HØGSKOLEN I OSLO
OG AKERSHUS

Helen A. Morales-Jensen and Jennie Quach

A study on how oil prices influence house prices in the Norwegian market

Master thesis in Master of Science in Business and Administration
Oslo and Akershus University College of Applied Sciences

ABSTRACT

The price level on housing has nearly increased by 75 percent since 2005 to 2014[1], while oil prices have faced a large decline since late June 2014. House prices continued to increase after the oil price drop. We analyse if there is any impact on house prices after the decline of oil prices in the Norwegian market, by using an empirical model by Jacobsen and Naug. Findings indicate that oil prices have a significant direct effect on house prices, which supports that there is a link between oil prices and house prices. However, we find that oil prices have a larger indirect effect on house prices. Interest rates, unemployment, and household expectations are the fundamental factors that were most affected by oil prices. Interest rate reacts quickly and strongly to oil price fluctuations, and gives house prices a fast impact. Unemployment and interest rates are the most important fundamental factors that explain the house prices. In short term, Stavanger was the only city that was significantly influenced after the oil price declined in 2014.

Prisnivået på boliger har økt med ca 75 prosent siden 2005 til 2014. Siden slutten av juni 2014 var det en stor nedgang i oljeprisene, og i denne perioden fortsatte boligprisene å stige. Vi analyserer om oljeprisfallet har en effekt på boligpriser i det norske markedet ved hjelp av en empirisk modell utredet av Jacobsen og Naug. Funnene fra analysen tyder på en signifikant direkte effekt på boligprisene, som gir støtte for at det eksisterer en sammenheng mellom oljepriser og boligpriser. Videre finner vi at oljepriser har en større indirekte effekt på boligprisene. Renter, arbeidsledighet og husholdningenes forventninger er de fundamentale faktorene som ble mest påvirket av oljepris. Rente reagerer raskt og sterkt på oljesvingninger, og har en rask effekt på boligprisene. Arbeidsledighet og renter er de viktigste fundamentale faktorene som forklarer boligprisene. Funnene viser at på kort sikt er Stavanger den eneste byen hvor boligprisene blir signifikant påvirket av oljepris fallet i 2014.

Høgskolen i Oslo og Akershus, Fakultet for Samfunnsfag
Oslo 2015

[1] http://www.aftenposten.no/okonomi/Hvorfor-er-boligprisene-sa-hoye-7690498.html

ACKNOWLEDGEMENTS

This thesis is a part of the Master of Science program in Business and Administration at Oslo and Akershus University College of Applied Sciences.

We wish to express our sincere gratitude to our supervisor, Jukka Lempa, for providing us advice with our thesis, as well as constructive feedback, guidance and motivation along the process of writing this thesis. We also want to express our gratitude to Øystein Strøm for providing us many good feedback and ideas to improve our thesis.

Oslo, May 29th 2015

Helen A. Morales-Jensen

Jennie Quach

CONTENT

Figures

Tables

1 INTRODUCTION

House prices in the Norwegian market have increased rapidly in the recent years, and this thesis is a result of our curiosity about the explanatory factors behind the huge increase of house prices. The main objective in this thesis is to investigate the relationship between house prices and oil prices in the Norwegian market. The relationship between house prices and oil prices are in focus because Norway is an oil nation and much of the country's revenues comes from oil activities. Oil is one of the main sources that have led Norway to become one of the world's richest countries. In the last few years, oil prices have increased significantly before the vast drop in June 2014. We find it interesting and want to investigate if this event would put a shift on the Norwegian economy, as well the impacts it has on the fundamental factors that drive the house prices. We are going to focus on the period after the oil price decline.

Subsequently, we came to the following research questions "*Is there a significant effect between oil prices and house prices, and how does oil prices affect prices in the Norwegian housing market?*"

We chose to use the house price model by Jacobsen and Naug in our analysis, because it is a well-used model in many published research articles and theses related to the housing market[2]. At the same time, there has been little research about the relationship between oil and house prices, and therefore we find it interesting to explore this bond.

We are going to present the relationship between oil prices, the Norwegian economy and house prices. Thereafter followed by an introduction of the Norwegian housing market and the fundamental factors that drive house prices. Before we move to the empirical house price model by Jacobsen and Naug, we will have an overview of the oil market. In our estimation of the house price model, we have constructed models both with and without oil price factor to make a comparison.

[2] See appendix 1.1 and 1.2

1.1 THE RELATION BETWEEN OIL PRICES AND HOUSE PRICES

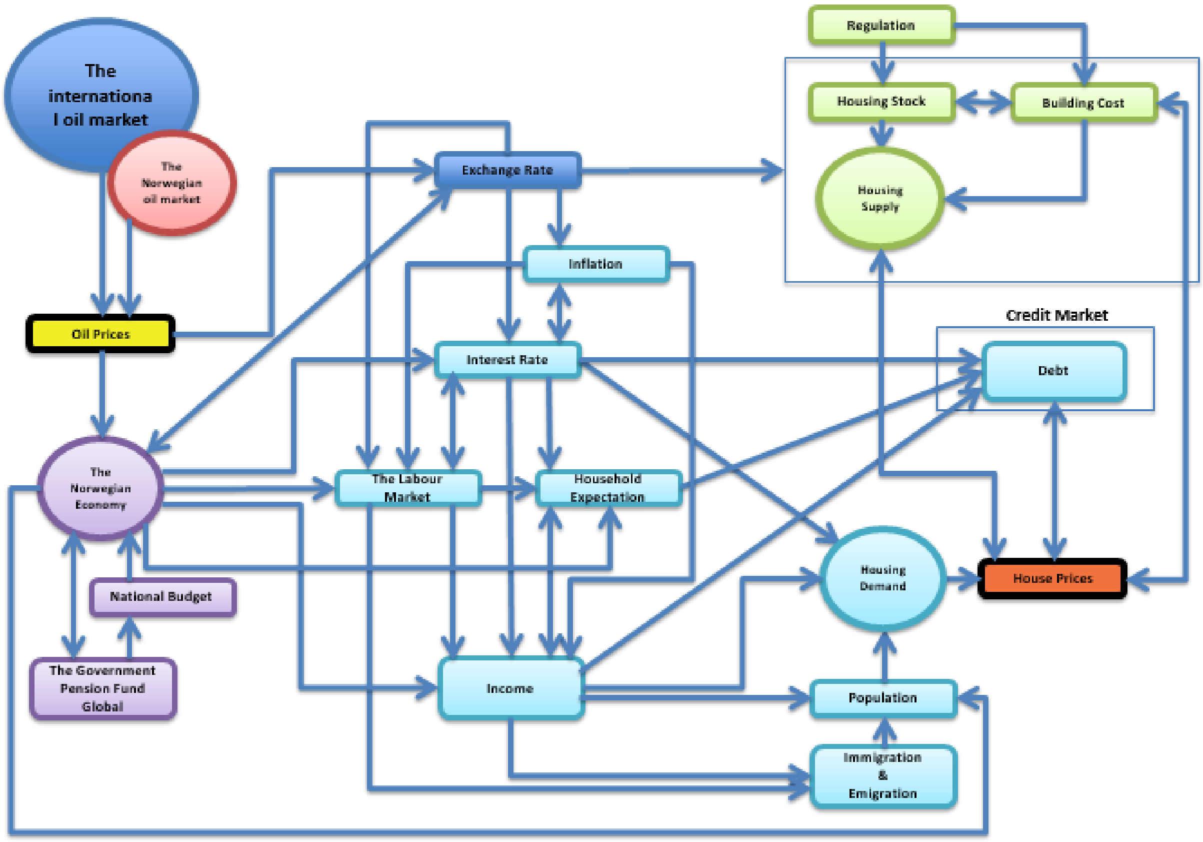


Figure 1: Overview of the relationship between oil prices and house prices in the Norwegian market
Source: Own figure

The figure above illustrates the relationship between oil prices and house prices. The effect that oil prices have on house prices goes particularly through fundamental factors. Moreover, there are also influences between the fundamental factors in both the demand and supply side in the housing market. In chapter 3, we will get a deeper insight of these fundamental factors.

2 THE NORWEGIAN HOUSING MARKET

In this chapter, we present an overview of the development of prices in the Norwegian housing market, the regional differences, and the supply and demand in the housing market.

2.1 HOUSING POLICY

The purpose of Housing Policy is that everyone should live well and safely. Housing policy is about making sure that people and households with a weak economy and special housing needs should have a good place to live. Financial loans and support schemes, legal regulation and provide competence initiatives are the key instruments in the implementation[3].

The Government establishes the national housing policy goals, sets the legal and financial framework and provides support to competence initiatives. Parliament adopts the annual budgets for the financial instruments. The Ministry of Local Government and Regional Development is responsible for implementing the national housing policy, with Husbanken as the main tool. The municipalities are responsible for the practical implementation, which may vary with local conditions. [4]

After 1945, the housing policy's aim was to ensure that everyone could own his or her home. This would be possible by subsidized loans, municipal economic support and site-provision, price-regulation, and cooperative organizations building new housing. Today about 80 percent of all Norwegian households own their own homes.

2.2 DEVELOPMENT IN HOUSE PRICES

In the recent years, there has been a significant increase of house prices in the Norwegian market, and statistics in figure 2 show that it has never been higher. Since 2007, the Norwegian house prices have increased rapidly, and are ranked as number 28 in the global list of the fastest growing housing markets in year 2014[5]. The price level on housing has in

[3] http://www.husbanken.no/boligpolitikk/
[4] http://www.husbanken.no/boligpolitikk/
[5] http://www.dn.no/nyheter/utenriks/2014/12/10/1905/Boligpriser/n-er-dette-et-av-verdens-sterkeste-boligmarkeder

overall increased by approximately 450 percent from 1993 to 2012[6], and nearly 75 percent since 2005 to 2014[7].

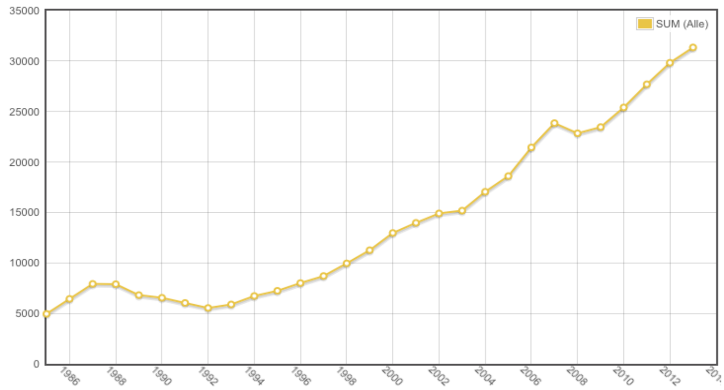


Figure 2: The development of house prices per square meter
Source: Appendix 2.1

Statistics shows that on the national level, average increase of house prices were 5.8 percent per quarter from Q4 2013 to Q4 2014[8]. Since the decline of oil prices in June 2014, house prices continued to increase in most urban areas. Stavanger was the only among major cities with a decline in house prices in 2014.

2.3 REGIONAL DIFFERENCES

This section gives a brief overview of the development of house prices in our selected cities during the decline of oil prices in 2014. We selected cities from different regions, and will in this thesis focus on Bergen, Oslo, Stavanger, Tromsø and Trondheim.

2.3.1 BERGEN, OSLO, TRONDHEIM AND TROMSØ

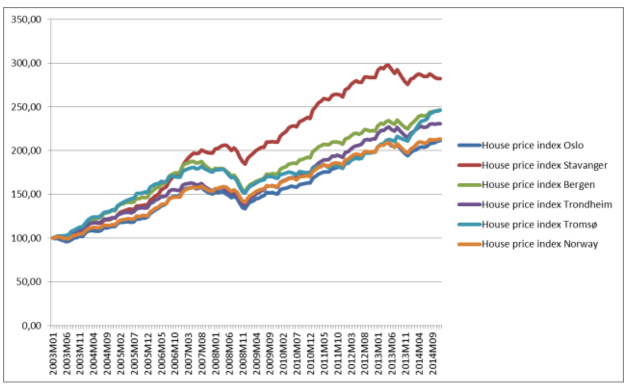


Figure 3: Development of house prices in Bergen, Oslo, Stavanger, Tromsø, Trondheim and Norway
Source: Source: Appendix 2.2

6 http://arkiv2.sv.no/Fylkes-og-lokallag/Oslo/Nyheter/Bolig-for-alle
7 http://www.aftenposten.no/okonomi/Hvorfor-er-boligprisene-sa-hoye-7690498.html
8 https://www.ssb.no/priser-og-prisindekser/statistikker/bpi/kvartal

During 2014, house prices have increased in almost every city, the national average increase was 2.2%. House prices in major cities Bergen, Oslo, Trondheim and Tromsø increased respectively in average by 4%, 0.5%, 2.1% and 10.8%. These numbers were determined by comparing average prices for 2013 with the average prices for 2014[9].

