental ratio in some periods in the time interval discussed. At the same time, the fundamental factors evaluated in the fundamental P/R-ratio supports the growth more the later years. Thus, the psychological factors presented by Case and Shiller do not seem to be able to explain the growth in prices alone.

Although the analysis of Case and Shiller's criteria's points to tendencies of a bubble, the analyzed fundamental factors discussed in chapter 8 supports the house prices in Oslo to a large degree, thus contradicting the results from the analysis of psychological factors. After an analysis of both fundamental and psychological factors we believe that the substantial price increase in Oslo is mainly based on fundamental factors. However, many fundamental factors can include an element of expectation, making expectations a part of the house price development. Further, even though expectations can increase or reduce house prices to some degree, it cannot explain the large price increase alone. As a bubble is defined to be present if price growth is founded on

expectations only, a bubble does not seem present in the housing market in Oslo (Stiglitz, 1990). Apart from disposable income, Case and Shiller's criteria's does not take fundamental factors into account, which is probably why the analysis concludes with bubble tendencies in the housing market in Norway and Oslo. Especially local factors, such as supply of housing compared to demand, is essential when analyzing the housing market in Oslo, and would possibly change the conclusion of Case and Shiller's framework, had it been included.

However, as there is a lack of data on people's expectations, several of the measures used are based on numbers from Norway as a whole and some conclusions are based on subjective assessments, it cannot be stated with full certainty that a housing bubble is present in Oslo.

10. Applying the Data into the "X-Factor"

10.1 Local, National and International Factors in the Housing Market in Oslo

As mentioned in chapter 7, the fundamental factors will be divided into local, national and international factors, classified on the size of the change from year to year, and then weighted based on the degree of importance for the house prices in Oslo.

As local factors we have chosen unemployment rate, population growth and replacement cost, while the national factors consist of GDP growth and disposable income. The interest rate is described, however not included in our model as it is already included in the original fundamental P/R-ratio. The price of oil/petroleum sector was considered as an international factor, but as the oil industry is such a big part of the Norwegian GDP, it will be included as a supporting factor for the GDP instead (NCB, 2015c).

As mentioned, the intervals in the classifications are made using histograms based on the percentage change of the factor during the analyzed time period. The histograms can be seen in Appendix 25. The argumentation for our choice and weight for each fundamental factor in the time period will follow.

Unemployment Rate

Several researchers have viewed the unemployment rate as an essential factor when determining the development in house prices, which we, based on our analysis, support. From chapter 8.1.3 we observe that the unemployment level is quite low and stable during the time period and follows the movements in the housing market quite closely (i.e. opposite direction). However, as a change in unemployment also often affects household's expectation of their future ability to service debt, it will affect our evaluation of the weight. We aim

to only include the measurable part of the fundamental factors, and therefore reduce the weight of the unemployment rate as a result. We have therefore chosen a weight of 1.5 for the entire period 1980-2015.

Population Growth

The development in population growth has put a great pressure on the demand for housing in Oslo. The population growth has been especially prevalent after 2004, and we therefore have given population growth a weight of 2.5 from 2005 – 2015. The years between 1980 and 2004 are given the weight 2, as the population growth was slow and steady, and not considered to be as important for the house price development. From 2004 and onwards, the combination of urbanization and an increasing share of immigrants have contributed to the population growth.

Replacement Cost

The replacement costs consist of building costs (material and labor) and the site cost. Our analysis shows that the replacement costs have followed the house prices closely through the entire period, meaning they are essential for the development of the house market. The replacement cost will to a large degree regulate how much new housing that will be brought into the market. A high replacement cost will put pressure on the developer's margin which in turn will influence their willingness to invest in new dwellings. This clearly indicates that the replacement cost should have a weight of 3. Also, the great deviation between supply and demand caused by the combination of increased population and many regulations indicates that replacement cost is an important factor which should be given a high weight.

Section 8.3 show that site costs has increased rapidly since 1997, accounting for an increasing part of the replacement cost. It is important to bear in mind that the site cost before 1997 is a proxy, and therefore might not be as credible. The years between 1980 and 1996 will therefore have a weight of 2.5, while from 1997 until 2015 will have a weight of 3.

GDP Growth

GDP is a measure of the overall Norwegian economy and is a sign of the general economic growth in Norway. A significant part of the GDP in Norway consists of revenues from the petroleum sector which has an overall impact on the Norwegian economy. A fall in the oil-price can therefore create uncertainty in the market. However, as described in section 8.1.1, the housing market in Oslo has not been extensively directly impacted by the price of oil (for better or for worse) compared to other parts of Norway. We have therefore decided to give

the GDP a weight of 1.5 for the entire time period. As the oil is included in the assessment of importance of GDP, we will not use oil as an individual international factor in the model.

Disposable Income

The disposable income of a household determines how much financial resources households have to invest in housing and is therefore an important factor to include. A high income can create a sense of safety of future solvency. The relationship in the movements between disposable income and house prices would indicate a high weight. We however believe that other factors, such as inheritance and other wealth, also affect household's ability to invest in the house market. Therefore, we have decided to give disposable income a weight of 2.

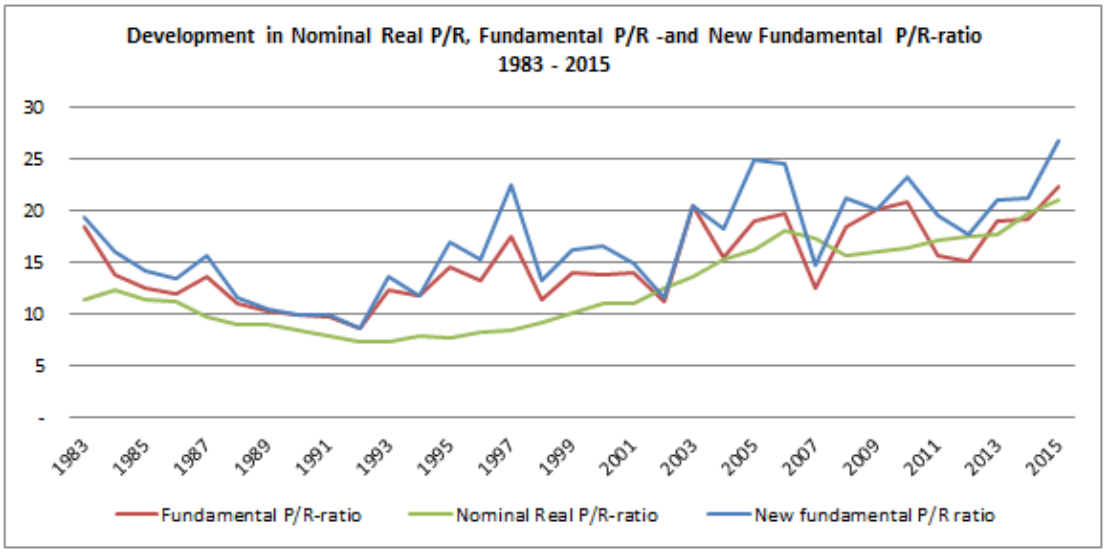
Interest Rate

The interest rate is one of the most important factors influencing the capability to enter and reinvest in the housing market. A decreasing interest rate gives the possibility of financing more expensive housing. The low interest rate the latest years has enabled households to take on more debt as the cost related to the debt is lower. The credit market development (section 8.2.1) is also dependent on the change in interest rate, which makes the interest rate essential. The impact of the interest rate is also discussed in section 8.2.3, which greatly supports the fact that it affects the house price level and should be given a high weight. However, as the interest rate already is a part of the original fundamental P/R-ratio- formula, this factor is already reflected.

10.2 Results from the Additional X-Factor

Based on the thorough analysis of fundamental factors affecting the housing market in Oslo, we have chosen five factors to be implemented in our model, as described in chapter 10.1. The results from our additional X-factor are presented in Figure 10.1. The new model will be compared to the original fundamental P/R-ratio and evaluated in relation to the real P/R-ratio.

Figure 10.1 Development in Nominal Real P/R, Fundamental P/R- and New Fundamental P/R-ratio 1983-2015



Source: Appendix 25

From the graph, we observe that our additional factor mostly increases the original fundamental P/R-ratio. The additional factor has captured the characteristics of the housing market in Oslo, where the new X-factor is in compliance with how the chosen fundamental factors have contributed to increasing house prices. Accordingly, our new fundamental P/R-ratio are above or equal to that of the original fundamental P/R-ratio. Furthermore, we see that both fundamental P/R-ratio models give the same result from 1988 until 1993, while the new fundamental P/R-ratio is slightly above the original model until 2003 and have since then, with few exceptions, been above both the real and the fundamental P/R-ratio. However, for the housing market in Oslo, most of the changes in the chosen factors have resulted in a positive additional factor, supporting the increase in house prices.

We see that both fundamental P/R-ratios are affected by changes in the underlying fundamental factors to a greater extent than the real P/R-ratio, as they are more volatile. The fundamental P/R-ratios react instantly to changes in the factors of the ratios, as this theoretical model is static, compared to a dynamic market. Both ratios portray steeper changes than the real P/R-ratio. The main cause can be more slow response in the market to shifts in the economy, creating a lag in the development of the real ratio. In addition, the real P/R-ratio takes all conditions in the market into account, such as household's expectations of future price movements. The combination of all factors affecting the housing market makes the development less volatile.

The Period from 2004 - 2008

First, the new model predicts a fall in house prices after 2005, where the original fundamental P/R-ratio starts to decline in 2006, together with the real P/R-ratio. The new fundamental P/R-ratio thus points out that the combination of fundamental factors between 2005 and 2006 should imply a fall in the P/R-ratio. The peak before 2005 was, according to our model, based on a high growth in replacement cost, GDP and disposable income. In addition, the importance (weight) of the population growth was changed from 2 to 2.5 between 2004 and 2005.

The new model shows a shorter period with overvaluation in the market, relative to the original P/R-ratio, in addition to having a smaller deviation to the real P/R-ratio. This difference indicates that there were other fundamental factors that affected the house prices. The new fundamental P/R-ratio did probably not fall as much as the original fundamental P/R-ratio because of the high increase in site cost and disposable income, in addition to a quite large increase in population. These factors likely contributed to reduce the decline in the real P/R-ratio, thus showing that the new fundamental P/R-ratio show a more correct picture of the situation.

Further, both the original and new fundamental P/R-ratio started to climb again before the real P/R-ratio. This can indicate that it took some time before positive signals in fundamental factors had an influence in the housing market. Hence, the real P/R-ratio declined further, even though fundamental factors suggest otherwise. The new P/R-ratio grew earlier than the original, as more fundamental factors are included and supported an increase in the real P/R-ratio.

The Period from 2009 – 2015

We observe a fall in the new ratio between 2008 and 2009, while the original ratio illustrates a steady increase in the ratio. The decline is, according to our model, due to a rather high increase in the unemployment rate, and also a reduced GDP.

According to theory, if the real P/R-ratio is above that of the fundamental P/R-ratio there are bubble tendencies in the market, as the P/R-ratio is no longer supported by fundamental factors. The original fundamental P/R-ratio signaled an overvaluation between 2011 and 2013, while the new ratio shows that the growth is supported by fundamental factors. As a burst of a housing bubble is not observed in Oslo between 2011 and 2013, this indicates that the new fundamental P/R-ratio presents a more accurate P/R-relationship. Hence, by including local factors for the housing market in Oslo, the new P/R-ratio is able to emphasize the characteristics of the house market in Oslo and thus better capture the substantial price growth from 2012 until today.

After 2013, the original fundamental P/R-ratio is close to the real P/R-ratio, indicating that the original P/R-ratio supported the development in the real ratio. However, as the real P/R-ratio is so close to the original fundamental ratio, it indicates that it is on the boarder of being overvalued, thus illustrating a greater risk for a housing bubble than our new model. Nevertheless, from 2014, the deviation between the real P/R-ratio and the original fundamental P/R-ratio increased. The deviation between our model and the real P/R-ratio is even greater, caused by a high population growth, together with an abnormal growth in replacement cost, resulting in a classification of 5. Thus, according to both our model and the original fundamental P/R-ratio, there are not bubble tendencies in the current housing market in Oslo, as the growth is supported by fundamental factors.

The new model can also be seen in relation to Case & Shiller's prediction of a housing bubble since 2012. It emphasizes an even stronger correlation between the fundamental factors and the growth in house prices than the original fundamental P/R-ratio. Accordingly, there is a strong coherence between the fundamental factor analysis in chapter 8 and the results of our model, both supporting the house price development in Oslo. Expectations of future price growth and other psychological factors pointed out by Case and Shiller is likely present, but the growth is not grounded solely on expectations of future price growth.

10.3 Limitations of Our Additional X-Factor

As this model is a draft of a theoretical framework of a house price model, there are several important limitations to take into consideration when using this model to find the additional X-factor in the housing market in Oslo. First of all, this model is meant to be applied on the current housing market, and not on historical numbers. The main reason for this is that it is challenging to go far back in time and evaluate the importance of the different fundamental factors in each year. The analysis will therefore be somewhat superficial in the subjective assessment of historical numbers in relation to the importance of each factor. We believe that the most recent years (2010 and onwards) present a more correct picture of the development in the new fundamental P/R-ratio. This is both due to a more valid data material, as well as the weighting of the factors are grounded in a more thorough analysis.