2.3.2 STAVANGER

Stavanger is the largest oil city in Norway, and the only major city in which the house prices were negatively affected by the decline in oil prices. As the city dominates in the oil sector, it correspondingly carries more oil risk compared to other cities. Thus, Stavanger might undertake more risk of direct influence because of the drop in oil prices. Oppositely, other cities might undertake more indirectly influence that do not appear until sometime later.

In the last few years, Stavanger had the largest increase in house prices until the steep fall of oil prices in 2014, as shown in figure 3.[10]During 2014, house prices in Stavanger declined in average by 1.6%.[11]

For more information and overview of percentage changes in house prices in different cities and regions in 2014, please refer to appendix 2.3.

2.4 SUPPLY AND DEMAND IN THE NORWEGIAN HOUSING MARKET

House prices are determined by supply and demand in the housing market. An excess of demand will push up the house prices. Oppositely, an excess of supply will push down the prices. Furthermore, many underlying factors affect the housing demand that again is conclusive to the price setting of houses. We will in chapter 3 look at these factors.

2.4.1 SUPPLY

We distinguish the supply of houses in long and short-term. In the short-term, the supply of houses are given by the existing housing stock. Strong growth in housing demand pushes up house prices. Capacity constraints in the construction industry prevent the overall housing supply to quickly adjust to the increased demand.

---

[9] http://www.smartepenger.no/2197-dette-er-boligprisvinnerne-i-2014
[10] http://www.dn.no/privat/eiendom/2014/06/12/Bolig/varsler-boligprisfall
[11] http://www.smartepenger.no/2197-dette-er-boligprisvinnerne-i-2014

The annual construction rate of houses is low because it takes time to build new houses. This implies that in the short run the house prices will largely fluctuate with the changes of supply. In the long-term, the housing stock will adapt to the demand of houses in the Norwegian market.

2.4.2 DEMAND

Housing demand consists of two components:

- Household's demand of houses for living.
- Household's demand of houses as an investment object.

These components are based on household's personal preferences. The demand of houses for living is more common, and is larger than the demand of houses as an investment object[12]. This is because people intend to secure their living before making further investments. There has been great demand in the housing market in the recent years, which had led to steeply increasing house prices. This can be illustrated by the curve shown in figure 2.

Although it is more common to buy houses for living, the amount of housing investments has also increased in recent years. An indicator of this is that the amount of houses rented out in Oslo May 2014, has increased compared to 2013. There were 2027 homes for rent at Finn.no in 2014, which is the highest number measured in May in any year, and about 300 dwellings more than May 2013[13]. However, the number of houses bought in 2014 is still higher than houses rented out.

According to Norges Eiendom, in 2014 the average sale period of houses was 38 days, and on average 14 751 ads were active. The demand in 2014 was relatively high with low turnover period per house on average. See appendix 2.4 for an overview of the sale period and active ads.

---

[12] http://www.norges-bank.no/Upload/import/publikasjoner/penger_og_kredit/2004-04/jacobsen.pdf
[13] http://www.dn.no/nyheter/okonomi/2014/05/15/Boligpriser/-hvis-det-hadde-vrt-ubalanse-i-boligmarkedet-burde-leieprisene-vrt-hyere

2.4.3 EQUILIBRIUM

Equilibrium in the housing market arises in the point of intersection between supply curve and demand curve. The equilibrium indicates the maximum price a household is willing to pay for a house.

3 FUNDAMENTAL FACTORS IN THE HOUSING MARKET

Many factors influence the development of house prices. We will in this chapter look at these, and provide an overview of how they are related to house prices. We will first start with possible fundamental factors that affect the demand side in the housing market and see if they were affected after the oil price declined.

3.1 FUNDAMENTAL FACTORS ON THE DEMAND SIDE

3.1.1 HOUSEHOLD EXPECTATION

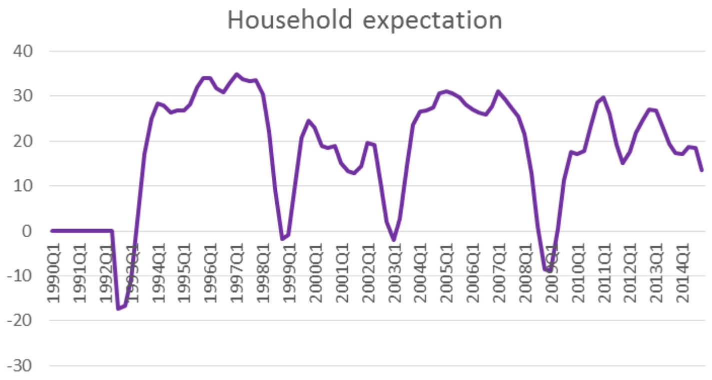


Figure 4: Development of Household Expectation quarterly
Source: Appendix 3.1

Psychology is important when predicting household economic behaviour. Finance Norway uses an indicator to measure household expectations, the “Consumer Confidence Index (CCI)”. This is a partnership between TNS Gallup and Finance Norway. The CCI measure Norwegians household confidence in their own and the country’s economy in every quarter. The purpose of this indicator is to measure the expected future demand from the consumer side with the result of people's confidence in their own household and the country`s economic prospects.[14]

Household’s expectations has improved in Q2 2014 compared to Q4 2013[15]. It was particularly the confidence about the country's economy that fell in 2013, while confidence of household`s own economy remained relatively high. The reason for this decrease of CCI is the fact that unemployment has risen for four consecutive months, and that house prices fell

[14] https://www.fno.no/aktuelt/sporreundersokelser/forventningsbarometeret1/bakgrunn-og-formal-med-undersokelsen/

[15] https://www.fno.no/aktuelt/sporreundersokelser/forventningsbarometeret1/forventningsbarometeret-2013/lavere-optimisme-og-rekordhoy-sparevilje/

two months in a row at the end of 2013.[16] However, most households still had strong confidence in their own economy and job security. The Norwegians economic expectations slowly went up in Q2 2014. Moderate wage growth, lower interest rates, rising house prices and better prospects for the global economy pulled the expectations up.[17] The rise of house prices was both an effect and a cause of increased optimism among households, because in the short-term house prices is influenced by household`s expectations.[18]

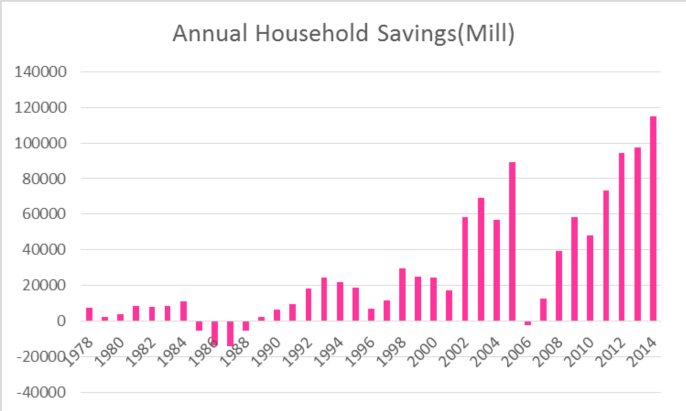


Figure 5: Development of household savings – yearly from 1978-2014
Source: Appendix 3.2

The decline of oil prices started at the end of June 2014, and since this incident, household confidence in the country's economy next year (2015) has suffered a major blow. Severely falling oil prices and reports of downsizing, particularly in the oil and gas industry made many uncertain about the future developments. Household`s was mainly uncertain about the country's economy, but also in some extent in their own economy. The response to this uncertainty is higher savings level, which is also the highest level ever measured in this quarter so far as figure 5 shows.[19] Households may postpone their investment in houses because of higher unemployment rate, especially in oil related sectors. At the same time the relative low interest rate, increases household’s intentions to expand loans and considering buying houses.

[16] https://www.fno.no/aktuelt/sporreundersokelser/forventningsbarometeret1/forventningsbarometeret-2013/lavere-optimisme-og-rekordhoy-sparevilje/
[17] https://www.fno.no/aktuelt/sporreundersokelser/forventningsbarometeret1/forventningsbarometeret-2014/noe-okt-optimisme-etter-fem-kvartaler-med-fall/
[18] https://www.fno.no/aktuelt/sporreundersokelser/forventningsbarometeret1/forventningsbarometeret-2014/nordmenn-har-aldri-vart-sterkere-i-troen-pa-egen-okonomi/
[19] https://www.fno.no/aktuelt/sporreundersokelser/forventningsbarometeret1/forventningsbarometeret-2014/vi-har-mistet-troen-pa-landets-okonomi’

3.1.2 POPULATION

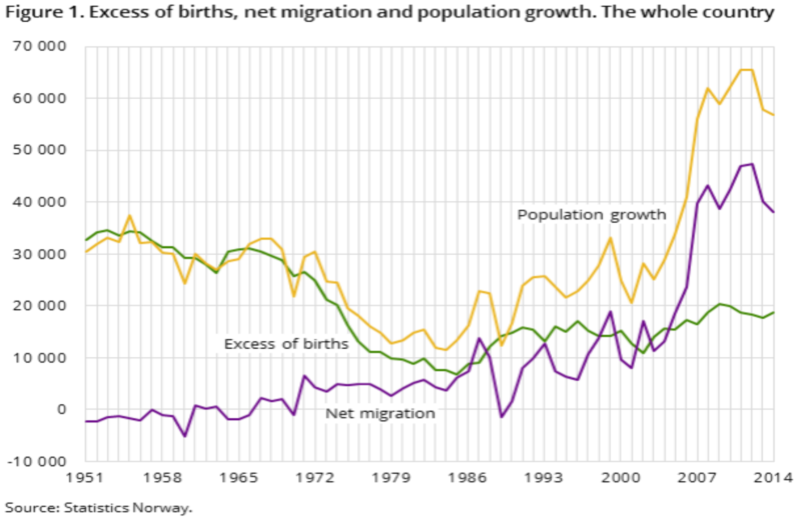


Figure 6: Population growth in Norway
Source: Appendix 3.3

Population growth is an important factor in economic activity. According to SSB, the population in Norway reached 5 165 802 people on 1 January 2015. During 2014, the Norwegian population grew with 56 746 people (1.1 percent), 18 690 were surplus in birth, and 38 155 were net immigration, see appendix 3.4 for statistics overview.[20]. Compared to the period 2008 to 2013, the population grew at a slower rate in 2014, which could be explained by the reduction of immigration from abroad. We are going to look at this in the coming subsection 3.1.2.1

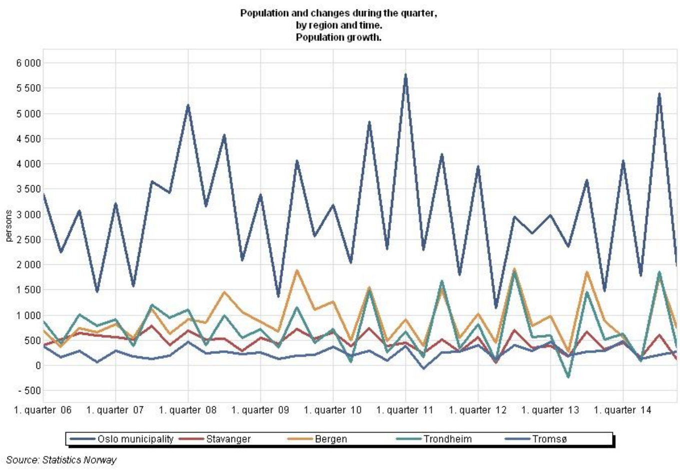


Figure 7: Quarterly population growth Q1 2006-Q4 2014
Appendix 3.5

[20] https://www.ssb.no/en/befolkning/nokkeltall

Figure 7 illustrates the quarterly population growth in the period Q1 2006 to Q4 2014. During 2014, the population grew with 13 213 people in Oslo, 1 348 in Stavanger, 3 163 in Bergen, 2 925 in Trondheim and 1091 in Tromsø. An increasing population means more pressure on the demand side of housing.

3.1.2.1 IMMIGRATION AND EMIGRATION

Immigration is one of the main drivers of the population growth in Norway. In 2014 the number of foreign citizens represented 9.9% (512 200 residents) of the total population 5 165 802. Net immigration of foreign citizens decreased from 41 900 in 2013 to 38 155 people in 2014. The population has increased due to immigration, but the number of immigrants has reduced compared to previous years. More and more people are moving to larger cities where there are better labour opportunities, which also increases the housing demand significantly and the need for infrastructure. Norway also has a stable economy that maintains an attractive welfare system.

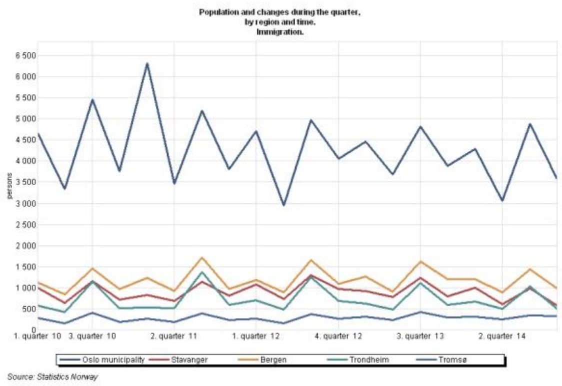


Figure 8: The development of immigration, quarterly changes from Q1 in 2010 to Q4 2014.
Source: Appendix 3.6

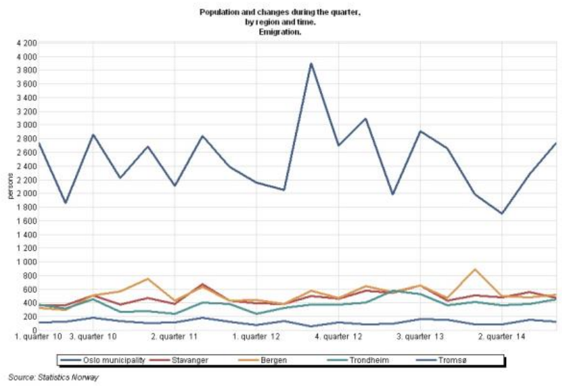


Figure 9: The development of emigration, quarterly changes from Q1 in 2010 to Q4 2014.
Source: Appendix 3.7

	Immigration	Emigration	Net immigration
Oslo	15799	8715	7084
Stavanger	3161	2017	1144
Bergen	4506	2393	2113
Trondheim	2692	1620	1072
Tromsø	1211	452	750
Norway	70030	31875	38155

Table 1: Overview of net immigration in different cities and Norway 2014
Source: Appendix 3.6 and 3.7

For more detailed overview of immigration and emigration for each city and Norway, refer to appendix 3.8.

3.1.3 INTEREST RATE

In Norway, the key policy rate is the interest rate on banks deposits up to a quota in the central bank of Norway[21]. This rate is the central bank of Norway`s most important instrument in the implementation of monetary policy. This interest rate can change quickly if the outlook for economic developments requires. Changes in the key policy rate will normally have a strong impact on short-term money market rates and on banks deposit and lending rates.

The central bank of Norway lowered its key policy rate by 0.25 percentage points to 1.5 percent in March 2012. The steep fall of oil prices has weakened the prospects for growth in the Norwegian economy and settled down the policy rate by a further 0.25 percentage points in December 2014 to 1.25 percent. Lower key policy rate normally means that banks adjust down the mortgage rates, which in turn leads to lower loan interest payments. Interest rates are therefore of great importance for people who consider investments on a new house and to expand loans.

3.1.4 HOUSEHOLD INCOME

House prices are related to the income of households, and the relationship between income and house prices partly reflects the healthiness of house price levels. Over the last 20 years, house prices have increased nearly six fold, and wages have increased by less than half of this.

Salary is important for income, but interest rates are also of great importance. Housing investments are normally financed by some debt in addition to household’s income. The question is which interest rate development the household expects in the future. A household can operate more debt when the interest rates and payments are low. The situation where costs and interest rates on loans increase at a higher rate than the income level might lead to loss of household`s purchasing power. Household’s financial vulnerability increases with the growth

[21] http://www.norges-bank.no/pengepolitikk/Styringsrenten/

of house price, and it would not be sustainable if the growth of house prices surpasses household’s income level over a long period.

Disposable income is the sum of wage income, business income, capital income, government transfers and other income, minus the sum of taxes, capital expenditures and other expenses[22]. Household's expectation of solvency is dependent on disposable income. The higher the disposable income is, the higher solvency, and this gives better opportunity to larger loans and more investments.

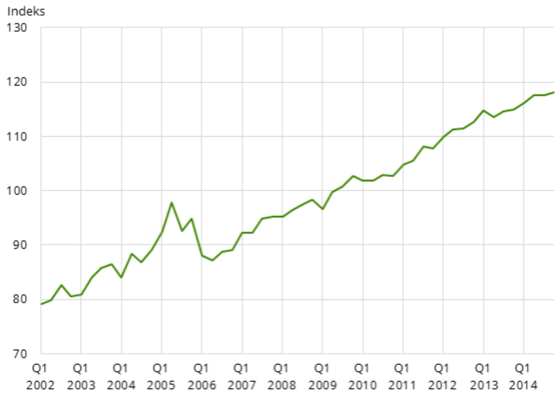


Figure 10: Disposable Real Income seasonally adjusted 2009 = 100
Source: Appendix 3.9

Statistics from figure 10 shows that the disposable income was higher than ever. There was a total increase of 5 percent in disposable income from 2013 to 2014. Higher wages was one of the main factors that pushed up disposable income. Higher capital income along with reduced capital expenditures also contributed to this income development.

[22] https://ssb.no/nasjonalregnskap-og-konjunkturer/statistikker/knri

3.1.5 UNEMPLOYMENT

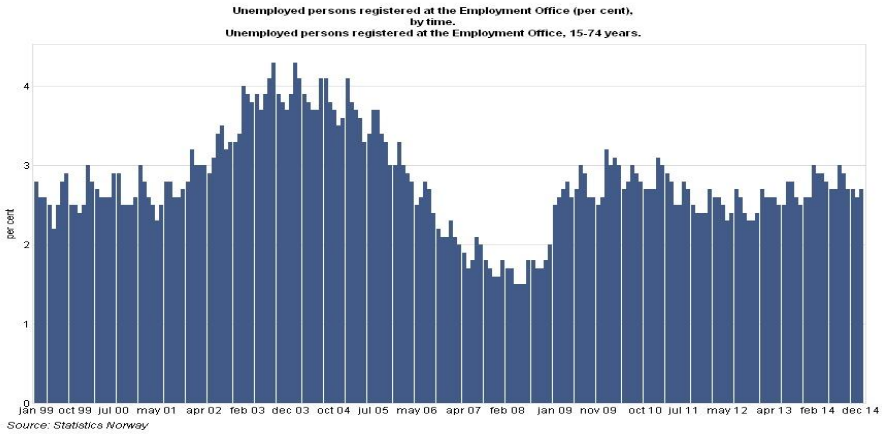


Figure 11: Registered unemployed in Norway
Source: Appendix 3.10

Unemployment has a close link with economic conditions. Poor economy level will raise unemployment[23]. Figure 11 shows that unemployment has varied between two to five percent. A small percentage change in unemployment does not lead to a large direct impact on demand in the house market, but it has a relatively great importance to optimism and pessimism. In other words, it has a larger importance than what percentage tells because it affects how most people look at the future.

In periods of rising unemployment, more people can get worried and frustrated about the future. Increased unemployment can lead to lower expectations of wage growth and increased uncertainty about future income and solvency. The uncertainty about whether people retain their jobs, or if it is the right time to invest in a new house, tends to make people postpone their actions. Consequently, a possibly large percentage of the demand will be gone, because people rather invest when times gets better and less uncertainty is due. When the demand decreases, it affects the short-term house price level. On the other side, the long-term price level will be less affected.

The rate of unemployment has in overall been low in Norway, this indicates a quite stable and healthy labour market. Although unemployment has in percentage increased during the fall of oil prices from 3.4% to 3.7% at the end of 2014, the house prices has continued to increase in all cities except from Stavanger.

[23] https://www.ssb.no/nasjonalregnskap-og-konjunkturer/oa/_attachment/209620?_ts=14a1040b5e0

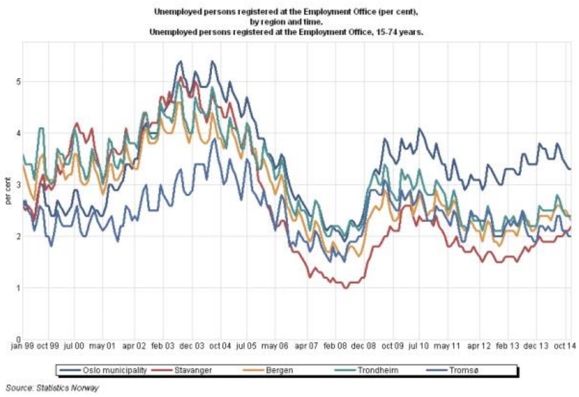


Figure 12: Registered unemployed in Oslo, Stavanger, Bergen, Trondheim and Tromsø
Source: Appendix 3.11

Figure 12 shows percentage unemployment in each region from January 1999 until December 2014. We can clearly see that unemployment rises in Stavanger, while decreasing in the other cities during the period when oil prices were tumbling.

3.1.6 CREDIT MARKET AND CREDIT GROWTH

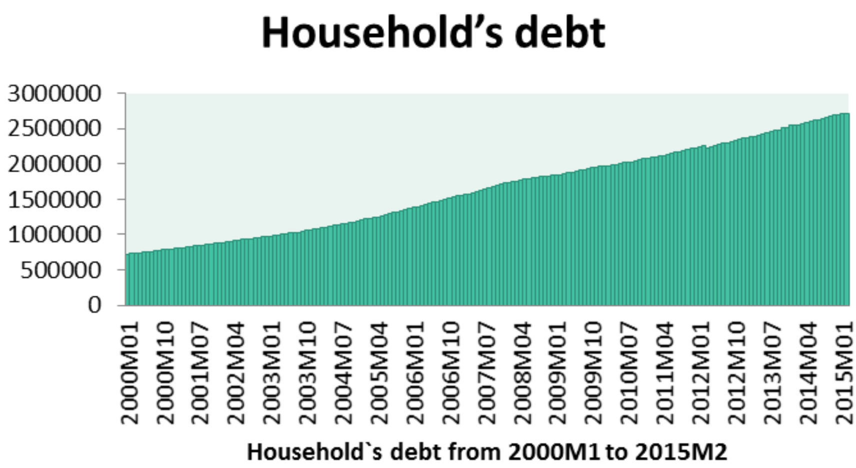


Figure 13: Development of Household's debt
Appendix 3.12

Today many households have high debt. As mentioned earlier in section 3.1.4, it is common to finance housing with loans. According to "Financial developments" by Financial Supervisory Authority of Norway, over half of loans from Norwegian banks are granted to households.[24] Household's debt is so far at a record with an amount of 2700 billion Norwegian krone in December 2014[25]. The loans are mainly used to purchase houses

[24] http://www.finanstilsynet.no/PageFiles/44069/Finansielle_utviklingstrekk_2014_rapport.pdf?epslanguage=no
[25] https://www.ssb.no/statistikkbanken/SelectVarVal/Define.asp?MainTable=GjeldBrutLantak&KortNavnWeb=k2&PLanguage=0&checked=true (Tabell: 06715: Innenlandsk bruttogjeld, etter låntakersektor og utvalgte valutaslag (mill. kr))

or refinance existing mortgages from the same bank or other banks. As shown in figure 13, household`s debt has increased much over time, especially after the adjustment of lower key policy rate in March 2012 where it was downscaled from 1.75% to 1.5%. The further downscaling of the key policy rate to 1.25% in December 2014 brought the debt to top. It is speculated that household's debt will continue to increase in 2015 because of increased demand after loans.

House prices and household debt are closely linked. Higher house prices lead to better collateral for banks and higher credit growth, which in turn may provide further increases in house prices and credit in a self-reinforcing spiral. Growth in household`s debt has long been higher than income, and it is still growing faster than the income level[26]. If the high house prices continue, it might constitute a risk to financial stability. High leverage compared to the property value and the granting of loans for people with poor solvency, increases the risk for household's economy and the solidity for financial institutions.