The analysis can have some weaknesses, as the additional X-factor is based on the nominal numbers of the chosen factors. As growth in house prices often are grounded in inflation in addition to the fundamental factors emphasized in this dissertation, it could be better to apply real numbers in our model.

When evaluating the market situation and conducting the weighting of the chosen fundamental factors, it is mostly based on a subjective assessment. Our assessment of the factors may be influenced by media coverage or

by conversations with experts within the industry. However, we do believe we have managed to make a rational assessment based on the facts presented in the thesis.

As the classification intervals are made based on the distribution found using histograms, it can cause the model to give very positive (negative) classifications to the less frequent changes, even though they might not be as important. In addition, the classifications are not applicable for other housing markets as the classifications are based on the specific data material for Oslo. If the model is applied to other housing markets, new classifications will therefore need to be made. Moreover, random or unusual changes in one of the factors can give great fluctuations in the classifications, causing the new fundamental P/R-ratio to deviate more (or less) than it should.

In addition, the model only takes the change from year to year into account, and not the level of the factor. This means that the importance of some changes can be overlooked. A reduction in for example unemployment rate can be more important from lower levels than from a high level. A reduction in the unemployment rate from 7 to 6 percent will not give as much pressure on the income level, as both rates are at relatively high levels. However, a decline from 3 to 2 percent will give a tight labor market, making it possible for employees to demand higher income.

In order to determine the validity of the model, it should be tested on several housing markets. An application of the fundamental factors related to these markets could provide greater insight of the robustness of the model and whether it can be applied on other housing markets. This can be an interesting topic for further investigation and research.

The housing market is complex and many factors are mutually dependent of each other. The model does not take multicollinearity between factors into account. This may cause some effects to be included several times, either directly or indirectly. For example, the growth in disposable income is dependent on the unemployment rate, as well as the growth in GDP has increased the level of disposable income overall.

As the fundamental P/R-formula already includes the nominal interest rate after tax (nominal), we have chosen to exclude this factor from our model, even though we consider it to be one of the most important factors for the housing market in Oslo. An analysis of the development in interest rate is nevertheless an important part of our overall analysis as the tax deduction on interest makes it more beneficial to own rather than to rent.

It is also important to note that in some years the additional factor will be equal to 0 percent. This is because the factors included in the model affect the house prices both positively and negatively, and can thus outweigh each other.

When concluding based on our analysis, we have no guarantee that the fundamental factors we include do not capture the expectations people have of future price developments. Even though we claim that the model is based on measurable fundamental factors only, our numbers can still contain element of expectations. Among others, the unemployment rate and disposable income can portray the household's expectations of the future economic situation and can thus influence decisions regarding housing investments. If these effects are captured in the fundamental factors, we will not be able to estimate a fundamental P/R-ratio based solely on fundamental factors.

11. Final Conclusion and Limitations

The purpose of this dissertation has been to investigate whether existing house price models are good enough at calculating fair house prices, and if including more fundamental factors will make a model more accurate. The models are applied on the historical and current housing market in Oslo, together with a fundamental factor analysis. They are consequently analyzing whether underlying fundamental factors support the house prices in Oslo or if the house prices are founded on expectations.

In order to understand the development of the housing market, we have chosen to look at models that analyses the market from different perspectives. The thesis is based on three house price models, together with one framework, by Case and Shiller, to identify possible bubble tendencies in the housing market in Oslo. The HP-filter addresses the house prices compared to the underlying long-term trend, giving an overall understanding of the development in the market. The P/R-ratio evaluates the relationship between the costs of owning housing compared to rent from a households perspective. The housing market from an investor's viewpoint is analyzed through Tobin's Q, while Case and Shiller's criteria's for a housing bubble evaluates the psychological element in the market.

The HP-filter has been able to capture deviation from trend when housing bubbles have occurred. Hence, the model has reflected the earlier crisis's in a sufficient manner, as prices before a burst have been identified as higher than the long-term trend. According to this house price model, current house prices in Oslo are not fairly priced, as they are above the long-term trend. The real P/R-ratio suggests that the current level of housing prices is above the average in the time-period and therefore is overvalued. However, when comparing the real P/R-ratio with the fundamental P/R-ratio, it has mainly been undervalued, thus indicating that the development in the real P/R-ratio is rooted in fundamental factors. Using data from NSHB and primary sources, Tobin's Q implies that as the q-value has been above 1 for a long time, the current housing market is overpriced and thus has bubble tendencies. As data is obtained from other sources than earlier research, we have reached somewhat different

conclusions. This is especially prevalent in the P/R-ratio where the rent is based on numbers from Are Oust instead of SSB, as well as the site cost collected uniquely for this thesis to be applied in Tobin's Q.

The fundamental factor analysis explains great parts of the increasing house prices since 1992 and the quick recovery after the Financial Crisis in 2007/08. The Norwegian economy has been characterized by a strong growth, together with a decreasing interest rate. The discovery of oil in the 1970's increased the overall price - and income level, contributed to a low unemployment rate and a well-functioning welfare system, providing a basis for a high house price level. However, the high house prices combined with low interest rate have caused the DTI-ratio among households to be relatively high, where an increase in the interest rate would affect a great amount of households. Banks have however implemented stricter requirements for house buyer's equity, as well as requiring households to be able to bear a 5 percent increase in the interest rate. NCB has avoided using the key rate to regulate the housing market as it will reduce the competitiveness of Norwegian export industry. The fall in oil-prices make it even more important to support the conditions for other industries in the Norway. The favorable taxation of property has incentivized households to invest in housing.

Also local factors have contributed to the growth in prices. The lack of supply is prevalent, mainly grounded by scarcity of available land to build on and in the long proceeding time by the regulation authorities. At the same time, stricter requirements of standard and new building regulations have made the construction of housing more expensive. The supply in the Oslo market has been characterized with this situation the last decade, causing a great deficit of housing. Further, the population growth in Oslo, especially from 2004 until today, is a great driver of the demand. Increasingly more households are in need of new housing as urbanization and immigration are growing, at the same time as persons per households have declined. The combination of these local factors has pressed the price of housing up since 1992, with an increasing growth the last few years.

Based on the empirical analysis, we found that the house price models showed contradicting results and were not able to consistently present if housing prices were fair or not. Hence, we wanted to investigate whether including more fundamental factors would add valuable information to explain the fairness of the house prices. We wanted to take the viewpoint of the households and based our investigation on the P/R-model. We have found the greatest weakness to be that the analysis was grounded on too few fundamental factors. Therefore, we developed an additional factor including several local and national factors considered important for the growth in housing prices in Oslo, namely the unemployment rate, population growth, replacement costs, GDP and disposable income. The new fundamental P/R-ratio presents for the main part a higher ratio than the original fundamental P/R-ratio, indicating that the house prices are supported by fundamental factors in the market. The model is able to show the fall in housing prices before the Financial Crisis better than the original fundamental

P/R-ratio, as well as capturing the substantial growth in prices the later years in a better way. Hence, even though Case and Shiller have predicted the burst of a housing bubble the later years, the development in the real P/R-ratio is supported by fundamental factors, according to our model.

It is hard to determine whether a bubble is present in this housing market. As mentioned, the current fundamental factors support the substantial price growth on housing. However, the current situation can be argued to not represent a long-term situation. The low level of interest rates, low unemployment rate and the lack of supply reflect a situation that can change. At the same time, a low interest rate is expected in the future, and enough available sites will likely not be available in a sufficient scope in the nearest future. On the other hand, it is believed that lower growth in disposable income, together with stricter lending policies can dampen the house price growth in the future. If the supply is able to catch up with the demand and no new major shocks in the economy arise, the house prices will likely correct itself to more sustainable levels in the medium/long term.

As most of the fundamental factors analyzed in the thesis support the growth in house prices, it is evident that the house prices in Oslo are not solely driven by expectations, contradicting the definition of a bubble, being that fundamental factors do not justify expectations. Our analysis of the housing market in Oslo based on Case and Shiller's bubble criteria's, supports a housing bubble in Oslo the later years. The psychological factors presented through the criteria's are, based on our evaluation, present in the housing market in Oslo, but are grounded in the development of fundamental factors. An analysis mainly based on households expectations and understanding of the housing market, can likely not provide a sufficient answer of whether a housing bubble is present or not. As our analysis show that the price increase is supported by fundamental factors, especially by the lack of supply, we believe that Case and Shiller have excluded an important aspect of the pricing mechanism in the housing market. Although Case and Schiller only examined at a national level and not Oslo in particular, the important relation between local supply and demand should have been reflected in their framework.

It is important to emphasize the general limitations of this thesis. As discussed throughout the paper, the applied models have limitations important to take into consideration when evaluating the results. The results presented in our analysis can therefore not be presented with absolute certainty. As data material for Norway is applied when data for Oslo is not available, the analysis can provide a misleading picture of the relationship between factors. Further, the analysis of historical data has been challenging, as sufficient information has been hard to retrieve. The main part of the thesis is focused on the current situation and the house price growth the last decade, meaning that the analysis of historical data is not as thoroughly analyzed as the more recent data.

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Appendices

List of Abbreviations

AKU = Labor Force Survey

CCI = Consumer Confidence Index

CPI = Consumer Price Index

DTI = Debt-to-Income

ECB = European Central Bank

FNO = Finance Norway (Finans Norge)

FSA = Financial Supervisory Authority of Norway

GDP = Gross Domestic Product

HP-filter = Hodrick-Prescott Filter

LTV = Loan-to-Value

NAV = Employment and Welfare Department Norway

NCB = Norway's Central Bank

NEF = The Norwegian Association of Real Estate

NSHB = The Norwegian State Housing Bank (Husbanken)

OECD = Organization for Economic Co-operation and Development

P/R-Ratio = Price-to-Rent Ratio

S&P = Standard and Poor

SSB = Statistics Norway (Statistisk Sentralbyrå)

Table of Figures

Appendix 1. Figure 5.1 and Figure 5.2

Year	Nominal House Price Index (1980=100)	CPI (1980=100)	Real House Price Index (1980=100)
1841	3,4149	3,6177	94,3940
1842	2,9335	3,6013	81,4553
1843	3,1571	3,6889	85,5828
1844	3,5169	3,5908	97,9417
1845	2,6705	3,7268	71,6571
1846	5,0745	4,2358	119,8022
1847	3,6350	5,0494	71,9885
1848	2,8073	3,9596	70,9002
1849	3,0819	3,6630	84,1374
1850	3,0979	3,6249	85,4624
1851	3,3663	3,8693	86,9982
1852	2,3184	4,0602	57,1008
1853	3,3387	4,1945	79,5957
1854	3,4157	4,5381	75,2681
1855	3,3933	4,9943	67,9447
1856	3,7926	5,3261	71,2070
1857	5,1747	4,7511	108,9142
1858	6,0748	4,1620	145,9607
1859	6,1448	4,2153	145,7724
1860	5,4588	4,6396	117,6553
1861	5,7372	4,7802	120,0202
1862	4,5870	4,7449	96,6717
1863	3,8648	4,6195	83,6624
1864	4,2305	4,4561	94,9370
1865	5,1731	4,4158	117,1499
1866	4,9906	4,9048	101,7497
1867	3,5677	5,1967	68,6535
1868	4,6619	5,4884	84,9410
1869	4,9651	4,8812	101,7200
1870	4,5157	4,5489	99,2721
1871	5,1050	4,6867	108,9264
1872	4,7098	4,8281	97,5511
1873	4,9211	5,1929	94,7662
1874	6,5542	5,5832	117,3910
1875	7,0141	5,1800	135,4075
1876	8,1055	4,9134	164,9678
1877	7,1528	5,0930	140,4435
1878	6,9185	4,4601	155,1189
1879	6,5847	4,1380	159,1300
1880	7,4937	4,5204	165,7756
1881	6,0955	4,6836	130,1452
1882	7,5303	4,4311	169,9417
1883	8,6038	4,2329	203,2615
1884	5,7710	4,0901	141,0981
1885	6,3514	3,8366	165,5466
1886	5,9800	3,6381	164,3704
1887	6,2236	3,5621	174,7160
1888	6,3718	3,6350	175,2880
1889	6,4372	3,8436	167,4793
1890	7,5054	3,9831	188,4305
1891	7,9546	4,2589	186,7780
1892	7,8220	4,2037	186,0759
1893	7,5168	3,8554	194,9679
1894	8,3398	3,5810	232,8893
1895	8,1164	3,5464	228,8616
1896	9,3988	3,5712	263,1822
1897	9,9352	3,6350	273,3196
1898	11,2213	3,9149	286,6322
1899	13,9849	4,0514	345,1865
1900	10,2532	4,3301	236,7900
1901	10,0542	4,1238	243,8074
1902	10,9605	4,1126	266,5119
1903	8,3980	4,0960	205,0265
1904	5,6923	4,1479	137,2316
1905	6,7357	4,2541	158,3325
1906	6,7975	4,3794	155,2143
1907	6,5449	4,7330	138,2831
1908	6,1765	4,5700	135,1549
1909	5,8934	4,5529	129,4413
1910	8,2583	4,5732	180,5820
1911	7,9917	4,7679	167,6166
1912	8,9645	5,1292	174,7724
1913	8,6015	5,0414	170,6169
1914	9,2205	5,3679	171,7728
1915	8,7408	7,3878	118,3134
1916	10,7151	9,3260	114,8948
1917	11,5705	13,9709	82,8189
1918	13,3222	17,7940	74,8689
1919	14,3587	17,0817	84,0591
1920	15,3506	19,2376	79,7947
1921	13,8589	17,8326	77,7164
1922	13,6585	14,9506	91,3575
1923	15,1153	14,0500	107,5829

1924	13,8752	15,4009	90,0933
1925	15,0264	15,6711	95,8863
1926	14,8594	13,3294	111,4779
1927	14,9675	11,9785	124,9529
1928	14,1993	11,1679	127,1442
1929	14,5537	10,7176	135,7923
1930	13,1308	10,3573	126,7781
1931	16,1385	9,8170	164,3937
1932	15,7068	9,6368	162,9870
1933	15,5829	9,5468	163,2276
1934	15,0644	9,5468	157,7959
1935	16,0533	9,7269	165,0400
1936	18,1973	9,9971	182,0259
1937	17,0756	10,7176	159,3229
1938	17,0998	11,0778	154,3602
1939	18,6159	11,1679	166,6913
1940	18,2729	13,0593	139,9232
1941	19,2469	15,3108	125,7076
1942	22,1857	16,2115	136,8521
1943	13,4308	16,6618	80,6080
1944	17,6738	16,8419	104,9393
1945	26,3171	17,1121	153,7923
1946	20,4762	17,5624	116,5908
1947	20,3693	17,6525	115,3902
1948	20,0700	17,5624	114,2782
1949	19,2905	17,5624	109,8393
1950	19,5223	18,4631	105,7367
1951	20,3145	21,4352	94,7718
1952	20,1076	23,3265	86,2005
1953	25,3189	23,7768	106,4854
1954	19,2334	24,8576	77,3744
1955	25,4249	25,1278	101,1825
1956	24,2958	26,0284	93,3434
1957	26,2441	26,7490	98,1125
1958	28,2751	28,0098	100,9469
1959	24,9779	28,7304	86,9390
1960	29,0867	28,8557	100,8004
1961	28,3475	29,6020	95,7623
1962	31,2628	31,0945	100,5413
1963	32,0315	31,8408	100,5990
1964	35,0477	33,5821	104,3643
1965	37,3846	35,0746	106,5860
1966	41,3276	36,3184	113,7924
1967	47,2948	37,8109	125,0823
1968	50,1255	39,3035	127,5345
1969	52,1065	40,2985	129,3014
1970	51,8171	44,5274	116,3714

1971	53,7697	47,5124	113,1697
1972	65,0366	50,7463	128,1604
1973	63,2763	54,7264	115,6230
1974	67,7152	59,7015	113,4229
1975	64,6327	66,6667	96,9490
1976	67,8745	72,8856	93,1247
1977	86,7500	79,6020	108,9797
1978	84,6665	86,0697	98,3698
1979	90,2795	90,0498	100,2551
1980	100,0000	100,0000	100,0000
1981	132,7503	113,4328	117,0299
1982	147,6449	126,3682	116,8371
1983	173,5334	137,0647	126,6070
1984	198,3335	145,7711	136,0582
1985	210,3453	153,9801	136,6055
1986	258,2129	164,9254	156,5635
1987	307,6915	179,3532	171,5561
1988	307,6000	191,2935	160,8000
1989	271,4274	200,0000	135,7137
1990	240,1656	208,2090	115,3484
1991	226,1658	215,4229	104,9869
1992	209,9383	220,3980	95,2542
1993	217,9956	225,3731	96,7265
1994	240,8738	228,6070	105,3659
1995	257,8167	234,3284	110,0237
1996	289,4469	237,0647	122,0962
1997	342,5740	243,2836	140,8126
1998	403,6419	248,7562	162,2640
1999	467,1050	254,4776	183,5545
2000	549,6769	262,4378	209,4503
2001	579,4022	270,3980	214,2775
2002	633,9735	273,8806	231,4780
2003	640,1222	280,5970	228,1287
2004	667,4737	281,8408	236,8265
2005	737,3124	286,3184	257,5148
2006	849,1102	292,7861	290,0105
2007	950,1426	295,0249	322,0551
2008	917,0171	306,2189	299,4646
2009	919,7772	312,6866	294,1531
2010	998,4495	320,1493	311,8700
2011	1096,9979	324,3781	338,1849
2012	1188,9263	326,6169	364,0125
2013	1237,0939	333,8308	370,5751
2014	1404,5737	340,5473	412,4460
2015	1538,0082	347,6988	442,3393

Appendix 2. Figure 6.1 and Figure 6.2

Year	Real House Price Index	HP-filter, λ = 100	Cycle Effects, λ = 100	HP-filter, λ = 2,500	Cycle Effects, λ = 2,500
1980	100	116,849	-16,849	98,768	1,232
1981	117,02990	120,737	-3,707	101,780	15,250
1982	116,83712	124,458	-7,620	104,793	12,044
1983	126,60696	127,804	-1,197	107,813	18,794
1984	136,05817	130,494	5,564	110,852	25,207
1985	136,60549	132,235	4,371	113,928	22,678
1986	156,56348	132,788	23,775	117,070	39,493
1987	171,55613	131,959	39,597	120,317	51,239
1988	160,80001	129,792	31,008	123,722	37,078
1989	135,71372	126,725	8,989	127,360	8,353
1990	115,34836	123,508	-8,160	131,320	-15,972
1991	104,98689	120,981	-15,994	135,695	-30,708
1992	95,25416	119,900	-24,646	140,570	-45,316
1993	96,72650	120,865	-24,138	146,020	-49,294
1994	105,36591	124,226	-18,860	152,100	-46,734
1995	110,02368	130,093	-20,069	158,847	-48,823
1996	122,09619	138,387	-16,291	166,277	-44,181
1997	140,81264	148,830	-8,017	174,389	-33,576
1998	162,26404	160,979	1,285	183,162	-20,898
1999	183,55447	174,311	9,244	192,563	-9,009
2000	209,45033	188,317	21,134	202,552	6,899
2001	214,27753	202,579	11,698	213,081	1,196
2002	231,47805	216,893	14,585	224,110	7,368
2003	228,12865	231,168	-3,039	235,595	-7,467
2004	236,82651	245,463	-8,636	247,499	-10,672
2005	257,51485	259,803	-2,288	259,778	-2,263
2006	290,01046	274,129	15,881	272,386	17,624
2007	322,05509	288,359	33,696	285,277	36,778
2008	299,46455	302,568	-3,104	298,410	1,055
2009	294,15310	317,170	-23,017	311,759	-17,606
2010	311,87001	332,547	-20,677	325,300	-13,430
2011	338,18492	348,851	-10,666	339,000	-0,815
2012	364,01246	366,027	-2,014	352,822	11,190
2013	370,57506	383,913	-13,338	366,729	3,847
2014	412,44603	402,328	10,118	380,686	31,760
2015	442,33928	420,957	21,383	394,662	47,677

Appendix 3. Figure 6.3

Year	Rent Index Are Oust (1970=100)	Rent Index Are Oust (1980=100)	Paid Rent Index SSB (1998=100)	Paid Rent Index SSB (2015=100)	Nominal Estimated Rent SSB (Based on Avg. Rent 2015)	Nominal Estimated Rent Index SSB (1980=100)
1980	247,83	100,00	39,00	24,18	579,80	100,00
1981	298,61	120,49	43,30	26,84	643,73	111,03
1982	342,47	138,19	48,70	30,19	724,01	124,87
1983	357,94	144,43	53,10	32,92	789,42	136,15
1984	375,75	151,62	57,10	35,40	848,89	146,41
1985	432,01	174,32	59,80	37,07	889,03	153,33
1986	532,53	214,88	62,70	38,87	932,14	160,77
1987	710,40	286,65	66,50	41,23	988,64	170,51
1988	765,66	308,95	71,70	44,45	1.065,94	183,85
1989	685,18	276,47	77,20	47,86	1.147,71	197,95
1990	645,64	260,52	82,20	50,96	1.222,04	210,77
1991	643,06	259,48	86,30	53,50	1.283,00	221,28
1992	649,38	262,03	89,50	55,49	1.330,57	229,49
1993	661,77	267,03	92,00	57,04	1.367,74	235,90
1994	682,70	275,47	92,60	57,41	1.376,66	237,44
1995	749,43	302,40	93,80	58,15	1.394,50	240,51
1996	784,68	316,62	95,40	59,14	1.418,28	244,62
1997	906,86	365,92	97,70	60,57	1.452,48	250,51
1998	990,89	399,83	100,00	62,00	1.486,67	256,41
1999	1.050,37	423,83	102,80	63,73	1.528,30	263,59
2000	1.105,97	446,26	107,10	66,40	1.592,22	274,62
2001	1.149,50	463,83	111,50	69,13	1.657,64	285,90
2002	1.137,64	459,04	116,80	72,41	1.736,43	299,49
2003	1.055,46	425,88	121,50	75,33	1.806,31	311,54
2004	1.024,82	413,52	123,90	76,81	1.841,99	317,69
2005	1.070,54	431,97	126,40	78,36	1.879,15	324,10
2006	1.108,87	447,43	129,20	80,10	1.920,78	331,28
2007	1.291,71	521,21	131,30	81,40	1.952,00	336,67
2008	1.386,02	559,26	134,90	83,63	2.005,52	345,90
2009	1.354,23	546,43	139,40	86,42	2.072,42	357,44
2010	1.437,42	580,00	143,40	88,90	2.131,89	367,69
2011	1.513,64	610,76	146,30	90,70	2.175,00	375,13
2012	1.588,72	641,05	148,90	92,31	2.213,65	381,79
2013	1.641,26	662,25	153,30	95,04	2.279,07	393,08
2014	1.676,78	676,58	157,50	97,64	2.341,51	403,85
2015	1.745,53	704,33	161,30	100,00	2.398,00	413,59

* The numbers for Rent Indices by Are Oust are based on numbers from Boligbygg Oslo KF from 2009-2015

Boligbygg Oslo KF		
Years	Rent	Change Yoy
2008	2.137	
2009	2.088	-2,29%
2010	2.216	6,14%
2011	2.334	5,30%
2012	2.449	4,96%
2013	2.530	3,31%
2014	2.585	2,16%
2015	2.691	4,10%

Appendix 4. Figure 6.4

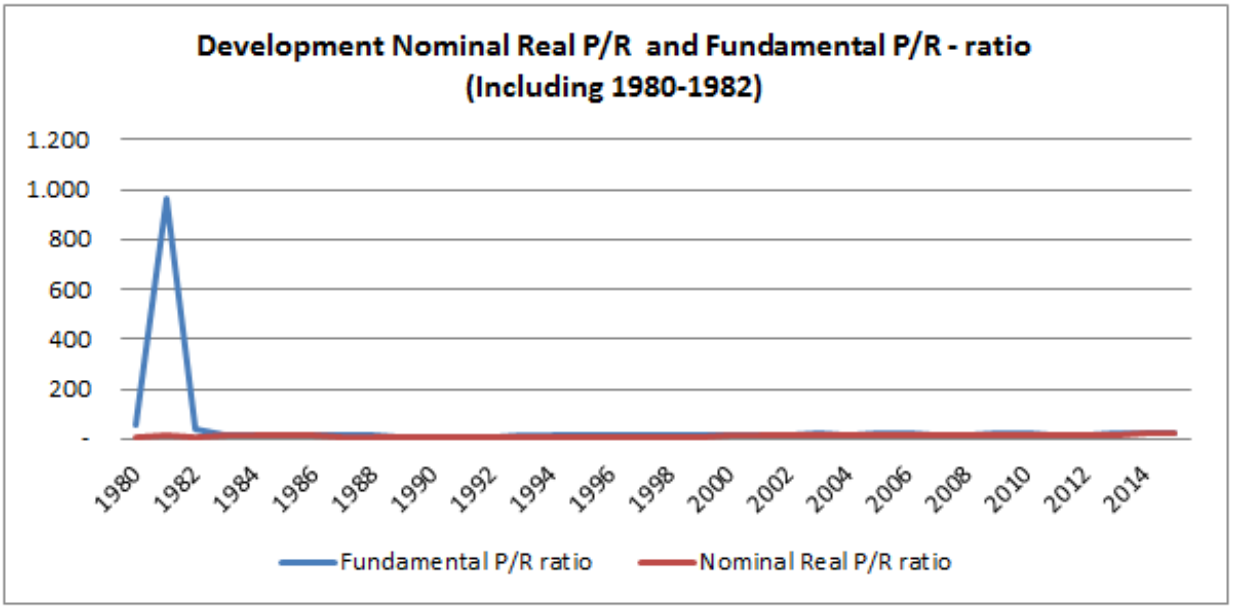
Year	CPI (1980=100)	Nominal Rent Index Oust (1980 = 100)	Nominal House Price Index (1980=100)
1980	100,00	100,00	100,00
1981	113,43	120,49	132,75
1982	126,37	138,19	147,64
1983	137,06	144,43	173,53
1984	145,77	151,62	198,33
1985	153,98	174,32	210,35
1986	164,93	214,88	258,21
1987	179,35	286,65	307,69
1988	191,29	308,95	307,60
1989	200,00	276,47	271,43
1990	208,21	260,52	240,17
1991	215,42	259,48	226,17
1992	220,40	262,03	209,94
1993	225,37	267,03	218,00
1994	228,61	275,47	240,87
1995	234,33	302,40	257,82
1996	237,06	316,62	289,45
1997	243,28	365,92	342,57
1998	248,76	399,83	403,64
1999	254,48	423,83	467,11
2000	262,44	446,26	549,68
2001	270,40	463,83	579,40
2002	273,88	459,04	633,97
2003	280,60	425,88	640,12
2004	281,84	413,52	667,47
2005	286,32	431,97	737,31
2006	292,79	447,43	849,11
2007	295,02	521,21	950,14
2008	306,22	559,26	917,02
2009	312,69	546,43	919,78
2010	320,15	580,00	998,45
2011	324,38	610,76	1.097,00
2012	326,62	641,05	1.188,93
2013	333,83	662,25	1.237,09
2014	340,55	676,58	1.404,57
2015	347,70	704,33	1.559,08