Household`s debt burden shows the relationship between the household`s total debt and income before tax. This indicates the household`s vulnerability to interest rate fluctuations. According to Statistics Norway, about 15.8 percent of private households in 2013 had a total debt that amounts to more than three times of total household annual income before tax. This indicates a relative high household debt burden.[27]

3.1.7 CURRENCY ON THE DEMAND SIDE

The definition of currency is "*a generally accepted form of money, including coins and paper notes, which is issued by a government and circulated within an economy. It is used as a medium of exchange for goods and services, and currency is the basis for trade*"[28]

The Norwegian economy is sensitive to the developments in oil prices. According to Norges Bank, earlier experiences indicate that international financial turmoil also affects the Norwegian krone. In the international currency market, the Norwegian krone is considered as an unstable currency. In periods of high volatility in international financial markets, there is a

[26] http://www.finanstilsynet.no/PageFiles/44069/Finansielle_utviklingstrekk_2014_rapport.pdf?epslanguage=no
[27] https://www.ssb.no/inntekt-og-forbruk/statistikker/ifhus/aar/2014-12-17
[28] http://www.investopedia.com/terms/c/currency.asp

tendency for international actors wanting to reduce holdings of the Norwegian krone in their portfolios. This causes the Norwegian krone to weaken[29].

The exchange rate can affect the country's economy in many ways, including the export demand for Norwegian goods and services, returns on financial placements in Norway versus abroad and domestic price trends through prices of imported goods. The Norwegian economy is small and it is heavily exposed to foreign demand. Therefore, exchange rate has a relatively large impact on the economic development. This is the reason for why Norway traditionally had the goal of fixed or stable exchange rate.

Ever since the fall of oil price in June 2014, the Norwegian krone has weakened. The Norwegian krone was even more affected by the surprising cut of the key policy rate by Norges Bank in December 2014, which weakened the Norwegian krone further. The krone has not been weaker against the European common currency, EURO, since September 2009. Similarly, the krone is also very weak against the dollar after the incident of the oil price drop. The previous bottom line was in late April 2009, when the krone was at 6.84 against the dollar. The weakened Norwegian Krone led to increased export demand and reduced import demand of goods in Norway. Changes in the Norwegian exchange rate affects many fundamental factors as shown in figure 1, section 1.1.

3.1.8 INFLATION

Inflation is the persistent rise in the general price level, which is the same as a fall in the value of the Norwegian krone or other monetary unit calculated in goods and services. In other words, it relates to the purchasing power.[30]

[29] http://www.norges-bank.no/Upload/import/publikasjoner/penger_og_kreditt/2000-03/bernh.pdf
[30] https://snl.no/inflasjon

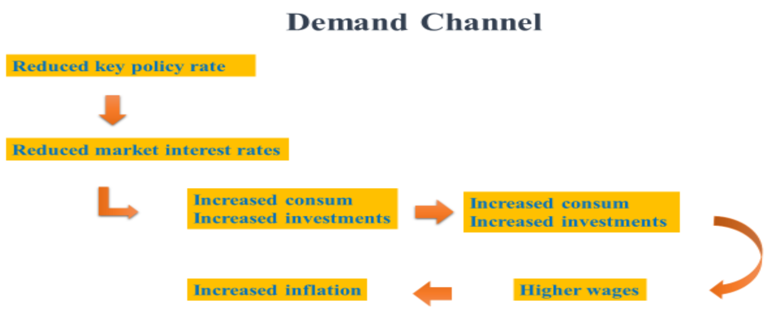


Figure 14: Key Policy Rate Effect on Inflation
Source: Appendix 3.13

The weak krone after the oil price drop means higher cost for importing goods from abroad. Oppositely, weaker krone makes Norway's exporting industries more global competitive. Higher importing costs push the general prices of goods, and products will be more expensive for households. By this, household purchasing power will be lower.

Consumer Price Index (CPI) is "*a measure that examines the weighted average of prices of a basket of consumer goods and services, such as transportation, food and medical care*"[31]. This is one of the most effective statistics used to identify periods of changes in purchasing power, which is inflation or deflation.

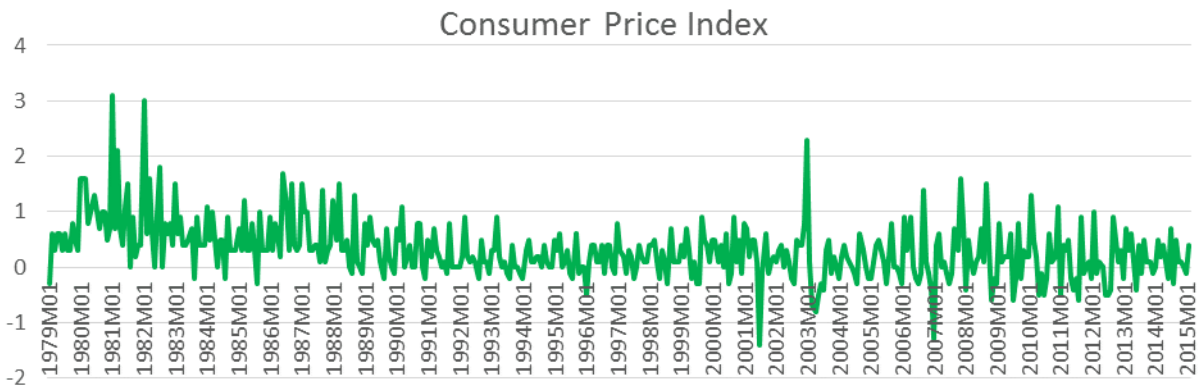


Figure 15: Development of consumer price index percentage changes monthly,
Source: Appendix 3.14

According to Statistics Norway (SSB), household's purchasing power has been lowered by 0.2% after the oil price decline. The CPI was in June 2014 at 1.8% when the oil price declined, and increased to 2% in December 2014. The reason for increased CPI in this period is a weaker Norwegian krone that caused lower interest rates. This have further led to more

[31] http://www.investopedia.com/terms/c/consumerpriceindex.asp

investments and increased consumption, which may again lead to higher wages and increased inflation as figures 14 and 15 show. It is speculated that the growth rate of wages may slow down compared to previous years, so the wage level in 2015 might either increase or remain the same as in 2014.[32]

3.2 FUNDAMENTAL FACTORS ON THE SUPPLY SIDE

3.2.1 THE HOUSING SUPPLY

We will in the coming sections present fundamental factors that affect the housing supply. Factors that we will look at are currency, housing stock, building cost and regulations.

3.2.2 CURRENCY ON THE SUPPLY SIDE

As mentioned earlier in section 3.1.7, the exchange rate affects fundamental factors in the demand side of the housing market, but also in the supply side. Fluctuations in the exchange rate can affect both building costs and housing stock. Weaker Norwegian Krone will be less profitable to construct houses, because of increased building costs. Thereby, exchange rate plays an important role in the supply side.

3.2.3 HOUSING STOCK

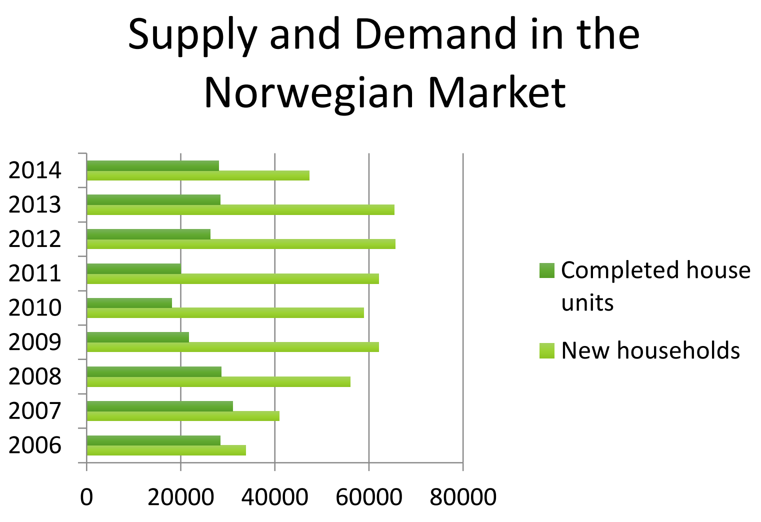


Figure 16: Supply and Demand in the Norwegian Market
Appendix 3.15

[32] http://www.dn.no/privat/privatokonomi/2014/12/08/1838/Valuta/slik-rammes-du-av-kronefallet

In the last few years, the number of households has increased more compared to the amount of built houses. The reason for this may be hard to tell. There might be restrictions on building, increasingly certification requirements and standards, bureaucracy and changing of relative prices such as the working hours are disproportionately expensive.

Housing stock is defined as the total number of dwelling units in an area [33]. By analysing the completed housing units and the amount of new households in the Norwegian market, it can provide us information of the supply level of houses in the existing housing market. When the housing stock adapts to housing demand over time, it tends to draw house prices down. House prices may therefore have been higher in the short term than they would in the long term.

Figure 16 indicates that the amount of new household`s on an annual basis is greater than the amount of completed house units per year. This could imply an increase on the demand side of the housing market.

3.2.4 BUILDING COST

Figure 17: Building Cost Index
Appendix 3.16

The cost of building new homes has increased sharply in recent years. Building cost is determined by different factors such as labour cost, building materials, machinery, transport, energy, regulatory requirements and the productivity in the industry. Building activity in Norway is abnormally high and this pushes costs up[34]. The reasons for higher costs can be increased quality requirements, more expensive materials, and more expensive land and centralization, stricter technical building requirements and low productivity growth in the

[33] http://www.allbusiness.com/barrons_dictionary/dictionary-housing-stock-4964200-1.html
[34] http://www.dn.no/nyheter/okonomi/2014/05/15/Boligpriser/-hvis-det-hadde-vrt-ubalanse-i-boligmarkedet-burde-leieprisene-vrt-hyere

industry. During the periods of capacity constraints and strong demand pressure in the housing market, high prices have also contributed to increase costs through higher land prices, higher wages, and higher profit margins. According to the graph in figure 17, the building cost has increased with a stable growth over time. Increased building cost makes it less profitable for the industry to build new houses. This might have led to higher house prices that make it more expensive for households to invest in new houses nowadays. There seems to exist a feedback effect between house prices and building costs in the Norwegian housing market.

3.2.5 REGULATION

Regulatory frameworks, law and municipal regulations in the housing market have been established to ensure that the construction of houses is set by standards. They contain for instance detailed construction planning, universal design, minimum requirements for building materials, the design and construction of houses have to fulfil satisfactory safety.

The government and Regional Development introduced the regulation on technical requirements for construction works, TEK 10 in 26 March 2010. This regulation entered into force on 1 July 2010. TEK 10 is an improved version of the previous regulation in 2007. Regulation can affect the supply side of the housing market[35]. Stricter construction techniques and municipal regulations of new houses have increased building costs in the last few years. Because of increased building costs, these have been transferred to buyers and tentants in the housing market by increased house prices.

3.3 CONCLUSION

Chapter 3 gives an insight of how factors were affected by the decline of oil prices, and how they influenced each other both on the demand and on supply side in the housing market. Briefly summarised, changes in oil prices made a negative shock and impact on the Norwegian economy that lowered household`s expectations both on their own and the country`s economy. Weaker Norwegian krone reduced household’s purchasing power, increased building costs, less profitable for importing goods abroad and the Norwegian exporting industry became more global competitive. Unemployment rose into a higher level

[35] http://heiskontrollen.no/index.php?option=com_content&view=article&id=85:gjeldene-byggteknisk-forskrift-tek10&catid=45:languages&Itemid=56

by 0.3 percentage change, particularly in the oil and gas industry. Further, the central bank of Norway settled down the key policy rate by 0.25 percentage points in December 2014 from 1.5 to 1.25 percent. This led bank to adjust down their mortgage rates and lenders got lower loan interest payments. Because of lower loan interest payments, household`s debt was increased to a record level in 2014. Conclusively, impacts on factors after the decline of oil prices resulted with an increase of demand in the Norwegian housing market, while the supply side remained restricted. Increased housing demand and restricted housing supply in the market might be the cause of still increasingly house prices. Please refer to section 1.1 for full overview of how the fundamental factors affect each other.

4 INTRODUCTION TO THE OIL MARKET

In previous sections, we have provided an overview of how the decline of oil prices influenced the fundamental factors and prices in the housing market. We will now look at the background for the decline of oil prices, and the consequences it had in the Norwegian economy.

4.1 THE OIL MARKET

Oil is a non-renewable natural resource that covers about 40 percent of the world's energy consumption. The majority of this is consumed by the many means of transportation of both goods and people around the world. It is vital to many other industries and thus a critical concern to many countries due to its importance in maintaining their industrialized civilizations.

We can differentiate between sweet and sour crude oil. Crude oil that has low sulphur content, less than 0.5%, is called sweet, and crude oil with a high sulphur content, more than 1.5%, is called sour. To measure crude gravity, the American Petroleum Institute, API, standard is often used. Heavy crude is under API 22°, light crude is above API 33° and medium crude are in between. Some crude streams contain metals. All of these factors affect crude prices.