Appendix 5. Figure 6.5

Year	Nominal Rent Index Oust (2015 = 100)	Nominal Rent Oust Base Year = 2015	Nominal House Prices	Nominal Real P/R -ratio
1980	14,20	382	3.605	9,44
1981	17,11	460	4.786	10,40
1982	19,62	528	5.323	10,08
1983	20,51	552	6.256	11,34
1984	21,53	579	7.150	12,34
1985	24,75	666	7.617	11,44
1986	30,51	821	9.158	11,16
1987	40,70	1.095	10.699	9,77
1988	43,86	1.180	10.671	9,04
1989	39,25	1.056	9.553	9,04
1990	36,99	995	8.315	8,35
1991	36,84	991	7.806	7,87
1992	37,20	1.001	7.343	7,33
1993	37,91	1.020	7.496	7,35
1994	39,11	1.052	8.275	7,86
1995	42,93	1.155	8.958	7,75
1996	44,95	1.210	10.025	8,29
1997	51,95	1.398	11.872	8,49
1998	56,77	1.528	13.992	9,16
1999	60,17	1.619	16.246	10,03
2000	63,36	1.705	18.688	10,96
2001	65,85	1.772	19.632	11,08
2002	65,17	1.754	21.777	12,42
2003	60,47	1.627	22.076	13,57
2004	58,71	1.580	24.180	15,30
2005	61,33	1.650	26.709	16,18
2006	63,53	1.709	30.757	17,99
2007	74,00	1.991	34.424	17,29
2008	79,40	2.137	33.224	15,55
2009	77,58	2.088	33.319	15,96
2010	82,35	2.216	36.171	16,32
2011	86,71	2.334	39.739	17,03
2012	91,02	2.449	43.004	17,56
2013	94,03	2.530	44.799	17,71
2014	96,06	2.585	50.864	19,68
2015	100,00	2.691	55.696	20,70

Average Rent 2015 Boligbygg Oslo KF	2.691

Appendix 6a. Figure 6.6 Including 1980-1982



Appendix 6b. Figure 6.6

Year	Nominal Mortgage Rate (i)	After Income Tax Mortgage Rate (ia)	Property Tax Rate (T)	Recurring Holding Cost (f)	Expected House Price Inflation Rate (π)	Fundamental P/R ratio	Nominal Real P/R ratio
1980	*12,4%*	*8,9%*	*0*	*4%*	*11,0%*	*51,87*	*9,44*
1981	*13,2%*	*9,5%*	*0*	*4%*	*13,4%*	*961,54*	*10,40*
1982	*13,8%*	*9,9%*	*0*	*4%*	*11,4%*	*39,43*	*10,08*
1983	13,8%	9,9%	0	4%	8,5%	18,40	11,34
1984	13,4%	9,6%	0	4%	6,4%	13,80	12,34
1985	13,4%	9,6%	0	4%	5,6%	12,43	11,44
1986	16,0%	11,5%	0	4%	7,1%	11,88	11,16
1987	16,8%	12,1%	0	4%	8,7%	13,52	9,77
1988	16,4%	11,8%	0	4%	6,7%	10,98	9,04
1989	14,4%	10,4%	0	4%	4,6%	10,24	9,04
1990	14,2%	10,2%	0	4%	4,1%	9,88	8,35
1991	13,7%	9,9%	0	4%	3,5%	9,65	7,87
1992	13,8%	9,9%	0	4%	2,3%	8,59	7,33
1993	8,9%	6,4%	0	4%	2,3%	12,33	7,35
1994	8,2%	5,9%	0	4%	1,4%	11,76	7,86
1995	7,5%	5,4%	0	4%	2,5%	14,49	7,75
1996	6,6%	4,8%	0	4%	1,2%	13,24	8,29
1997	6,0%	4,3%	0	4%	2,6%	17,48	8,49
1998	9,7%	7,0%	0	4%	2,2%	11,38	9,16
1999	7,6%	5,5%	0	4%	2,3%	13,94	10,03
2000	8,9%	6,4%	0	4%	3,1%	13,68	10,96
2001	8,6%	6,2%	0	4%	3,0%	13,90	11,08
2002	8,6%	6,2%	0	4%	1,3%	11,25	12,42
2003	4,7%	3,4%	0	4%	2,5%	20,48	13,57
2004	4,0%	2,9%	0	4%	0,4%	15,43	15,30
2005	4,0%	2,9%	0	4%	1,6%	18,94	16,18
2006	4,7%	3,4%	0	4%	2,3%	19,67	17,99
2007	6,7%	4,8%	0	4%	0,8%	12,46	17,29
2008	7,3%	5,3%	0	4%	3,8%	18,33	15,55
2009	4,3%	3,1%	0	4%	2,1%	20,02	15,96
2010	4,6%	3,3%	0	4%	2,5%	20,78	16,32
2011	5,0%	3,6%	0	4%	1,2%	15,63	17,03
2012	4,8%	3,5%	0	4%	0,8%	15,02	17,56
2013	4,7%	3,4%	0	4%	2,1%	18,93	17,71
2014	4,4%	3,2%	0	4%	2,0%	19,19	19,68
2015	3,6%	2,6%	0	4%	2,1%	22,26	20,98

Tax Rates Used	
1980 - 2013	28%
2014 - 2015	27%

Appendix 7. Figure 6.7 and Figure 6.8

Year	Real House Price (1)	Real Building Cost (2)	Real Site Costs (3)	Real Replacement Cost (2+3)	Real Tobin's Q (1)/(2+3)
1980	3.605,00	3.145,96		4.509,52	0,80
1981	4.218,88	3.211,85		4.603,97	0,92
1982	4.211,98	3.471,49		4.976,15	0,85
1983	4.564,20	2.909,37		4.170,38	1,09
1984	4.904,88	2.916,92		4.181,20	1,17
1985	4.946,74	2.905,44		4.164,74	1,19
1986	5.552,81	3.001,60		4.302,59	1,29
1987	5.965,32	3.297,13		4.726,21	1,26
1988	5.578,34	3.653,49		5.237,03	1,07
1989	4.776,50	3.644,88		5.224,68	0,91
1990	3.993,58	3.299,33		4.729,37	0,84
1991	3.623,57	3.073,59		4.405,78	0,82
1992	3.331,70	2.750,92		3.943,26	0,84
1993	3.326,04	2.548,08		3.652,50	0,91
1994	3.619,75	2.274,17		3.259,87	1,11
1995	3.822,84	2.415,53		3.462,50	1,10
1996	4.228,80	2.599,59		3.726,33	1,13
1997	4.879,90	2.676,14		3.909,27	1,25
1998	5.624,78	2.927,90		4.435,40	1,27
1999	6.384,06	3.094,40		4.784,13	1,33
2000	7.120,93	3.421,32		5.250,33	1,36
2001	7.260,41	3.905,59		5.717,73	1,27
2002	7.951,28	4.353,67		6.301,14	1,26
2003	7.867,51	4.777,42		6.124,55	1,28
2004	8.579,31	5.438,87		7.106,48	1,21
2005	9.328,43	6.270,49		8.369,55	1,11
2006	10.504,94	6.278,47		8.737,61	1,20
2007	11.668,17	6.627,58		9.888,32	1,18
2008	10.849,75	6.227,29		8.561,41	1,27
2009	10.655,72	6.720,94		9.055,55	1,18
2010	11.298,17	6.087,86		8.602,31	1,31
2011	12.250,83	6.929,16		10.200,03	1,20
2012	13.166,50	7.971,25		11.430,96	1,15
2013	13.419,67	7.499,46		11.156,51	1,20
2014	14.935,96	8.136,82		12.125,25	1,23
2015	16.237,92	10.173,69		14.665,13	1,11

Appendix 8. Figure 8.1 and Figure 8.2

Year	GDP, NOK in millions	Total Population Norway	GDP per Capita	Nominal GDP per Capita Index (1980 = 100)	Change Nominal GDP	Deflator (2010=100)	Deflator (1980=100)	Real GDP per Capita Index	% Change Real GDP	Real HPI 1980 = 100
1979	*269.067*	*4.066.134*	*66.173*	*84,80*		*23,5*	*88,68*	*95,63*		
1980	318.279	4.078.900	78.031	100,00	17,9%	26,5	100,00	100,00	4,6%	100,00
1981	365.013	4.092.340	89.194	114,31	14,3%	30	113,21	100,97	1,0%	117,03
1982	404.325	4.107.063	98.446	126,16	10,4%	33,1	124,91	101,01	0,0%	116,84
1983	449.657	4.122.511	109.074	139,78	10,8%	35,4	133,58	104,64	3,6%	126,61
1984	506.486	4.134.353	122.507	157,00	12,3%	37,6	141,89	110,65	5,7%	136,06
1985	562.402	4.145.845	135.654	173,85	10,7%	39,6	149,43	116,34	5,1%	136,61
1986	581.913	4.159.187	139.910	179,30	3,1%	39,4	148,68	120,60	3,7%	156,56
1987	634.875	4.175.521	152.047	194,86	8,7%	42,2	159,25	122,36	1,5%	171,56
1988	664.084	4.198.289	158.180	202,71	4,0%	44,3	167,17	121,26	-0,9%	160,80
1989	708.635	4.220.686	167.896	215,17	6,1%	46,7	176,23	122,10	0,7%	135,71
1990	749.860	4.233.116	177.141	227,02	5,5%	48,5	183,02	124,04	1,6%	115,35
1991	790.087	4.249.830	185.910	238,25	5,0%	49,6	187,17	127,29	2,6%	104,99
1992	813.093	4.273.634	190.258	243,82	2,3%	49,3	186,04	131,06	3,0%	95,25
1993	855.400	4.299.167	198.969	254,99	4,6%	50,4	190,19	134,07	2,3%	96,73
1994	897.243	4.324.815	207.464	265,88	4,3%	50,3	189,81	140,07	4,5%	105,37
1995	963.124	4.348.410	221.489	283,85	6,8%	51,9	195,85	144,93	3,5%	110,02
1996	1.054.657	4.369.957	241.343	309,29	9,0%	54,1	204,15	151,50	4,5%	122,10
1997	1.141.324	4.392.714	259.822	332,97	7,7%	55,6	209,81	158,70	4,8%	140,81
1998	1.163.192	4.417.599	263.309	337,44	1,3%	55,2	208,30	162,00	2,1%	162,26
1999	1.265.701	4.445.329	284.726	364,89	8,1%	58,9	222,26	164,17	1,3%	183,55
2000	1.507.886	4.478.497	336.695	431,49	18,3%	68	256,60	168,15	2,4%	209,45
2001	1.564.585	4.503.436	347.420	445,24	3,2%	69,1	260,75	170,75	1,5%	214,28
2002	1.560.181	4.524.066	344.863	441,96	-0,7%	67,9	256,23	172,49	1,0%	231,48
2003	1.619.613	4.552.252	355.783	455,95	3,2%	69,9	263,77	172,86	0,2%	228,13
2004	1.781.981	4.577.457	389.295	498,90	9,4%	73,9	278,87	178,90	3,5%	236,83
2005	1.988.942	4.606.363	431.781	553,35	10,9%	80,4	303,40	182,38	1,9%	257,51
2006	2.215.312	4.640.219	477.415	611,83	10,6%	87,5	330,19	185,30	1,6%	290,01
2007	2.349.861	4.681.134	501.985	643,32	5,1%	90,1	340,00	189,21	2,1%	322,06
2008	2.605.380	4.737.171	549.986	704,83	9,6%	99,6	375,85	187,53	-0,9%	299,46
2009	2.429.698	4.799.252	506.266	648,80	-7,9%	94,4	356,23	182,13	-2,9%	294,15
2010	2.590.089	4.858.199	533.138	683,24	5,3%	100	377,36	181,06	-0,6%	311,87
2011	2.791.973	4.920.305	567.439	727,20	6,4%	106,8	403,02	180,44	-0,3%	338,18
2012	2.965.208	4.985.870	594.722	762,17	4,8%	110,4	416,60	182,95	1,4%	364,01
2013	3.071.134	5.051.275	607.992	779,17	2,2%	113,2	427,17	182,40	-0,3%	370,58
2014	3.154.104	5.109.056	617.356	791,17	1,5%	113,7	429,06	184,40	1,1%	412,45
2015	3.140.845	5.165.802	608.007	779,19	-1,5%	111,5	420,75	185,19	0,4%	442,34

Appendix 9. Figure 8.3

Year	Nom. Disp Income, total in million	Population Norway	Nom.Disp Income, per Capita	CPI (1980=100)	Real Disp. Income, per Capita	Nom. Disp Income Index (1980=100)	Real Disposable Income Index (1980=100)	Real House Price Index (1980=100)
1980	139.618	4.078.900	34.229	100	34.229	100	100	100
1981	162.143	4.092.340	39.621	113,4328	34.929	115,7519	102,0444	117,0299
1982	180.398	4.107.063	43.924	126,3682	34.759	128,3223	101,5464	116,8371
1983	198.196	4.122.511	48.077	137,0647	35.076	140,4542	102,4729	126,6070
1984	217.892	4.134.353	52.703	145,7711	36.154	153,9697	105,6243	136,0582
1985	235.203	4.145.845	56.732	153,9801	36.844	165,7416	107,6383	136,6055
1986	255.994	4.159.187	61.549	164,9254	37.319	179,8138	109,0274	156,5635
1987	274.922	4.175.521	65.841	179,3532	36.710	192,3537	107,2485	171,5561
1988	291.343	4.198.289	69.396	191,2935	36.277	202,7374	105,9824	160,8000
1989	312.138	4.220.686	73.954	200,0000	36.977	216,0555	108,0277	135,7137
1990	333.456	4.233.116	78.773	208,2090	37.834	230,1336	110,5301	115,3484
1991	358.478	4.249.830	84.351	215,4229	39.156	246,4294	114,3933	104,9869
1992	382.103	4.273.634	89.409	220,3980	40.567	261,2070	118,5160	95,2542
1993	408.669	4.299.167	95.058	225,3731	42.178	277,7084	123,2216	96,7265
1994	423.442	4.324.815	97.910	228,6070	42.829	286,0408	125,1234	105,3659
1995	445.578	4.348.410	102.469	234,3284	43.729	299,3608	127,7527	110,0237
1996	468.870	4.369.957	107.294	237,0647	45.259	313,4562	132,2239	122,0962
1997	501.236	4.392.714	114.106	243,2836	46.903	333,3581	137,0245	140,8126
1998	545.417	4.417.599	123.465	248,7562	49.633	360,6982	145,0007	162,2640
1999	572.087	4.445.329	128.694	254,4776	50.572	375,9757	147,7441	183,5545
2000	611.826	4.478.497	136.614	262,4378	52.056	399,1143	152,0796	209,4503
2001	622.507	4.503.436	138.229	270,3980	51.121	403,8331	149,3477	214,2775
2002	685.213	4.524.066	151.460	273,8806	55.301	442,4847	161,5612	231,4780
2003	738.786	4.552.252	162.290	280,5970	57.837	474,1263	168,9705	228,1287
2004	772.364	4.577.457	168.732	281,8408	59.868	492,9461	174,9023	236,8265
2005	846.711	4.606.363	183.813	286,3184	64.199	537,0054	187,5553	257,5148
2006	802.585	4.640.219	172.963	292,7861	59.075	505,3057	172,5853	290,0105
2007	863.994	4.681.134	184.569	295,0249	62.561	539,2142	182,7691	322,0551
2008	919.768	4.737.171	194.160	306,2189	63.406	567,2322	185,2375	299,4646
2009	972.249	4.799.252	202.583	312,6866	64.788	591,8417	189,2764	294,1531
2010	1.016.975	4.858.199	209.332	320,1493	65.386	611,5566	191,0223	311,8700
2011	1.068.821	4.920.305	217.227	324,3781	66.967	634,6212	195,6424	338,1849
2012	1.127.161	4.985.870	226.071	326,6169	69.216	660,4602	202,2125	364,0125
2013	1.194.434	5.051.275	236.462	333,8308	70.833	690,8166	206,9361	370,5751
2014	1.255.670	5.109.056	245.773	340,5473	72.170	718,0199	210,8430	412,4460
2015	1.312.394	5.165.802	254.054	347,6988	73.067	742,2123	213,4642	442,3393

Appendix 10. Figure 8.4

Year	Unemployment Rate Oslo	Real House Price Index (1980=100)
1980	0,50%	100,00
1981	0,60%	117,03
1982	1,10%	116,84
1983	1,80%	126,61
1984	1,70%	136,06
1985	1,10%	136,61
1986	0,50%	156,56
1987	0,50%	171,56
1988	1,00%	160,80
1989	2,80%	135,71
1990	4,30%	115,35
1991	5,10%	104,99
1992	6,08%	95,25
1993	5,84%	96,73
1994	5,69%	105,37
1995	5,19%	110,02
1996	4,60%	122,10
1997	3,80%	140,81
1998	2,80%	162,26
1999	2,60%	183,55
2000	2,60%	209,45
2001	2,80%	214,28
2002	3,80%	231,48
2003	4,90%	228,13
2004	5,10%	236,83
2005	4,60%	257,51
2006	3,40%	290,01
2007	2,48%	322,06
2008	2,20%	299,46
2009	3,40%	294,15
2010	3,80%	311,87
2011	3,30%	338,18
2012	3,16%	364,01
2013	3,40%	370,58
2014	3,60%	412,45
2015	3,50%	442,34

Appendix 11. Figure 8.5

Year	Nominal Interest Rate in %	Real Interest Rate in %	Nominal Key rate in %	CPI	Real Key Rate in %	Real HPI Oslo
1980	12,4%	1,5%		100		100
1981	13,2%	-0,4%		113,43		117,03
1982	13,8%	2,5%	11,03%	126,37	8,73%	116,84
1983	13,8%	5,4%	10,06%	137,06	7,34%	126,61
1984	13,4%	7,2%	10,80%	145,77	7,41%	136,06
1985	13,4%	7,9%	11,36%	153,98	7,37%	136,61
1986	16,0%	8,9%	14,16%	164,93	8,59%	156,56
1987	16,8%	8,3%	13,90%	179,35	7,75%	171,56
1988	16,4%	10,1%	13,08%	191,29	6,84%	160,80
1989	14,4%	10,3%	10,60%	200,00	5,30%	135,71
1990	14,2%	10,6%	10,82%	208,21	5,20%	115,35
1991	13,7%	10,8%	8,34%	215,42	3,87%	104,99
1992	13,8%	12,0%	9,50%	220,40	4,31%	95,25
1993	8,9%	6,9%	6,50%	225,37	2,88%	96,73
1994	8,2%	7,0%	4,78%	228,61	2,09%	105,37
1995	7,5%	5,2%	4,75%	234,33	2,03%	110,02
1996	6,6%	5,4%	4,48%	237,06	1,89%	122,10
1997	6,0%	3,4%	3,38%	243,28	1,39%	140,81
1998	9,7%	7,5%	5,51%	248,76	2,22%	162,26
1999	7,6%	5,3%	6,35%	254,48	2,49%	183,55
2000	8,9%	5,8%	6,22%	262,44	2,37%	209,45
2001	8,6%	5,7%	6,98%	270,40	2,58%	214,28
2002	8,6%	7,4%	6,73%	273,88	2,46%	231,48
2003	4,7%	2,2%	4,21%	280,60	1,50%	228,13
2004	4,0%	3,6%	1,82%	281,84	0,65%	236,83
2005	4,0%	2,4%	1,92%	286,32	0,67%	257,51
2006	4,7%	2,4%	2,74%	292,79	0,94%	290,01
2007	6,7%	5,9%	4,38%	295,02	1,48%	322,06
2008	7,3%	3,5%	5,32%	306,22	1,74%	299,46
2009	4,3%	2,2%	1,75%	312,69	0,56%	294,15
2010	4,6%	2,1%	1,92%	320,15	0,60%	311,87
2011	5,0%	3,8%	2,14%	324,38	0,66%	338,18
2012	4,8%	4,0%	1,55%	326,62	0,48%	364,01
2013	4,7%	2,6%	1,50%	333,83	0,45%	370,58
2014	4,4%	2,4%	1,49%	340,55	0,44%	412,45
2015	3,6%	1,5%	1,05%	347,70	0,30%	442,34

Appendix 12. Figure 8.6

Year	Total Population in Oslo	Year	Total Population in Oslo
1980	454.872	2006	538.411
1981	452.023	2007	548.617
1982	450.386	2008	560.484
1983	448.775	2009	575.475
1984	447.257	2010	586.860
1985	447.351	2011	599.230
1986	449.395	2012	613.285
1987	451.345	2013	623.966
1988	453.730	2014	634.463
1989	456.124	2015	648.576
1990	458.364	*E2016*	*657.836*
1991	461.644	*E2017*	*669.052*
1992	467.441	*E2018*	*679.673*
1993	473.454	*E2019*	*689.647*
1994	477.781	*E2020*	*699.267*
1995	483.401	*E2021*	*708.344*
1996	488.659	*E2022*	*717.098*
1997	494.793	*E2023*	*725.534*
1998	499.693	*E2024*	*733.648*
1999	502.867	*E2025*	*741.473*
2000	507.467	*E2026*	*749.056*
2001	508.726	*E2027*	*756.248*
2002	512.589	*E2028*	*763.141*
2003	517.401	*E2029*	*769.716*
2004	521.886	*E2030*	*776.057*
2005	529.846		

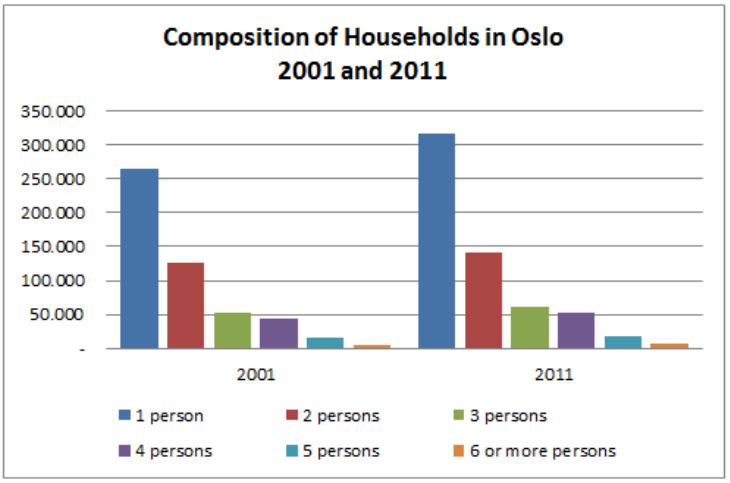
Appendix 13. Figure 8.7 and Figure 8.8

Year	Net Immigration	Excess of Births	Population Growth
1980	-2.052	-875	-2.849
1981	-998	-1.177	-1.637
1982	-954	-697	-1.611
1983	-459	-1.127	-1.518
1984	1.001	-993	94
1985	2.699	-852	2.044
1986	2.428	-294	1.950
1987	2.485	-399	2.385
1988	1.791	137	2.394
1989	1.249	759	2.240
1990	2.284	1.017	3.280
1991	4.863	1.047	5.797
1992	4.640	1.345	6.013
1993	3.440	1.047	4.327
1994	3.747	1.785	5.620
1995	3.543	1.709	5.258
1996	4.221	2.066	6.134
1997	3.501	2.313	4.900
1998	908	2.292	3.174
1999	2.340	2.231	4.600
2000	-1.356	2.594	1.259
2001	1.488	2.386	3.863
2002	2.190	2.541	4.812
2003	1.214	3.264	4.485
2004	3.829	3.809	7.960
2005	4.355	4.245	8.565
2006	5.845	4.736	10.206
2007	7.041	4.879	11.867
2008	9.732	5.395	14.991
2009	5.587	5.871	11.385
2010	6.535	5.959	12.370
2011	8.325	5.818	14.055
2012	5.080	5.771	10.681
2013	4.904	5.721	10.497
2014	7.189	6.198	13.213

Year	Urbanization
1994	20.623
1995	22.202
1996	23.147
1997	22.890
1998	22.469
1999	23.549
2000	23.428
2001	25.104
2002	22.431
2003	22.828
2004	24.195
2005	23.832
2006	25.902
2007	26.292
2008	24.147
2009	24.329
2010	26.063
2011	28.214
2012	28.698
2013	28.840
2014	29.590
2015	31.560

Appendix 14. Composition of Households and Persons per Private Household

Year	1 person	2 persons	3 persons	4 persons	5 persons	6 or more persons
2001	264.538	126.673	53.416	43.750	15.262	6.105
2011	316.993	140.819	60.522	53.331	19.175	7.191



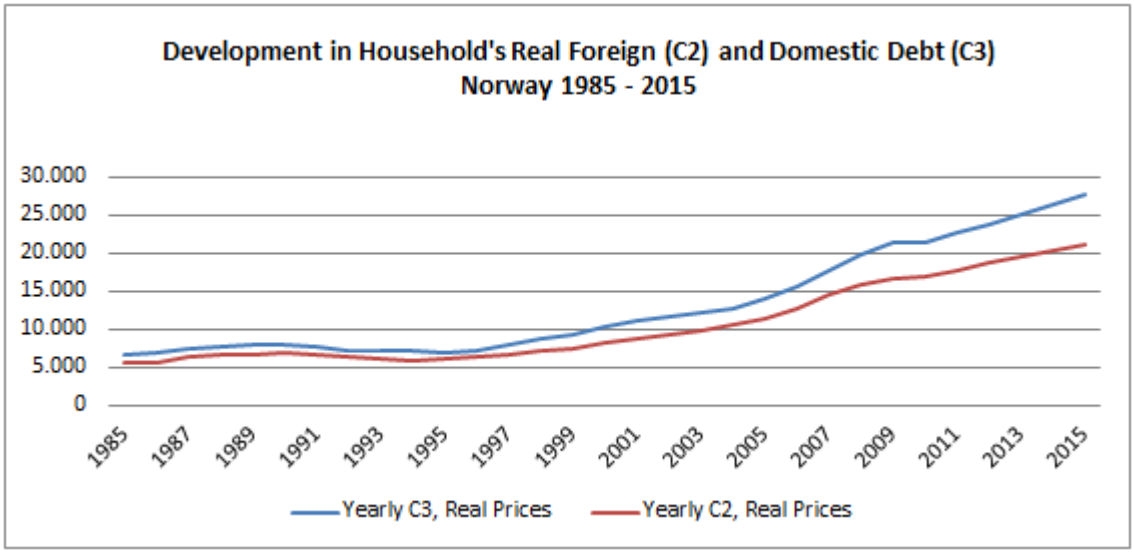
Persons per Private Household			
1980	2,01	**2009**	1,86
1990	1,85	**2010**	1,88
2001	1,90	**2011**	1,89
2005	1,89	**2012**	1,91
2006	1,88	**2013**	1,91
2007	1,87	**2014**	1,88
2008	1,86		