The crude oil is recovered through drilling on land and at sea. Since it is non-renewable, there are concerns over the depletion of the earth's oil reserves, and what effect this could have on future generations and societies[36]. In addition, the use of oil as an energy source has a damaging impact on the earth's biosphere and nature. Examples are oil spills that might occur, and release of various pollutants in the atmosphere. According to British Petroleum (BP), the estimated remaining oil reserves is 1687.9 billion barrels, which is enough to last the world by 53.3 years with the current production rates.[37]. With other words, oil plays a vital role and is one of the driving forces of the global economy.

---

[36] http://www.iea.org/publications/freepublications/publication/keyworld2014.pdf
[37] http://www.ibtimes.co.uk/world-energy-day-2014-how-much-oil-left-how-long-will-it-last-1471200

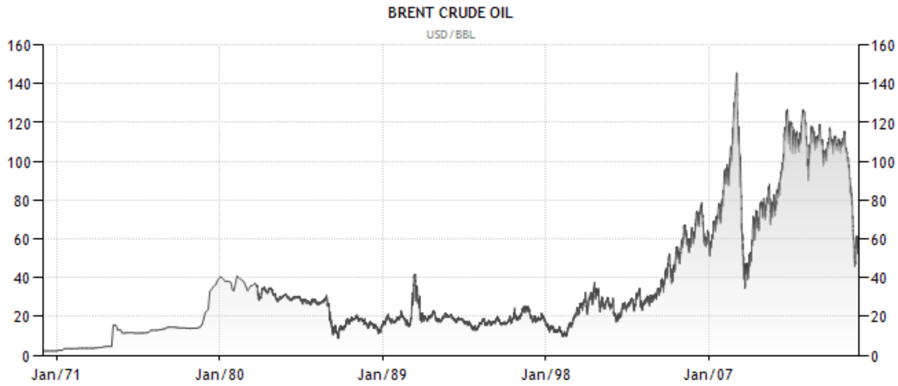


Figure 18: The development of oil prices, 1970 – 2015
Source: Appendix 4.1

Figure 18 displays the development of Brent Crude Oil prices in USD per barrel, from 1970 until 2015 in USD. The record low oil price was 2.23 USD in May 1970 and all-time high in July 2008 by 145.61 USD[38].

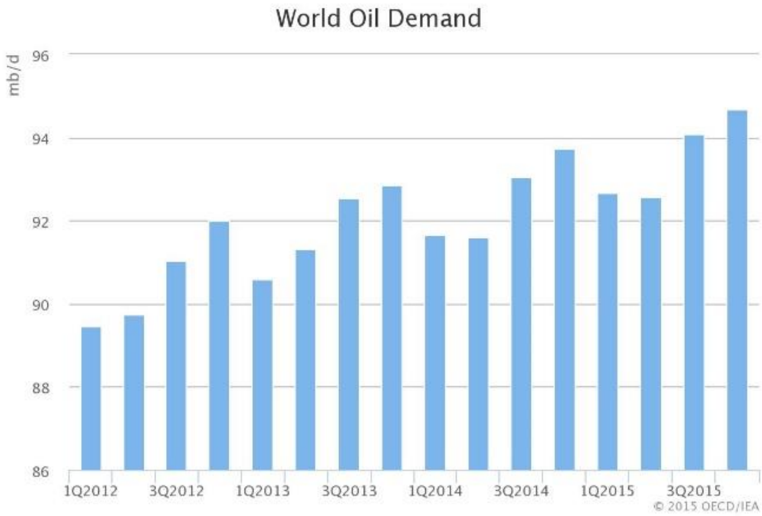


Figure 19: World Oil Demand
Source: Appendix 4.2

Figure 19 illustrates the global oil demand from 2012 until 2014, and estimated numbers for 2015. In 2014, the demand for oil was 91.67 million barrels a day (mb/d) in Q1, 91.59 mb/d in Q2, 93.05 mb/d in Q3, and 93.73 mb/d in Q4. The figure shows that the global demand for crude oil in December 2014 grew by 2.2 million barrels per day. The oil price started to decline in June 2014, and this could be the explanation for increased global oil demand.

[38] http://www.tradingeconomics.com/commodity/brent-crude-oil

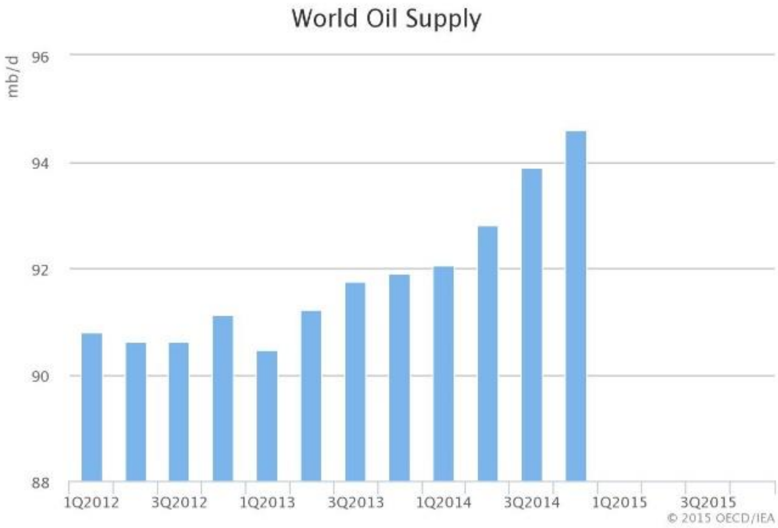


Figure 20: World Oil Supply
Source: Appendix 4.3

Figure 20 illustrates the rapid rise in oil supply. However, the supply levels of oil for each quarter in 2014 was higher than the demand, which imply that oil inventories grew in this period[39]. Global strategic petroleum reserves (GSPR) refer to crude oil inventories held by the government of a particular country. The purpose of the reserves is to provide economic and national security during an energy crisis. Countries that participate in the GSPR and that are member of the International Energy Agency (IEA) are expected to have an oil reserve of at least 90 days' worth of the previous year's net imports. If oil production decreases due to unexpected situations, for example physical disruption of the recovery or refinery process, the oil reserves are intended to meet daily energy requirements[40]. A falling oil price provides the opportunity to boost petroleum inventories at a lower cost to increase oil reserves and energy security.

4.2 ORGANIZATION OF THE PETROLEUM EXPORTING COUNTRIES

Organization of the Petroleum Exporting Countries (OPEC) is an international organization established in Baghdad, Iraq, in 10-14 September 1960. Today the organization consists of 12 oil producing nations; Algeria, Angola, Ecuador, Iran, Iraq, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, United Arab Emirates and Venezuela[41]. OPEC's objective is to coordinate and unify petroleum policies among member countries in order to secure fair and stable prices for petroleum producers, an efficient economic and regular supply of petroleum to consuming

[39] https://www.iea.org/oilmarketreport/omrpublic/
[40] http://www.investopedia.com/terms/g/global-strategic-petroleum-reserves.asp
[41] http://www.opec.org/opec_web/static_files_project/media/downloads/publications/WOO_2014.pdf

nations. In addition, a fair return on capital to those investing in the industry[42]. The crude oil production by OPEC is an important factor that can affect oil prices. OPEC produces about 40 percent of the world´s crude oil, and exports about 60 percent of the total petroleum traded internationally. Due to its large portion of market share, OPEC's actions can influence international oil prices by either cutting back or boosting oil production. OPEC aims to manage oil production in its member countries by setting production targets. In the past, when production targets were reduced, crude oil prices have increased. Saudi Arabia produces 10 million barrels a day, which is a third of OPECs total, and changes in oil production in Saudi Arabia will often affect the oil prices[43].

4.3 THE DECLINE IN OIL PRICE JUNE 2014

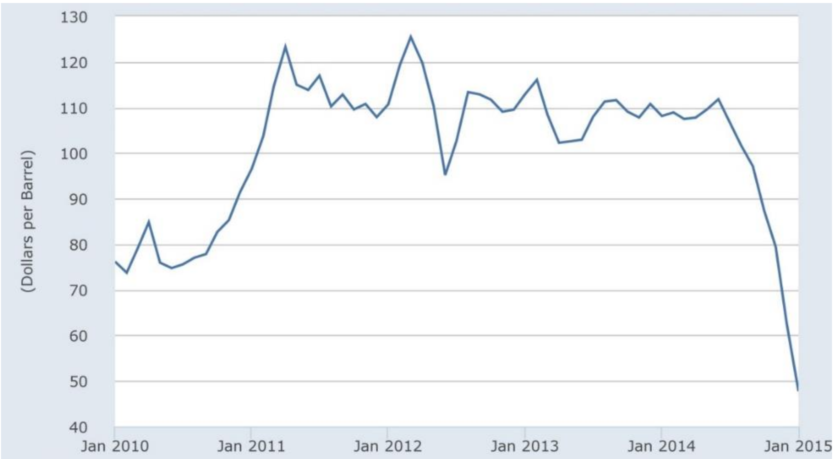


Figure 21: Development of Oil Prices Brent – Europe. Monthly
Source: Appendix 4.4

Over the past years, oil prices have been relatively stable, but in June 2014, the oil prices began to plummet. Figure 21 displays that the oil price was on a high level at $114.55 a barrel 20th of June 2014, before it started to decline. Since then, the oil prices have fallen by over 50 percent, ending up at $55.60 US dollars 30th December 2014.

4.4 REASONS FOR DECLINE IN OIL PRICE

America has become the world's largest oil producer. The high oil prices stimulated companies in the US and Canada to start drilling for new, hard-to-extract crude oil in North

[42] http://www.opec.org/opec_web/en/about_us/24.htm
[43] http://www.eia.gov/finance/markets/supply-opec.cfm

Dakota's shale formations and Alberta's oil sands. According to U.S Energy Information (EIA), the U.S oil production growth in 2014 was the greatest in over 100 years[44].

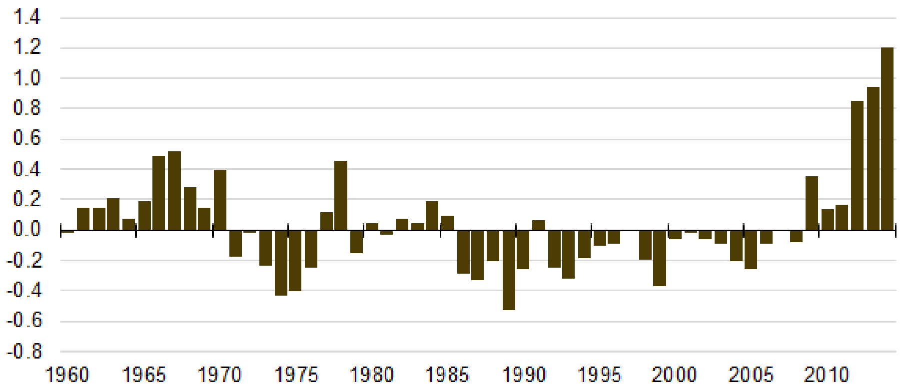


Figure 22: Annual changes in U.S field production of crude oil, 1960-2014, million barrels per day
Source: Appendix 4.5

Figure 22 illustrates the large volume increase from 2008 until 2014. U.S. crude oil production increased by 1.2 million barrels per day (bbl/d) to 8.7 million bbl/d during 2014. On a percentage basis, output increased by 16.2% in 2014, the highest growth rate since 1940[45]. Most of the increase during 2014 came from tight oil plays in North Dakota, Texas, and New Mexico, where hydraulic fracturing and horizontal drilling were used to produce oil from shale formations.

Annual increases in crude oil production regularly surpassed 15% in the first half of the 20th century, but those changes were relatively less in absolute terms, because production levels were much lower than they are now. Crude oil production in the United States has increased in each of the previous six years. This trend follows a period from 1985 to 2008 in which crude oil production fell in almost every year[46].

The production levels in USA alone has increased each year since 2009, and production reached 8 680 000 barrels per day in 2014. Import of crude oil has decreased every year since 2007, and import levels were 7 337 000 barrels per day in 2014[47]. The rise in crude oil production and the lower imports of crude oil increased the market supply as whole.