Appendix 15. Figure 8.9

Year	Real House Price Index (1980=100)	Actual Population	Population Growth Index (1980=100)
1980	100	454.872	100
1981	117,0299	452.023	99,3737
1982	116,8371	450.386	99,0138
1983	126,6070	448.775	98,6596
1984	136,0582	447.257	98,3259
1985	136,6055	447.351	98,3466
1986	156,5635	449.395	98,7959
1987	171,5561	451.345	99,2246
1988	160,8000	453.730	99,7489
1989	135,7137	456.124	100,2752
1990	115,3484	458.364	100,7677
1991	104,9869	461.644	101,4888
1992	95,2542	467.441	102,7632
1993	96,7265	473.454	104,0851
1994	105,3659	477.781	105,0364
1995	110,0237	483.401	106,2719
1996	122,0962	488.659	107,4278
1997	140,8126	494.793	108,7763
1998	162,2640	499.693	109,8535
1999	183,5545	502.867	110,5513
2000	209,4503	507.467	111,5626
2001	214,2775	508.726	111,8394
2002	231,4780	512.589	112,6886
2003	228,1287	517.401	113,7465
2004	236,8265	521.886	114,7325
2005	257,5148	529.846	116,4824
2006	290,0105	538.411	118,3654
2007	322,0551	548.617	120,6091
2008	299,4646	560.484	123,2180
2009	294,1531	575.475	126,5136
2010	311,8700	586.860	129,0165
2011	338,1849	599.230	131,7360
2012	364,0125	613.285	134,8258
2013	370,5751	623.966	137,1740
2014	412,4460	634.463	139,4817
2015	442,3393	648.576	142,5843

Appendix 16. Figure 8.10 and Development in Household's Real Foreign and Domestic Debt

Year	Yearly C3, Nominal Prices	Yearly C2, Nominal Prices	CPI (1985 = 100)	Yearly C3, Real Prices	Yearly C2, Real Prices	Nominal C3 Index (1985 = 100)	Real C3 Index (1985 = 100)	Nominal Index C2 (1985 = 100)	Real C2 Index (1985 = 100)	Real House Price Index (1985 = 100)
1985	668.576	543.932	100,00	6.685,76	5.439,32	100	100	100	100	100,00
1986	739.556	608.081	107,11	6.904,75	5.677,25	110,62	103,28	111,79	104,37	114,61
1987	857.353	726.692	116,48	7.360,63	6.238,87	128,24	110,09	133,60	114,70	125,59
1988	948.748	812.421	124,23	7.636,86	6.539,52	141,91	114,23	149,36	120,23	117,71
1989	1.019.337	873.795	129,89	7.847,88	6.727,36	152,46	117,38	160,64	123,68	99,35
1990	1.057.767	920.483	135,22	7.822,67	6.807,39	158,21	117,00	169,23	125,15	84,44
1991	1.070.350	926.277	139,90	7.650,65	6.620,85	160,09	114,43	170,29	121,72	76,85
1992	1.029.355	890.769	143,13	7.191,54	6.223,32	153,96	107,57	163,76	114,41	69,73
1993	1.036.704	876.557	146,37	7.083,00	5.988,84	155,06	105,94	161,15	110,10	70,81
1994	1.045.274	883.167	148,47	7.040,53	5.948,65	156,34	105,31	162,37	109,36	77,13
1995	1.058.501	910.979	152,18	6.955,54	5.986,16	158,32	104,04	167,48	110,05	80,54
1996	1.109.340	961.796	153,96	7.205,47	6.247,14	165,93	107,77	176,82	114,85	89,38
1997	1.242.063	1.050.054	158,00	7.861,32	6.646,05	185,78	117,58	193,05	122,19	103,08
1998	1.404.958	1.154.435	161,55	8.696,69	7.145,95	210,14	130,08	212,24	131,38	118,78
1999	1.540.081	1.243.545	165,27	9.318,77	7.524,48	230,35	139,38	228,62	138,33	134,37
2000	1.755.203	1.385.578	170,44	10.298,30	8.129,60	262,53	154,03	254,73	149,46	153,32
2001	1.934.882	1.543.451	175,61	11.018,33	8.789,29	289,40	164,80	283,76	161,59	156,86
2002	2.068.390	1.669.922	177,87	11.628,82	9.388,57	309,37	173,93	307,01	172,61	169,45
2003	2.201.503	1.793.249	182,23	12.080,94	9.840,61	329,28	180,70	329,68	180,92	167,00
2004	2.332.455	1.931.482	183,04	12.743,07	10.552,41	348,87	190,60	355,10	194,00	173,37
2005	2.610.191	2.136.906	185,95	14.037,43	11.492,14	390,41	209,96	392,86	211,28	188,51
2006	2.980.097	2.438.142	190,15	15.672,73	12.822,52	445,74	234,42	448,24	235,74	212,30
2007	3.414.597	2.783.268	191,60	17.821,55	14.526,50	510,73	266,56	511,69	267,06	235,76
2008	3.947.544	3.146.805	198,87	19.849,96	15.823,50	590,44	296,90	578,53	290,91	219,22
2009	4.326.704	3.373.020	203,07	21.306,52	16.610,18	647,15	318,69	620,12	305,37	215,33
2010	4.439.139	3.524.114	207,92	21.350,64	16.949,70	663,97	319,34	647,90	311,61	228,30
2011	4.786.504	3.739.488	210,66	22.721,21	17.751,10	715,93	339,84	687,49	326,35	247,56
2012	5.063.766	3.991.405	212,12	23.872,59	18.817,06	757,40	357,07	733,81	345,95	266,47
2013	5.467.459	4.245.580	216,80	25.218,75	19.582,81	817,78	377,20	780,53	360,02	271,27
2014	5.828.688	4.502.686	221,16	26.354,70	20.359,11	871,81	394,19	827,80	374,30	301,92
2015	6.302.434	4.792.959	225,81	27.910,64	21.225,85	942,67	417,46	881,17	390,23	323,81



Appendix 17. Figure 8.11

Year	DTI-Ratio in Percent	DTI-Ratio Index	Real House Price Index (1980=100)
1980	114%	100,00	100,00
1981	111%	97,45	117,03
1982	113%	99,39	116,84
1983	117%	102,63	126,61
1984	125%	109,48	136,06
1985	142%	124,58	136,61
1986	157%	138,10	156,56
1987	176%	154,52	171,56
1988	181%	158,65	160,80
1989	178%	156,19	135,71
1990	172%	151,19	115,35
1991	160%	140,47	104,99
1992	148%	130,29	95,25
1993	139%	121,86	96,73
1994	136%	119,49	105,37
1995	123%	108,34	110,02
1996	125%	109,57	122,10
1997	127%	111,59	140,81
1998	126%	110,18	162,26
1999	129%	113,52	183,55
2000	135%	118,79	209,45
2001	148%	130,11	214,28
2002	148%	129,76	231,48
2003	151%	132,92	228,13
2004	155%	136,44	236,83
2005	167%	146,88	257,51
2006	199%	174,63	290,01
2007	207%	182,09	322,06
2008	207%	181,74	299,46
2009	206%	181,04	294,15
2010	211%	185,51	311,87
2011	216%	189,46	338,18
2012	219%	192,36	364,01
2013	221%	194,29	370,58
2014	224%	196,75	412,45
2015	230%	201,93	442,34

Appendix 18. Figure 8.12

Year	Nominal Interest Burden in % of Disposable Income	Nominal Lending rate in %
1980	4,5%	12,4%
1981	5,1%	13,2%
1982	5,7%	13,8%
1983	6,3%	13,8%
1984	6,3%	13,4%
1985	7,0%	13,4%
1986	8,6%	16,0%
1987	11,3%	16,8%
1988	12,2%	16,4%
1989	11,6%	14,4%
1990	11,4%	14,2%
1991	10,5%	13,7%
1992	11,1%	13,8%
1993	9,0%	8,9%
1994	7,2%	8,2%
1995	6,7%	7,5%
1996	6,2%	6,6%
1997	5,0%	6,0%
1998	5,6%	9,7%
1999	6,4%	7,6%
2000	6,4%	8,9%
2001	7,4%	8,6%
2002	7,6%	8,6%
2003	6,5%	4,7%
2004	4,8%	4,0%
2005	4,7%	4,0%
2006	5,3%	4,7%
2007	7,0%	6,7%
2008	8,9%	7,3%
2009	6,3%	4,3%
2010	5,6%	4,6%
2011	5,9%	5,0%
2012	6,3%	4,8%
2013	6,4%	4,7%
2014	6,3%	4,4%
2015	5,6%	3,6%

Appendix 19. Figure 8.13 and Figure 8.14

Year	Completed Dwellings	Population in Oslo	Households	New Households	Gap
1982		450.386	224.073		
1983	4546	448.775	223.271	-801	5.347
1984	3120	447.257	222.516	-755	3.875
1985	2268	447.351	222.563	47	2.221
1986	2685	449.395	223.580	1.017	1.668
1987	3032	451.345	224.550	970	2.062
1988	3304	453.730	225.736	1.187	2.117
1989	2814	456.124	226.927	1.191	1.623
1990	3539	458.364	247.764	20.837	-17.298
1991	2181	461.644	249.537	1.773	408
1992	863	467.441	252.671	3.134	-2.271
1993	908	473.454	255.921	3.250	-2.342
1994	1314	477.781	258.260	2.339	-1.025
1995	1856	483.401	261.298	3.038	-1.182
1996	1092	488.659	264.140	2.842	-1.750
1997	1420	494.793	267.456	3.316	-1.896
1998	1037	499.693	270.104	2.649	-1.612
1999	1583	502.867	271.820	1.716	-133
2000	1035	507.467	267.088	-4.732	5.767
2001	818	508.726	267.751	663	155
2002	1685	512.589	269.784	2.033	-348
2003	1618	517.401	272.316	2.533	-915
2004	3470	521.886	274.677	2.361	1.109
2005	4049	529.846	280.342	5.665	-1.616
2006	3960	538.411	286.389	6.047	-2.087
2007	3709	548.617	293.378	6.989	-3.280
2008	2524	560.484	301.335	7.957	-5.433
2009	3447	575.475	309.395	8.060	-4.613
2010	2095	586.860	312.160	2.764	-669
2011	1333	599.230	317.053	4.893	-3.560
2012	3861	613.285	321.092	4.039	-178
2013	3287	623.966	326.684	5.592	-2.305
2014	3349	634.463	337.480	10.797	-7.448
2015	2041	648.576	344.987	7.507	-5.466

Year	Persons per Household
1980	2,01
1990	1,85
2001	1,9
2005	1,89
2006	1,88
2007	1,87
2008	1,86
2009	1,86
2010	1,88
2011	1,89
2012	1,91
2013	1,91
2014	1,88

Appendix 20. Figure 8.16, Figure 8.17 and Figure 8.18

Year	Real House Price	Real Building Cost	Nom. Site Cost Avg H AK	Site cost in % of Building Cost*	Real Site Cost	Real House Price Index (1980=100)	Real Site Cost Index (1980=100)
1980	3.605,00	3.145,96		*43,3%*		100	100
1981	4.218,88	3.211,85		*43,3%*		117,0299	102,0946
1982	4.211,98	3.471,49		*43,3%*		116,8371	110,3477
1983	4.564,20	2.909,37		*43,3%*		126,6070	92,4796
1984	4.904,88	2.916,92		*43,3%*		136,0582	92,7195
1985	4.946,74	2.905,44		*43,3%*		136,6055	92,3545
1986	5.552,81	3.001,60		*43,3%*		156,5635	95,4114
1987	5.965,32	3.297,13		*43,3%*		171,5561	104,8053
1988	5.578,34	3.653,49		*43,3%*		160,8000	116,1328
1989	4.776,50	3.644,88		*43,3%*		135,7137	115,8591
1990	3.993,58	3.299,33		*43,3%*		115,3484	104,8753
1991	3.623,57	3.073,59		*43,3%*		104,9869	97,6996
1992	3.331,70	2.750,92		*43,3%*		95,2542	87,4430
1993	3.326,04	2.548,08		*43,3%*		96,7265	80,9955
1994	3.619,75	2.274,17		*43,3%*		105,3659	72,2887
1995	3.822,84	2.415,53		*43,3%*		110,0237	76,7821
1996	4.228,80	2.599,59		*43,3%*		122,0962	82,6326
1997	4.879,90	2.676,14		46,1%		140,8126	90,4347
1998	5.624,78	2.927,90		51,5%		162,2640	110,5564
1999	6.384,06	3.094,40		54,6%		183,5545	123,9212
2000	7.120,93	3.421,32		53,5%		209,4503	134,1348
2001	7.260,41	3.905,59		46,4%		214,2775	132,8982
2002	7.951,28	4.353,67		44,7%		231,4780	142,8230
2003	7.867,51	4.777,42		28,2%		228,1287	98,7951
2004	8.579,31	5.438,87		30,7%		236,8265	122,2984
2005	9.328,43	6.270,49		33,5%		257,5148	153,9401
2006	10.504,94	6.278,47		39,2%		290,0105	180,3469
2007	11.668,17	6.627,58		49,2%		322,0551	239,1349
2008	10.849,75	6.227,29		37,5%		299,4646	171,1783
2009	10.655,72	6.720,94		34,7%		294,1531	171,2144
2010	11.298,17	6.087,86		41,3%		311,8700	184,4039
2011	12.250,83	6.929,16		47,2%		338,1849	239,8780
2012	13.166,50	7.971,25		43,4%		364,0125	253,7268
2013	13.419,67	7.499,46		48,8%		370,5751	268,1986
2014	14.935,96	8.136,82		49,0%		412,4460	292,5021
2015	16.237,92	10.173,69		44,1%		442,3393	329,3911

* The average site cost in percent of building cost from 1997-2015 are 43.3%

Appendix 21. Figure 8.19

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
2009	45	37	29	28	27	23	33	27	24	26	23	32	29,50
2010	30	28	30	42	23	21	37	26	24	24	22	33	28,33
2011	24	26	19	20	17	19	27	18	18	19	19	21	20,58
2012	19	16	16	17	16	17	24	17	17	15	18	22	17,83
2013	17	15	16	18	17	17	28	20	21	24	27	33	21,08
2014	37	32	26	23	18	16	31	24	21	20	21	25	24,50
2015	21	17	15	16	12	13	21	16	16	17	17	24	17,08

Appendix 22. Expectations of Future Economy and Figure 9.1

NORWAY	Expectations:	2015
Norwegian Economy next 12 months	Better	14%
	Worse	37%
	Unchanged	48%
	Don't know	4%
Personal economy next 12 months	Better	25%
	Worse	10%
	Unchanged	64%
	Don't know	2%
OSLO	**Expectations:**	**2015**
Norwegian Economy next 12 months	Better	18%
	Worse	31%
	Unchanged	46%
	Don't know	5%
Personal economy next 12 months	Better	28%
	Worse	11%
	Unchanged	59%
	Don't know	2%

Figure 9.1

Year	Oslo and Akershus	Norway
2010	66%	61%
2011	71%	61%
2012	73%	62%
2013	50%	42%
2014	56%	45%
2015	60%	41%

Appendix 23. Figure 9.2 and Figure 9.3

Quarterly Data	CCI	Quarterly Data	CCI	Quarterly Data	CCI
1992Q3	-17,4056	**2000Q2**	18,9903	**2008Q1**	21,59156
1992Q4	-16,65091	**2000Q3**	18,46526	**2008Q2**	12,9617
1993Q1	-10,52067	**2000Q4**	18,93895	**2008Q3**	1,23904
1993Q2	4,33862	**2001Q1**	15,21164	**2008Q4**	-8,48398
1993Q3	17,06414	**2001Q2**	13,40849	**2009Q1**	-8,72109
1993Q4	24,94243	**2001Q3**	12,81394	**2009Q2**	0,45673
1994Q1	28,5015	**2001Q4**	14,38803	**2009Q3**	11,36706
1994Q2	27,87696	**2002Q1**	19,54267	**2009Q4**	17,76001
1994Q3	26,4461	**2002Q2**	19,13242	**2010Q1**	17,02465
1994Q4	26,80648	**2002Q3**	10,92866	**2010Q2**	17,67088
1995Q1	26,88197	**2002Q4**	2,12674	**2010Q3**	22,91537
1995Q2	28,22157	**2003Q1**	-1,97275	**2010Q4**	28,78765
1995Q3	32,08436	**2003Q2**	2,62	**2011Q1**	29,69523
1995Q4	33,95389	**2003Q3**	14,40888	**2011Q2**	26,15522
1996Q1	33,96	**2003Q4**	23,60423	**2011Q3**	19,12015
1996Q2	31,83412	**2004Q1**	26,53716	**2011Q4**	14,88634
1996Q3	30,81759	**2004Q2**	26,83097	**2012Q1**	17,75775
1996Q4	32,98142	**2004Q3**	27,58243	**2012Q2**	22,73972
1997Q1	34,90779	**2004Q4**	30,56444	**2012Q3**	25,45787
1997Q2	33,70635	**2005Q1**	31,05309	**2012Q4**	27,14522
1997Q3	33,4064	**2005Q2**	30,56156	**2013Q1**	26,60123
1997Q4	33,53742	**2005Q3**	29,71401	**2013Q2**	23,28692
1998Q1	30,44603	**2005Q4**	28,14502	**2013Q3**	19,72975
1998Q2	21,98661	**2006Q1**	27,06368	**2013Q4**	17,51983
1998Q3	9,14195	**2006Q2**	26,31784	**2014Q1**	16,71672
1998Q4	-1,88895	**2006Q3**	25,82344	**2014Q2**	18,52129
1999Q1	-0,78966	**2006Q4**	27,78382	**2014Q3**	19,03551
1999Q2	10,81822	**2007Q1**	31,17308	**2014Q4**	13,95207
1999Q3	20,73641	**2007Q2**	29,27514	**2015Q1**	6,66366
1999Q4	24,66301	**2007Q3**	27,51405	**2015Q2**	-0,18081
2000Q1	22,98466	**2007Q4**	25,38735	**2015Q3**	-4,14985

Figure 9.3

Year	Average CCI	Change in Real House Prices
1992	-17,0283	-9,3%
1993	8,9561	1,5%
1994	27,4078	8,9%
1995	30,2854	4,4%
1996	32,3983	11,0%
1997	33,8895	15,3%
1998	14,9214	15,2%
1999	13,8570	13,1%
2000	19,8448	14,1%
2001	13,9555	2,3%
2002	12,9326	8,0%
2003	9,6651	-1,4%
2004	27,8788	3,8%
2005	29,8684	8,7%
2006	26,7472	12,6%
2007	28,3374	11,0%
2008	6,8271	-7,0%
2009	5,2157	-1,8%
2010	21,5996	6,0%
2011	22,4642	8,4%
2012	23,2751	7,6%
2013	21,7844	1,8%
2014	17,0564	11,3%
2015	0,7777	7,2%

Appendix 24. Figure 9.4

Month	Sell first	Buy first	Month	Sell first	Buy first	Month	Sell first	Buy first
01-05-2007	36,1%	33,8%	01-01-2010	50,1%	23,5%	01-12-2011	46,0%	29,0%
01-06-2007	48,0%	30,0%	01-02-2010	52,0%	24,0%	01-02-2012	46,0%	33,0%
01-08-2007	48,1%	30,2%	01-03-2010	54,0%	23,0%	01-04-2012	46,0%	29,0%
01-11-2007	50,9%	23,3%	01-04-2010	52,0%	24,0%	01-06-2012	42,0%	30,0%
01-01-2008	50,2%	21,4%	01-05-2010	52,0%	21,0%	01-10-2012	41,0%	29,0%
01-03-2008	53,4%	22,3%	01-06-2010	52,0%	22,0%	01-11-2012	46,0%	33,0%
01-08-2008	61,3%	15,5%	01-08-2010	51,0%	25,0%	01-02-2013	42,0%	36,0%
01-10-2008	69,9%	9,9%	01-09-2010	53,0%	25,0%	01-04-2013	38,0%	32,0%
01-11-2008	71,2%	8,1%	01-10-2010	50,0%	25,0%	01-06-2013	36,0%	31,0%
01-12-2008	67,8%	9,5%	01-11-2010	50,0%	24,0%	01-10-2013	38,0%	27,0%
01-01-2009	65,0%	9,9%	01-12-2010	50,0%	25,0%	01-11-2013	48,0%	29,0%
01-02-2009	65,0%	10,4%	01-01-2011	46,0%	29,0%	01-02-2014	46,0%	28,0%
01-03-2009	63,5%	12,0%	01-02-2011	44,0%	27,0%	01-03-2014	46,0%	28,0%
01-04-2009	64,3%	11,3%	01-03-2011	46,0%	27,0%	01-06-2014	47,0%	30,0%
01-05-2009	62,5%	14,6%	01-04-2011	45,0%	26,0%	01-10-2014	42,0%	33,0%
01-06-2009	60,8%	15,1%	01-05-2011	44,0%	29,0%	01-12-2014	42,0%	30,0%
01-08-2009	62,8%	16,2%	01-06-2011	44,0%	27,0%	01-01-2015	57,0%	28,0%
01-09-2009	60,5%	17,3%	01-08-2011	44,0%	29,0%	01-06-2015	57,0%	33,0%
01-10-2009	59,1%	19,8%	01-09-2011	45,0%	28,0%	01-09-2015	57,0%	30,0%
01-11-2009	57,9%	19,7%	01-10-2011	47,0%	30,0%	01-12-2015	58,0%	31,0%
01-12-2009	56,1%	19,8%	01-11-2011	49,0%	27,0%	01-03-2016	62,0%	27,0%

Appendix 25. Histograms, Classifications and Figure 10.1

Histograms

Change in Population Growth	
Bin	Frequency
-0,63%	1
-0,08%	4
0,47%	4
1,02%	11
1,57%	6
2,12%	6
More	4

Change in Disposable Income	
Bin	Frequency
-5,90%	1
-2,29%	0
1,32%	1
4,92%	12
8,53%	15
12,14%	5
More	2

Change in Replacement Cost	
Bin	Frequency
-10,13%	1
-4,53%	5
1,07%	4
6,68%	3
12,28%	11
17,88%	6
More	6

Change in GDP	
Bin	Frequency
-7,95%	1
-3,58%	0
0,78%	2
5,15%	13
9,52%	10
13,89%	7
More	3

Change in Unemployment Rate	
Bin	Frequency
-1,20%	1
-0,70%	3
-0,20%	8
0,30%	13
0,80%	4
1,30%	5
More	2

Classifications

Unemployment Rate	Classification
>1 %	-5
0,8 %;1 %	-4
0,6%;0,8 %	-3
0,4%;0,6%	-2
0,2 %;0,4 %	-1
-0,2%;0,2%	0
-0,4%;-0,2%	1
-0,6 %;-0,4%	2
-0,8 %; -0,6%	3
-1%;-0,8%	4
<-1%	5

Population Growth	Classification
>2,5 %	5
2 %;2,5 %	4
1,5%;2 %	3
1 %;1,5 %	2
0,2 %;1 %	1
0,2 %;-0,2%	0
-0,2%;-1%	-1
-1 %;-1,5%	-2
-1,5 %; -2%	-3
-2%;-2,5%	-4
<-2,5%	-5

Replacement Cost	Classification
>15%	5
12%;15%	4
9%:12%	3
6%;9%	2
3%;6%	1
-3%;3%	0
-3%;-6%	-1
-6%;-9%	-2
-9%;-12%	-3
-12%;-15%	-4
<-15%	-5

GDP	Classification
>12 %	5
9,5 %;12%	4
7 %; 9,5 %	3
4,5%;7 %	2
2 %;4,5 %	1
-2%; 2 %	0
-4,5 %; -2%	-1
-7%;-4,5%	-2
-9,5%;-7%	-3
-12%;-9,5%	-4
<-12%	-5

Disposable Income	Classification
>10%	5
8 %;10%	4
6 %; 8 %	3
4%;6%	2
2 %;4%	1
-2%; 2 %	0
-4 %; -2 %	-1
-6%;-4%	-2
-8%;-6%	-3
-10%;-8%	-4
<-10%	-5