OPEC's meeting in 27th of November 2014, on how to respond to the drop in oil price, failed to reach an agreement on production curbs. Oil prices were dependent on the decision of

[44] http://www.eia.gov/todayinenergy/detail.cfm?id=20572
[45] http://www.eia.gov/todayinenergy/detail.cfm?id=20572
[46] http://www.eia.gov/todayinenergy/detail.cfm?id=20572
[47] http://www.eia.gov/dnav/pet/PET_SUM_SND_A_EPC0_MBBLPD_A_CUR.htm

production agreement. If OPEC had cut production levels, it might have led to higher oil prices in short term and increased extraction of oil from countries that are not member of OPEC. The increase in availability of oil in the market would lead to declining revenues for OPEC. If OPEC decided not to cut production levels, the oil prices would drop even more and the revenues of OPEC would decline, because energy trades, shapes their budgets. The outcome was that OPEC decided to not cut back on production, and it led to high oil supply in the market and sent the price tumbling.

A possible explanation for this could be that Saudi Arabia does not want to sacrifice own market share to restore the oil price. They could curb production sharply to restore the price, but then the main benefits would go to Iran and Russia. Saudi Arabia has $900 billion USD in reserves and they have low extracting costs from 5-6 USD a barrel[48]. Overproduction of oil in the international market is the main reason for increased supply of oil, which drew the oil price down.

4.5 NORWAY - AN OIL NATION

In December 1969, the US oil company Phillips Petroleum informed the Norwegian government about the discovery of Ekofisk. The oil field came on stream in 1971 and this was the beginning of Norway as an oil nation. During the 1980s and 1990s, several oil and gas fields were discovered. This resulted in a steadily increasing workforce, increased research of oil and gas industry technology, and made Norway into a world leader in all aspects of oil industry. With more than 40 years of oil and gas production, Norway as a state has managed to receive an enormous sum of revenues. This led the country to becoming debt free in 1994, and the government pension fund global was established. Norway ranks as one of the world´s best places to live, and provides a welfare system that benefits all its inhabitants. Today Norway is Europe's largest oil producer, the world's third-largest natural gas exporter, and an important supplier of both oil and natural gas to other European countries[49]. Norwegian crude oil extraction peaked in 2001 at 3.12 bbl/d and in 2014; it was 1.52 bbl/d[50].

[48] http://www.economist.com/blogs/economist-explains/2014/12/economist-explains-4

[49] http://www.eia.gov/countries/cab.cfm?fips=no

[50] http://fractionalflow.com/2015/03/10/norwegian-crude-oil-reserves-and-extraction-per-2014/

4.6 NORWEGIAN GROSS DOMESTIC PRODUCT

The gross domestic product (GDP) is" *an aggregated measurement of total economic production for a country that is all the finished goods and services produced within a country's borders in a specific period*".[51]

Quarterly National Accounts. Seasonally adjusted change in volume from the previous period. Per cent [1]					
	2014	1st quarter 2014	2nd quarter 2014	3rd quarter 2014	4th quarter 2014
Gross domestic product	2.2	0.5	1.1	0.5	0.9
Gross domestic product Mainland Norway	2.3	0.4	1.2	0.1	0.5
Petroleum activities and ocean transport	1.9	1.1	0.8	1.8	2.5
Final domestic use of goods and services	2.2	-0.4	1.8	0.8	-1.7
Final consumption expenditure of households and NPISH	2.1	1.0	0.7	0.1	1.0
Final consumption expenditure of general government	2.5	0.2	0.8	0.6	0.9
Gross fixed capital formation (GFCF)	1.2	0.7	1.2	-1.5	-2.7
Total exports	1.7	2.1	-0.5	1.4	3.4
Total imports	1.6	-0.3	1.0	2.8	-3.7
Employed persons	1.1	0.2	0.3	0.3	0.2
Total hours worked	1.6	0.2	0.3	0.2	0.3

[1] Figures for the last two years are preliminary.

Table 2: National Accounts Quarterly Norway
Source: Appendix 4.6

Mainland Norway is defined as all economic activity in Norway, excluding petroleum activities and ocean transport. Petroleum activities constitute a major part of value added in the Norwegian economy[52], where the GDP grew by 2.2% in Q4 2014. This contributed to an increase in total GDP of 0.9% in Q4 2014.

According to SSB, the export grew by 1.7% during 2014, due to higher exports of machinery and other equipment, chemicals, and mineral products. Export increased after the decline in oil price. It was a decrease of 0.5% in Q2, while in Q3 exports increased by 1.4% and 3.4% in Q4 2014. In the other side, it was a decline of imports after the decline of oil price in June 2014. In Q2, imports increased by 1%, in Q3 with 2.8 percent and fell with 3.7% in Q4. In overall, import increased by 1.6% during 2014. The weakening of the Norwegian krone partly due to the oil price drop could explain some of the increase in export and decrease in import.

National accounts illustrate the overall figures of a country's economy. It is used to track the country's development over time and for comparisons internationally. The Norwegian national accounts in table 2 display the percentage changes in 2014. The GDP increased by

[51] http://www.investopedia.com/terms/g/gdp.asp
[52] http://www.statsbudsjettet.no/Upload/Statsbudsjett_2015/dokumenter/pdf/national_budget2015.pdf

0.5% in Q1, 1.1% in Q2, 0.5% in Q3 and 0.9% in Q4. In 2014, the total GDP was 2.2% compared to a GDP of 0.6% in 2013. The Norwegian economy is vulnerable to the development of oil prices because of the different sources of income from petroleum activities.

4.7 NORWEGIAN GOVERNMENT REVENUES AND EXPENSES

The state budget consists of estimates on anticipated revenues and expenditures. In Norway, the government prepares a budget proposal for an in-depth treatment in the state administration. The first budget proposal will be submitted at the beginning of October in the year before the budget year.

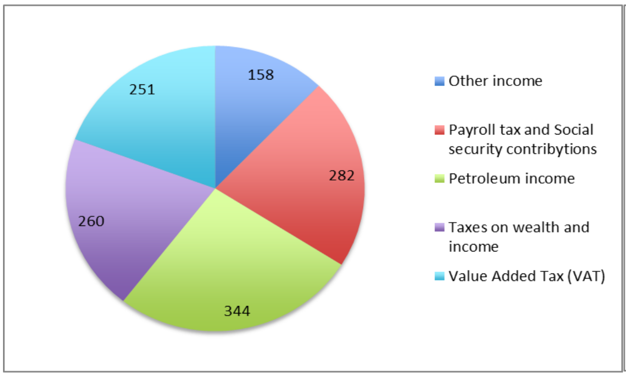


Figure 23: Revenues on the state budget, excluding loan transactions in 2014
Source: Appendix 4.7

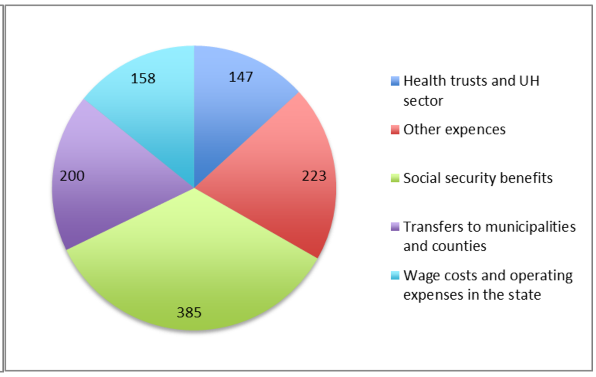


Figure 24: The expenditure of the National budget, excluding loan transactions in 2014
Source: Appendix 4.8

The governments revenues for 2014 was estimated at 1 295 billion Norwegian kroner. Revenues are derived from petroleum revenues, employer's contribution, social security contribution, value added tax, tax on fortune, and tax on income. All of these constitute 88 percent of total revenues. Other revenue sources are taxes related to vehicles, tobacco, alcohol, interest earnings and dividends as shown in figure 23.

Government revenues from the petroleum sector are estimated at 297 billion in 2014, which is a decrease of 50 billion compared to 2013. The reduction started in 2013, when petroleum revenues also fell by 50 billion from the year before. This is because of lower production in the petroleum sector and lower prices of oil and gas compared to previous levels.

Excluding the petroleum revenues, there was a 76 billion increase in government's revenues from 2013 to 2014[53]. Contributing factors to the increase are increased tax payments in mainland Norway and increase in interests and dividends in the Government Pension Fund Global[54].

The government's expenses estimated for 2014 were 1114 billion Norwegian krone. Figure 24 shows all categories of expenses. The largest expenses in the national budget are social security benefits, which include pensions, sickness benefits, unemployment benefits, parental benefits, and health benefits. Other expenses are wage costs and operating expenses in the state, and transfers to municipalities and counties[55].

4.8 NORWEGIAN GOVERNMENT REVENUES FROM THE PETROLEUM INDUSTRY

Norway has its own system to ensure government revenues from petroleum activities. The basis for granting this system is the extraordinary returns related to the extraction of resources. Ownership of the petroleum resources belongs to the community, and the state secures a large portion of the values created through taxation and direct ownership[56]. The Government revenues from the Norwegian continental shelf can be divided into several sources. Tax revenues from oil companies, revenues from Petoro that manages the state`s direct ownership in Norwegian fields, and dividend from Statoil where the state owns 67 percent of shares[57].

4.8.1 TAX REVENUES FROM OIL COMPANIES

Income from petroleum-related activities on the Norwegian continental shelf are liable to 27 percent ordinary company tax. There is an additional tax of 51 percent on income from the extraction, processing and pipeline transportation of petroleum. The companies related to exploration and processing of petroleum are therefore obligated with a marginal tax rate of 78 percent[58].

---

53 http://www.ssb.no/offentlig-sektor/statistikker/offinnut
54 http://www.ssb.no/offentlig-sektor/statistikker/offinnut
55 http://www.statsbudsjettet.no/Statsbudsjettet-2014/Satsinger/?pid=59865
56 https://www.regjeringen.no/nb/tema/energi/olje-og-gass/statens-inntekter-fra-petroleumsverksemda/id2076770/
57 http://e24.no/energi/statens-oljeinntekter-kollapser-med-dagens-oljepris/23374213
58 http://verdtavite.kpmg.no/petroleumsbeskatning.aspx

4.8.2 STATE DIRECT FINANCIAL INTEREST

The Norwegian government has large holdings in oil and gas licences on Norway's continental shelf through the State Direct Financial Interest (SDFI) managed by Petoro AS. The company's most important task is to ensure the highest possible value creation from the SDFI[59]. The SDFI is an arrangement where the state owns a portion of several oil and gas fields, pipelines and onshore facilities. The owner portion of oil and gas fields are determined in conjunction with the granting of the license, and the size varies from field to field. As one of several owners, the State pays its share of investment costs and receives a corresponding portion of the revenues from the production license[60].

4.8.3 DIVIDEND FROM STATOIL

Statoil was established in 1972, as a government owned oil company. Statoil is integrated oil and gas company with headquarters in Stavanger. The company operates about 70 percent of the oil and gas production in Norway[61]. In June 18th 2001, Statoil was partly privatised, and listed on the Oslo Stock Exchange and the New York Stock Exchange. The Norwegian government is the majority shareholder with a stake of 67 percent managed by the oil and energy ministry[62]. The dividend received becomes a part of the petroleum revenues and in 2013 the dividend was 14.42 billion Norwegian kroner. Statoil is the largest company in the Norwegian oil industry and its performance is highly dependent on the international oil price development. The dividend payouts from Statoil contribute to the government budget.

4.8.4 ENVIRONMENTAL LEVY

The government receives income from carbon dioxide tax introduced in 1991 with the purpose of reducing carbon dioxide emissions from petroleum. For 2014, the rate was set at 98 cents per litre of oil, condensate or standard cubic meters. The total cost of emitting CO2 in business is high, about 450 Norwegian krone per ton CO2. In addition to carbon dioxide tax, there are also quotas. This means that companies must buy carbon offsets for every ton of carbon dioxide they release on the Norwegian Continental Shelf.

---

59 https://www.petoro.no/about-petoro
60 https://www.regjeringen.no/nb/tema/energi/olje-og-gass/statens-inntekter-fra-petroleumsverksemda/id2076770/
61 https://snl.no/Statoil_ASA
62 https://www.regjeringen.no/nb/aktuelt/staten-har-nadd-67-prosent-eierandel-i-s/id547947/

4.9 THE GOVERNMENT PENSION FUND GLOBAL

In 1990, The Government Petroleum Fund was established and later changed to "The Government Pension Fund Global". Its main objective is to generate high returns and safeguard wealth for current and future generations. The investment strategy consists of 60 percent in equities, about 35 percent in fixed income and up to 5 percent in real estate. Investments are dispersed internationally to hedge against the dependence of Norwegian economy on petroleum revenue.

The funds market value is affected by investment returns, capital inflow and exchange rates, and reached 6431 billion Norwegian kroner in 2014[63]. The Ministry of Finance owns the oil fund on behalf of the Norwegian people, while Norges Bank Investment Management manages it. The Ministry of Finance determines the fund's investment strategy, with advice from Norges Bank Investment Management and discussions in Parliament[64].