LOCAL												
Year	Change in Unemployment Rate	Classification	Weight	Change in Population Growth	Classification	Weight	Change in Nominal Replacement Cost	Classification	Weight	Average Classification	Average Weight	Score
1979												
1980	-0,1%	0	1,5	-0,56%	-1	2	8,87%	2	2,5	0,33	2,00	**0,7**
1981	0,1%	0	1,5	-0,63%	-1	2	15,81%	5	2,5	1,33	2,00	**2,7**
1982	0,5%	-2	1,5	-0,36%	-1	2	20,41%	5	2,5	0,67	2,00	**1,3**
1983	0,7%	-3	1,5	-0,36%	-1	2	-9,10%	-3	2,5	-2,33	2,00	**-4,7**
1984	-0,1%	0	1,5	-0,34%	-1	2	6,63%	2	2,5	0,33	2,00	**0,7**
1985	-0,6%	3	1,5	0,02%	0	2	5,22%	1	2,5	1,33	2,00	**2,7**
1986	-0,6%	3	1,5	0,46%	1	2	10,65%	3	2,5	2,33	2,00	**4,7**
1987	0,0%	0	1,5	0,43%	1	2	19,46%	5	2,5	2,00	2,00	**4,0**
1988	0,5%	-2	1,5	0,53%	1	2	18,19%	5	2,5	1,33	2,00	**2,7**
1989	1,8%	-5	1,5	0,53%	1	2	4,30%	1	2,5	-1,00	2,00	**-2,0**
1990	1,5%	-5	1,5	0,49%	1	2	-5,76%	-1	2,5	-1,67	2,00	**-3,3**
1991	0,8%	-3	1,5	0,72%	1	2	-3,61%	-1	2,5	-1,00	2,00	**-2,0**
1992	1,0%	-4	1,5	1,26%	2	2	-8,43%	-2	2,5	-1,33	2,00	**-2,7**
1993	-0,2%	1	1,5	1,29%	2	2	-5,28%	-1	2,5	0,67	2,00	**1,3**
1994	-0,2%	0	1,5	0,91%	1	2	-9,47%	-3	2,5	-0,67	2,00	**-1,3**
1995	-0,5%	2	1,5	1,18%	2	2	8,87%	2	2,5	2,00	2,00	**4,0**
1996	-0,6%	2	1,5	1,09%	2	2	8,88%	2	2,5	2,00	2,00	**4,0**
1997	-0,8%	4	1,5	1,26%	2	2	7,66%	2	3	2,67	2,17	**5,8**
1998	-0,99%	4	1,5	0,99%	1	2	16,01%	5	3	3,33	2,17	**7,2**
1999	-0,2%	1	1,5	0,64%	1	2	10,34%	3	3	1,67	2,17	**3,6**
2000	0,0%	0	1,5	0,91%	1	2	13,18%	4	3	1,67	2,17	**3,6**
2001	0,2%	0	1,5	0,25%	1	2	12,21%	4	3	1,67	2,17	**3,6**
2002	1,0%	-4	1,5	0,76%	1	2	11,62%	3	3	0,00	2,17	**0,0**
2003	1,1%	-5	1,5	0,94%	1	2	-0,42%	0	3	-1,33	2,17	**-2,9**
2004	0,2%	0	1,5	0,87%	1	2	16,55%	5	3	2,00	2,17	**4,3**
2005	-0,5%	2	1,5	1,53%	3	2,5	19,64%	5	3	3,33	2,33	**7,8**
2006	-1,2%	5	1,5	1,62%	3	2,5	6,76%	2	3	3,33	2,33	**7,8**
2007	-0,9%	4	1,5	1,90%	3	2,5	14,04%	4	3	3,67	2,33	**8,6**
2008	-0,3%	1	1,5	2,16%	4	2,5	-10,13%	-3	3	0,67	2,33	**1,6**
2009	1,2%	-5	1,5	2,67%	5	2,5	8,01%	2	3	0,67	2,33	**1,6**
2010	0,4%	-1	1,5	1,98%	3	2,5	-2,74%	0	3	0,67	2,33	**1,6**
2011	-0,5%	2	1,5	2,11%	4	2,5	20,14%	5	3	3,67	2,33	**8,6**
2012	-0,1%	0	1,5	2,35%	4	2,5	12,84%	4	3	2,67	2,33	**6,2**
2013	0,24%	-1	1,5	1,74%	3	2,5	-0,25%	0	3	0,67	2,33	**1,6**
2014	0,20%	0	1,5	1,68%	3	2,5	10,87%	3	3	2,00	2,33	**4,7**
2015	-0,1%	0	1,5	2,22%	4	2,5	23,49%	5	3	3,00	2,33	**7,0**

NATIONAL									
Year	Change in Nominal GDP Per Capita	Classification	Weight	Change in Nominal Disposable Income Per Capita	Classification	Weight	Average Classification	Average Weight	Score
1979									
1980	17,92%	5	1,5	12,32%	5	2	5,00	1,75	**8,8**
1981	14,31%	5	1,5	15,75%	5	2	5,00	1,75	**8,8**
1982	10,37%	4	1,5	10,86%	5	2	4,50	1,75	**7,9**
1983	10,80%	4	1,5	9,45%	4	2	4,00	1,75	**7,0**
1984	12,32%	5	1,5	9,62%	4	2	4,50	1,75	**7,9**
1985	10,73%	4	1,5	7,65%	3	2	3,50	1,75	**6,1**
1986	3,14%	1	1,5	8,49%	4	2	2,50	1,75	**4,4**
1987	8,67%	3	1,5	6,97%	3	2	3,00	1,75	**5,3**
1988	4,03%	1	1,5	5,40%	2	2	1,50	1,75	**2,6**
1989	6,14%	2	1,5	6,57%	3	2	2,50	1,75	**4,4**
1990	5,51%	2	1,5	6,52%	3	2	2,50	1,75	**4,4**
1991	4,95%	2	1,5	7,08%	3	2	2,50	1,75	**4,4**
1992	2,34%	1	1,5	6,00%	2	2	1,50	1,75	**2,6**
1993	4,58%	2	1,5	6,32%	3	2	2,50	1,75	**4,4**
1994	4,27%	1	1,5	3,00%	1	2	1,00	1,75	**1,8**
1995	6,76%	2	1,5	4,66%	2	2	2,00	1,75	**3,5**
1996	8,96%	3	1,5	4,71%	2	2	2,50	1,75	**4,4**
1997	7,66%	3	1,5	6,35%	3	2	3,00	1,75	**5,3**
1998	1,34%	0	1,5	8,20%	4	2	2,00	1,75	**3,5**
1999	8,13%	3	1,5	4,24%	2	2	2,50	1,75	**4,4**
2000	18,25%	5	1,5	6,15%	3	2	4,00	1,75	**7,0**
2001	3,19%	1	1,5	1,18%	0	2	0,50	1,75	**0,9**
2002	-0,74%	0	1,5	9,57%	4	2	2,00	1,75	**3,5**
2003	3,17%	1	1,5	7,15%	3	2	2,00	1,75	**3,5**
2004	9,42%	3	1,5	3,97%	1	2	2,00	1,75	**3,5**
2005	10,91%	4	1,5	8,94%	4	2	4,00	1,75	**7,0**
2006	10,57%	4	1,5	-5,90%	-2	2	1,00	1,75	**1,8**
2007	5,15%	2	1,5	6,71%	3	2	2,50	1,75	**4,4**
2008	9,56%	4	1,5	5,20%	2	2	3,00	1,75	**5,3**
2009	-7,95%	-3	1,5	4,34%	2	2	-0,50	1,75	**-0,9**
2010	5,31%	2	1,5	3,33%	1	2	1,50	1,75	**2,6**
2011	6,43%	2	1,5	3,77%	1	2	1,50	1,75	**2,6**
2012	4,81%	2	1,5	4,07%	2	2	2,00	1,75	**3,5**
2013	2,23%	1	1,5	4,60%	2	2	1,50	1,75	**2,6**
2014	1,54%	0	1,5	3,94%	1	2	0,50	1,75	**0,9**
2015	-1,51%	0	1,5	3,37%	1	2	0,50	1,75	**0,9**

RESULTS				
Year	Total Weights	Total Score	Weighted Fundamental Classification (FC)	Additional Factor
1979				
1980	3,75	9,42	2,51	1,25%
1981	3,75	11,42	3,04	1,25%
1982	3,75	9,21	2,46	1,00%
1983	3,75	2,33	0,62	0,25%
1984	3,75	8,54	2,28	1,00%
1985	3,75	8,79	2,34	1,00%
1986	3,75	9,04	2,41	1,00%
1987	3,75	9,25	2,47	1,00%
1988	3,75	5,29	1,41	0,50%
1989	3,75	2,38	0,63	0,25%
1990	3,75	1,04	0,28	0,00%
1991	3,75	2,38	0,63	0,25%
1992	3,75	-0,04	-0,01	0,00%
1993	3,75	5,71	1,52	0,75%
1994	3,75	0,42	0,11	0,00%
1995	3,75	7,50	2,00	1,00%
1996	3,75	8,38	2,23	1,00%
1997	3,92	11,03	2,82	1,25%
1998	3,92	10,72	2,74	1,25%
1999	3,92	7,99	2,04	1,00%
2000	3,92	10,61	2,71	1,25%
2001	3,92	4,49	1,15	0,50%
2002	3,92	3,50	0,89	0,25%
2003	3,92	0,61	0,16	0,00%
2004	3,92	7,83	2,00	1,00%
2005	4,08	14,78	3,62	1,25%
2006	4,08	9,53	2,33	1,00%
2007	4,08	12,93	3,17	1,25%
2008	4,08	6,81	1,67	0,75%
2009	4,08	0,68	0,17	0,00%
2010	4,08	4,18	1,02	0,50%
2011	4,08	11,18	2,74	1,25%
2012	4,08	9,72	2,38	1,00%
2013	4,08	4,18	1,02	0,50%
2014	4,08	5,54	1,36	0,50%
2015	4,08	7,88	1,93	0,75%

Additional factor		
Impact on House Prices	Factor Classification	Additional Factor
Very High Negative Impact	<-2.5	-1,25%
High Negative Impact	-2.5;-2	-1,00%
Medium Negative Impact	-2;-1,5	-0,75%
Moderate Negative Impact	-1,5;–1	-0,50%
Small Negative Impact	-1;-0,5	-0,25%
Neutral Impact	-0,5;0,5	0,00%
Small Positive Impact	0,5;1	0,25%
Moderate Positive Impact	1;1,5	0,50%
Medium Positive Impact	1,5;2	0,75%
High Positive Impact	2;2.5	1,00%
Very High Positive Impact	>2,5	1,25%

New Fundamental P/R-Ratio

Year	Nominal Mortgage rate (i)	After income tax mortgage rate (ia)	Property tax rate (T)	Recurring holding cost (f)	Expected house price inflation rate (pi)	Additional factor	New fundamental P/R ratio	Fundamental P/R ratio	Nominal Real P/R ratio
1980	*12,4%*	*8,9%*	*0*	*4%*	*11,0%*	*1,25%*	*147,49*	*51,87*	*9,44*
1981	*13,2%*	*9,5%*	*0*	*4%*	*13,4%*	*1,25%*	*-87,26*	*961,54*	*10,40*
1982	*13,8%*	*9,9%*	*0*	*4%*	*11,4%*	*1,00%*	*65,10*	*39,43*	*10,08*
1983	13,8%	9,9%	0	4%	8,5%	0,25%	19,28	18,40	11,34
1984	13,4%	9,6%	0	4%	6,4%	1,00%	16,01	13,80	12,34
1985	13,4%	9,6%	0	4%	5,6%	1,00%	14,19	12,43	11,44
1986	16,0%	11,5%	0	4%	7,1%	1,00%	13,48	11,88	11,16
1987	16,8%	12,1%	0	4%	8,7%	1,00%	15,63	13,52	9,77
1988	16,4%	11,8%	0	4%	6,7%	0,50%	11,62	10,98	9,04
1989	14,4%	10,4%	0	4%	4,6%	0,25%	10,51	10,24	9,04
1990	14,2%	10,2%	0	4%	4,1%	0,00%	9,88	9,88	8,35
1991	13,7%	9,9%	0	4%	3,5%	0,25%	9,89	9,65	7,87
1992	13,8%	9,9%	0	4%	2,3%	0,00%	8,59	8,59	7,33
1993	8,9%	6,4%	0	4%	2,3%	0,75%	13,59	12,33	7,35
1994	8,2%	5,9%	0	4%	1,4%	0,00%	11,76	11,76	7,86
1995	7,5%	5,4%	0	4%	2,5%	1,00%	16,95	14,49	7,75
1996	6,6%	4,8%	0	4%	1,2%	1,00%	15,26	13,24	8,29
1997	6,0%	4,3%	0	4%	2,6%	1,25%	22,37	17,48	8,49
1998	9,7%	7,0%	0	4%	2,2%	1,25%	13,27	11,38	9,16
1999	7,6%	5,5%	0	4%	2,3%	1,00%	16,20	13,94	10,03
2000	8,9%	6,4%	0	4%	3,1%	1,25%	16,51	13,68	10,96
2001	8,6%	6,2%	0	4%	3,0%	0,50%	14,94	13,90	11,08
2002	8,6%	6,2%	0	4%	1,3%	0,25%	11,57	11,25	12,42
2003	4,7%	3,4%	0	4%	2,5%	0,00%	20,48	20,48	13,57
2004	4,0%	2,9%	0	4%	0,4%	1,00%	18,25	15,43	15,30
2005	4,0%	2,9%	0	4%	1,6%	1,25%	24,81	18,94	16,18
2006	4,7%	3,4%	0	4%	2,3%	1,00%	24,49	19,67	17,99
2007	6,7%	4,8%	0	4%	0,8%	1,25%	14,76	12,46	17,29
2008	7,3%	5,3%	0	4%	3,8%	0,75%	21,25	18,33	15,55
2009	4,3%	3,1%	0	4%	2,1%	0,00%	20,02	20,02	15,96
2010	4,6%	3,3%	0	4%	2,5%	0,50%	23,19	20,78	16,32
2011	5,0%	3,6%	0	4%	1,2%	1,25%	19,42	15,63	17,03
2012	4,8%	3,5%	0	4%	0,8%	1,00%	17,68	15,02	17,56
2013	4,7%	3,4%	0	4%	2,1%	0,50%	20,90	18,93	17,71
2014	4,4%	3,2%	0	4%	2,0%	0,50%	21,22	19,19	19,68
2015	3,6%	2,6%	0	4%	2,1%	0,75%	26,73	22,26	20,98