In 2014, the Government Pension Fund Global achieved a 7.6% return on investments, this correspond to 544 billion Norwegian krone[65]. During 2014, 149.8 billion Norwegian krone were transferred to the national budget. The amount was in original estimated to be 135 billion Norwegian kroner for the year 2014 (2.9 percent of the oil fund). This could be explained by the shock and changes in the Norwegian economy, and the need for more funding because of the fall in oil price.

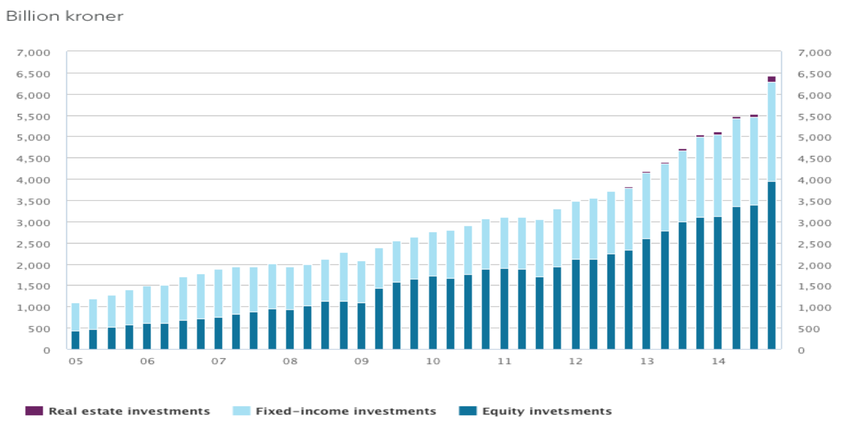


Figure 25: Market value development of the Government Pension Fund Global (the oil fund)
Source: Appendix 4.9

63 http://www.nbim.no/en/the-fund/market-value/
64 www.norges-bank.no
65 http://www.nbim.no/en/the-fund/

Figure 25 illustrates the increasing development of market value in billion Norwegian Kroner from 2005 Q1 until 2014 Q4[66]. Further, it indicates that the market value has continued to increase despite the decrease in oil price. This is because they have diversified investments globally to ensure protection against fluctuations in the oil price.

4.9.1 FISCAL POLICY

The fiscal policy is a guideline passed by the Norwegian Parliament in 2001, which determines the proportion of revenues from oil activities that can be used each year in the state budget. The purpose is to prevent draining the funds capital over time, so that future generations can benefit from the oil fund.[67].

The fiscal policy guideline suffice a gradual phasing-in of oil revenues into the Norwegian economy, on par with the expected real rate of return on the Government Pension Fund Global, estimated at 4 percent to ensure a stable economic development[68]. Monetary use shall be adapted with cyclical fluctuations in the Norwegian economy. This means that the state can use more than 4 percent when the economy performs worse and less than 4 percent when it goes well. In other words, it should function countercyclical. In 2009, this room for manoeuvre was used to mitigate the effects of the financial crisis on the economy[69].

4.10 CONCLUSION

The oil market has a large influence in the Norwegian economy. The increased oil production in both in the United States and Canada in 2014, led to a higher supply in the global oil market and pulled down the oil price. In addition, OPEC did not limit the oil production, which further strengthen the supply even more. In the same time, oil demand also increased due to low oil prices. However, the supply was higher than the demand of oil in the market. The Norwegian krone exchange rate fell immediately that led to negative shock signal about the shape of the Norwegian economy. Exports increased rapidly compared to the period before the oil price went down. Oppositely, the import declined. The Government Pension Fund Global was not affected by this incident because the investments are diversified abroad. Meanwhile more money was withdrawn from the oil fund into the national budget as a

[66] www.nbim.no
[67] https://snl.no/Handlingsregelen
[68] http://www.nbim.no/en/the-fund/
[69] http://www.statsbudsjettet.no/Upload/Statsbudsjett_2014/dokumenter/pdf/national_budget_2014.pdf

response to the oil price drop. Increased expenses and less oil revenues was a result of the decline in oil prices in 2014.

5 STATISTICAL THEORY

5.1 TIME SERIES

A time series is a sequence of numerical data points in successive order observed over a time interval. It can be decomposed into trend, cycle, seasonality and irregular fluctuations. Time series models are used to gather information, and find answers to questions on statistical properties. Trend is an issue with time series, when the independent variable becomes more significant than what is true due to the same underlying trend as the dependent variable. This means that the collected dataset is non-stationary, and we therefore have a spurious regression model where the results are misleading. A spurious regression model will give a high R^2 because the variables in the model correlate with each other.

To stabilize the variance of the time series we can transform the time series $\mathrm{X_t}$ into log values $\mathrm{y_t} = \log(\mathrm{X_t})$ (Tsay, 2010).

5.2 R-SQUARED

R-squared is a statistical measure on how much variation the independent variables explains in the dependent variable. The mathematical definition for R-squared is the same as for the regression with a single repressor:

$$R^2 = \frac{\mathrm{ESS}}{\mathrm{TSS}} = \frac{\sum_{i=1}^{n}(\hat{Y}_i - \bar{Y})^2}{\sum_{i=1}^{n}(Y_i - \bar{Y})^2}$$

The value of R-squared ranges from 0 to 1. If the R-squared value is 0, the regression fits perfectly. If the R-squared value is 0, it fits no better than the simple mean of the dependent variable. The value of R-squared increases when more variables are included in the model, no matter if they are relevant or not. This can be a problem and provide false signal of the explained variation in the dependent variable.

5.3 ADJUSTED R-SQUARED

The adjusted R-squared is a modified version of R-squared. It penalizes R-squared for the variables that does not contribute to the explanatory power of the model. While R-squared assumes that each variable in the regression line explains the variation in the dependent variable, the adjusted R-squared measures the percentage of the variation explained by only the independent variables that actually affect the dependent variable. [70]

5.4 DURBIN WATSON TEST

The Durbin Watson test is a statistical measure that tests whether there is autocorrelation in the residuals. The Durbin Watson test variable is:

$$DW = \sum_{t=2}^{T}(\hat{\varepsilon}_t - \hat{\varepsilon}_{t-1})^2 \big/ \sum_{t=1}^{T} \hat{\varepsilon}_t^2$$

The Durbin Watson statistic value ranges from 0 to 4. A value of 2 indicates that there does not exist any autocorrelation in the sample. Values approaching 0 is evidence of positive autocorrelation, while values towards 4 is evidence towards negative autocorrelation in the residuals.[71]

5.5 STUDENT T-TEST

A student t-test is a statistical hypothesis test. It is used to test for instance the mean value in an independent identically distributed dataset.

The null hypothesis, $H_0: \mu_1 = \mu_2$ is tested against the alternative hypothesis, $H_1: \mu_1 \neq \mu_2$

The test variable is:

$$\frac{\overline{\mathrm{Y}} - \mu_{\mathrm{Y},0}}{\mathrm{SE}(\overline{\mathrm{Y}})}$$

The t-score is a ratio between the difference of two groups and the difference within the groups. If the t score is large, it is a signal that the groups are different. If the t score is small, it is a signal that the groups are similar. The bigger the t-value, the more likely it is that the results are repeatable[72]. If the p-value is less than the significance level, we reject the null hypothesis and conclude that the mean is statistically different.

---

[70] http://www.statisticshowto.com/adjusted-r2/
[71] http://www.investopedia.com/terms/d/durbin-watson-statistic.asp
[72] http://www.statisticshowto.com/students-t-test/

5.6 STATIONARITY

Often time series models are assumed stationary, meaning that it does not follow a trend. Stationarity is the foundation in time series analysis and we distinguish between strict and weak stationarity.

A time series X_t is strictly stationary if the joint distribution of $X_{t_1}, \ldots, X_{t_k}$ is identical to $X_{t_1+t}, \ldots, X_{t_k+t}$ for all *t*, where *k* is an arbitrary positive integer and $t_1, \ldots, t_k$ is a collection of *k* positive integers. This means that a time series is strictly stationary if the joint distribution $X_{t_1}, \ldots, X_{t_k}$ is invariant under time shift. This is a strong condition and hard to verify empirically. An test for stationarity is the augment dickey fuller test.

A time series X_t is weakly stationary if both the mean of X_t and the covariance between X_t and X_{t-k} and time are invariant, where k is an arbitrary integer. In other words, a time series is weakly stationary if the following conditions have been fulfilled:

1. $E[X_t] = \mu$ for all *t*
2. $Var[X_t] = \sigma^2$ for all *t*
3. $Cov[X_t, X_{t+k}] = \rho$ for all *t* and all $k \neq 0$

If these conditions are not fulfilled, then X_t is not stationary. Non-stationary variables can in some cases be converted to stationarity by transforming the data so the OLS method can be used. The most common transformation is to use the difference operator:

$$\Delta X_t = X_t - X_{t-1}.$$

If the variable becomes stationary after differentiating once then it is said to be integrated of first order. A time series X_t is integrated of order *d(I(d))* if it must be differentiated *d* times before becoming stationary. A stationary variable is per definition *I(0)*.[73]

5.7 AUGMENTED DICKEY FULLER TEST

The ADF test tests the null hypothesis that there is a unit root against the alternative of (trend-) stationarity.

[73] https://bora.uib.no/bitstream/handle/1956/6122/97362087.pdf?sequence=1

To introduce the test, consider an AR(1) process:

$$y_t = \phi y_{t-1} + \varepsilon_t$$

If $\phi < 1$, the AR(1) process is stationary and we can rewrite the equation above as:

$$\Delta y_t = \mu y_{t-1} + \varepsilon_t,$$

where $\mu = \phi - 1$. This rewritten equation can be used to test for a unit root, using the parameter μ. The null hypothesis is

$$H_0: \mu = 0,$$

which implies that y_t is integrated of order one, $y_t \sim I(1)$. The alternative is:

$$H_1: \mu < 0,$$

which imply that y_t is stationary. (Bjørndal and Thorsund 2015)

5.8 ENDOGENIETY

A variable that is correlated with the error term in a regression model is called endogenous. Endogenity can occur from measurement error, auto regression with auto correlated errors, simultaneity, or omitted variables. If one or more of the independent variables in a regression are endogenous, we have an issue with endogenous regressors or simultaneity[74].

There are two common sources of endogeneity. The first is a confounding variable, which is a variable in a statistical model that correlates directly or inversely with both the dependent and independent variable[75]. The second cause is a loop of causality between the dependent and independent variables of a model[76].

[74] Applied time series for macroeconomics by Bjørnland og Thorsund, 2015
[75] http://en.wikipedia.org/wiki/Confounding
[76] http://en.wikipedia.org/wiki/Endogeneity_(econometrics)

5.9 ERROR CORRECTION MODEL

The Error Correction Model (ECM) is used to analyse the short-term dynamics between the dependent variable and the independent variables. The ECM also ensures a long-term equilibrium relationship.

Error correction model are usually of the following form:

$$\Delta y_t = b_1 \Delta x_t - \lambda[y_{t-1} - \beta_0 - \beta_1 x_{t-1}] + \varepsilon_t$$

The first part of the equation up to the curly brackets is the short-term relationship, b_1 and λ are short term parameters. The parameter λ is the adjustment parameter and it describes the speed back to equilibrium after a deviation from the equilibrium between x and y.

The curly bracket is the long-term relationship between y and x, which is equal to zero in the equilibrium. The parameter β_1 estimates the long-term effect an increase in x has on y. The long term effect is spread over future time periods according to the speed of adjustment λ.

For the model to revert to equilibrium, the lambda value must be between zero and one. If lambda is zero then there is no long-term relationship between x and y.

5.10 AUTOCORRELATION

A typical characteristic with time series data is that the value of the dependent variable in one period is correlated with its value in the next period. A time series that is correlated with its own lagged values is described as auto correlated or serially correlated.

Consider the following regression model:

$$Y_i = \alpha + \beta X_i + \varepsilon_i$$

Serial correlation means that there is covariance between the error terms:

$$Cov(\varepsilon_i, \varepsilon_s) \neq 0 \qquad i \neq s$$

A regression model gives the best estimates, when there is no autocorrelation. Omitted variable, misspecification of the model or measurement error in the independent variable can lead to problems with autocorrelation.

6 THE EMPIRICAL MODEL

The main objective of this thesis is to investigate whether house prices in Norway are affected by oil fluctuations. To answer this, we will do an empirical analysis in the period Q1 2006 to Q4 2014, and chose to study five cities, Bergen, Oslo, Stavanger, Trondheim and Tromsø. In addition, we will also do the same on the national level. We are going to focus on the period after the oil price declined in June 2014. In our estimations, we choose to use the house price model by Jacobsen and Naug[77], because the model is used in many articles and theses related to the housing market[78]. In the coming sections, we will present the house price model by Jacobsen and Naug.

6.1 HOUSE PRICE MODEL BY JACOBSEN AND NAUG

Jacobsen and Naug introduced a house price model in 2004[79]. This model includes the most important factors that have explanatory effect in the housing market. Their estimation period of the model is from Q2 1990 to Q1 2004. They find that interest rate, housing construction, unemployment and household income are the most important explanatory factors for the house prices. Furthermore, their results indicate that interest rate has both a strong explanatory effect and fast impact on house prices. In chapter 8, we are going to re-estimate their house price model with our data and see if our results correspond to theirs.

6.2 THE EQUATION FOR HOUSEHOLD EXPECTATION BY JACOBSEN AND NAUG

Jacobsen and Naug pointed out that both actual and expected interest rates are important in the explanation of house prices. In addition, they also included consumer confidence indicator from TNS Gallup in their model to capture the effect of household`s expectations. This indicator had a strong correlation with house prices, as well with unemployment and interest rates.

The consumer confidence indicator by TNS Gallup is, as mentioned in section 3.1.1, based on household`s expectations of their own financial position and country`s economy. TNS Gallup

---

[77] http://www.norges-bank.no/Upload/import/english/publications/economic_bulletin/2005-01/jacobsen.pdf
[78] http://brage.bibsys.no/xmlui/bitstream/handle/11250/167773/1/Fredriksen%20Heidi%202007.pdf, https://bora.uib.no/bitstream/handle/1956/6122/97362087.pdf?sequence=1

[79] http://www.norges-bank.no/Upload/import/english/publications/economic_bulletin/2005-01/jacobsen.pdf

has since 1997 done quarterly surveys to measure this consumer confidence indicator. The survey is based on 5 equally weighted questions, see appendix 5.1. The indicator is computed by first subtracting the negative answers from the positive ones, and then by dividing this number with the total number of questions to find the average expectation value. The sign of the final value indicates the prospect the majority of households have on their own and the country's economy.

We will now present Jacobsen and Naug model for household`s expectations of their own and the country`s economy.

<u>The model for household`s expectations of their own and the country`s economy:</u>

$$\Delta E_t = \alpha + \gamma_1 \Delta(INTEREST\ RATE(1-\tau))_t + \gamma_2 \Delta unemployment_t + \gamma_3 E_{t-1} + \gamma_4 (INTEREST\ RATE(1-\tau)_{t-1} + \gamma_5 unemployment_{t-1} + \gamma_6 S1 + \gamma_7 S2 + \gamma_8 S3$$

α	Constant
Δ	Difference operator
Uppercase	Variables that is not measured in the scale of logarithm
Lowercase	Variables measured in the scale of logarithm
Si	1 - Quarter i 0 – Otherwise (Seasonal variable)
τ	Tax
γ_i	Coefficient
t	Time period
t-1	Lagged time period
$INTEREST\ RATE(1-\tau)$	Average interest rate after tax
$unemployment$	Unemployment
E	Indicator of household expectations for their own financial situation and the Norwegian economy from TNS Gallup

Table 3: Explanation of symbols and variables in the equation for household's expectations for their own and the country`s economy

As mentioned earlier, the consumer confidence indicator by TNS Gallup have a strong correlation with house prices, as well with unemployment and interest rates. Therefore, Jacobsen and Naug decided to correct household expectation by using the expectation model above, before computing the deviation between the actual and expected value of the expectation indicator. This deviation measures the shift in expectations due to other factors than interest rates and unemployment. Examples are negative shocks as stock market drops, terrorism and bad sign for the Norwegian economy.

The residuals retained from the estimation of the household expectation model are further inserted into following equation to find the deviation between the actual and expected value.

$EXPEC_t = (\varepsilon_t + \varepsilon_{t-1}) + 100 * (\varepsilon_t + \varepsilon_{t-1})^3$, where ε_t are the residuals from the household expectation model.

Jacobsen and Naug expectation equation stated in their article "*What drives house prices? , 2004*" is presented differently, by that the sign is negative(minus) instead of positive (plus), as shown below:

$$EXPEC_t = (E_t - E_{t-1}) + 100 * (E_t - E_{t-1})^3$$

$(E_t - E_{t-1})$ is almost the same as the residual from the expectation model[80].The reason for they are not exactly the same between these two equations is because E is measured as the sum of two quarters, instead of the level in quarter t.

The phrase that we chose to set up $EXPEC_t = (\varepsilon_t + \varepsilon_{t-1}) + 100 * (\varepsilon_t + \varepsilon_{t-1})^3$ is therefore the same as $EXPEC_t = (E_t - E_{t-1}) + 100 * (E_t - E_{t-1})^3$. This is confirmed by Naug via mail correspondence.

Thereby,

$$EXPEC_t = (E_t - E_{t-1}) + 100 * (E_t - E_{t-1})^3 = (\varepsilon_t + \varepsilon_{t-1}) + 100 * (\varepsilon_t + \varepsilon_{t-1})^3$$

$EXPEC_t$ is the expectation variable, and will be implemented in the house price equation.

[80] http://www.norges-bank.no/Upload/import/english/publications/economic_bulletin/2005-01/jacobsen.pdf

6.3 THE EQUATION FOR HOUSE PRICES BY JACOBSEN AND NAUG

Jacobsen and Naug developed the equation below for house prices. We will look at the content of this equation.

The equation for house prices:

$$\Delta house\ price = \beta_1 \Delta income_t + \beta_2 \Delta(INTEREST\ RATE(1-\tau))_t$$
$$+ \beta_3 \Delta(INTEREST\ RATE(1-\tau)_{t-1} + \beta_4 EXPEC_t + \lambda[\text{houce price}_{t-1}$$
$$+ \delta_1 (INTEREST\ RATE(1-\tau)_{t-1} + \delta_2 unemployment_t$$
$$+ \delta_3 (income - housingstock)_{t-1}] + \alpha + \beta_5 S1 + \beta_6 S2 + \beta_7 S3$$

[Curly bracket]	Measures the deviation of the estimated long term context
EXPEC	Residuals from the regression of household expectation of country`s and own economy
λ	Adjustment term, expresses the time back to the state of equilibrium
β_i	Coefficient
δ_i	Coefficients in the long term context
$(Income - housingstock)$	(Income − housingstock) Is included in the model, because Jacobsen and Naug discovered that it was a strong correlation between income and housing stock when adjusting for seasons.

Table 4: Explanation of symbols and variables in the equation for house prices

This house price model contains effects from household's total income, average interest rates after tax on loans, housing stock, and the residuals from the equation on household expectation ($EXPEC_t$).

6.4 THE EQUATION FOR HOUSE PRICES - SHORT TERM EFFECT

The house price equation below contains only short-term variables. In chapter 8, we use this equation in our estimation to get a better insight of the effect from the short-term variables.

The equation for house prices with only short-term variables:

$$\Delta house\ price = \beta_1 \Delta income_t + \beta_2 \Delta(INTEREST\ RATE(1-\tau))_t + \beta_3 \Delta(INTEREST\ RATE(1-\tau)_{t-1} + \beta_4 EXPEC_t + \alpha + \beta_5 S1 + \beta_6 S2 + \beta_7 S3$$

6.5 THE EQUATION FOR HOUSE PRICES - LONG TERM EFFECT

The house price equation below contains only variables from the long-term context.

<u>The equation for house prices with only long-term variables:</u>

$$\Delta house\ price = \lambda[\text{houce price}_{t-1} + \delta_1(INTEREST\ RATE(1-\tau)_{t-1} + \delta_2 unemployment_t + \delta_3(income - housingstock)_{t-1}] + \alpha + \beta_5 S1 + \beta_6 S2 + \beta_7 S3$$

6.6 THE EQUATION FOR HOUSE PRICES AND OIL PRICES

In our estimation and analysis, we use the following simple regression model for house prices.

<u>A simple regression model:</u>

$$\Delta house\ price = \alpha + \Delta oil\ price,$$

where $\Delta oil\ price$ is the independent variable. The oil price variable is a difference operator and is measured in the scale of logarithm. For explanations of variables and symbols, refer to tables 3 and 4.

6.7 THE EQUATION FOR HOUSE PRICES WITH THE OIL PRICE VARIABLE

We use the equation below in our estimation for house prices included the oil price variable.

<u>The house price equation included oil prices:</u>

$$\Delta house\ price = \beta_1 \Delta income_t + \beta_2 \Delta(INTEREST\ RATE(1-\tau))_t + \beta_3 \Delta(INTEREST\ RATE(1-\tau)_{t-1} + \beta_4 EXPEC_t + \lambda[\text{houce price}_{t-1} + \delta_1(INTEREST\ RATE(1-\tau)_{t-1} + \delta_2 unemployment_t + \delta_3(income - housingstock)_{t-1}] + oil\ price + \alpha + \beta_5 S1 + \beta_6 S2 + \beta_7 S3$$

For explanations of variables and symbols, refer to tables 3 and 4. The oil price variable is measured in the scale of logarithm.

6.8 THE EQUATION FOR HOUSE PRICES WITH THE OIL PRICE VARIABLE- SHORT TERM EFFECT

The following equation for house prices includes oil prices and variables from the short-term context.

<u>The equation for house prices with short-term variables and the oil price variable:</u>

$$\Delta house\ price = \beta_1 \Delta income_t + \beta_2 \Delta(INTEREST\ RATE(1-\tau))_t + \beta_3 \Delta(INTEREST\ RATE(1-\tau)_{t-1} + \beta_4 EXPEC_t + oil\ price + \alpha + \beta_5 S1 + \beta_6 S2 + \beta_7 S3$$

6.9 THE EQUATION FOR HOUSE PRICES WITH THE OIL PRICE VARIABLE - LONG TERM EFFECT

This equation for house prices includes oil prices and variables from the long-term context.

<u>The equation for house prices with long-term variables and the oil price variable:</u>

$$\Delta house\ price = \lambda[houce\ price_{t-1} + \delta_1(INTEREST\ RATE(1-\tau)_{t-1} + \delta_2 unemployment_t + \delta_3(income - housingstock)_{t-1}] + oil\ price + \alpha + \beta_5 S1 + \beta_6 S2 + \beta_7 S3$$

7 DATA

7.1 DATA AND IMPLEMENTATION

The main data sources are Statistics Norway (SSB), TNS Gallup, Fred.no and NAV, see appendix 7.1. The data used in our empirical analysis is mainly from the period Q1 2006 to Q4 2014. Time series are quarterly data, not adjusted for seasonality or trend. This is because seasonal dummy variables are already inserted in the model by Jacobsen and Naug. When it comes to data used to estimate the equation for house prices and oil prices, $\Delta house\ price = \alpha + \Delta oil\ price$, the period is from M2 2003 to M12 2014. Time series for this are monthly data, not adjusted for seasonality or trend.

In our analysis, we have selected five different cities located in different regions to make comparisons of Bergen, Oslo, Stavanger, Tromsø and Trondheim. In addition, we also included Norway to capture the overall view of the country. Data for house prices and unemployment contains specific data`s based on Norway and each of our selected cities.

We started to re-estimate the expectation model and used the least square method in Eviews as the modelling tool for estimating our data. In the re-estimation of this, we only included variables specified in the expectation model mentioned in section 6.2, which consist of unemployment, interest rate and the consumer confidence indicator by TNS Gallup. We did exactly the same structure and method with the house price model, and included all the specified variables in the house price equation, mentioned in section 6.3.

In the house price model with oil prices, we simply added the oil price variable into the model. This equation is shown in section 6.7. In addition to this, we also estimated a house price model with only short-term variables and another one with only long-term variables, both with and without oil price variable. The purpose of estimating models by separating short -and long-term variables with and without oil prices, are to investigate differences between them. The constant term and the seasonal variables are inserted in all of those models for all cities and Norway.

As mentioned in chapter 1 at the introduction part, the main purpose of this analysis is to investigate if oil prices have a significant effect on house prices. To capture this, we used the house price model presented in section 6.6 in our estimation, where the dependent variable is, $\Delta house\ price$ and the independent variable is $\Delta oil\ price$. In addition, we also included a constant to make the model more stable. We especially used a difference operator ($\Delta\beta_t = \beta_t - \beta_{t-1}$) of the oil price variable, because the dependent variable, $\Delta house\ price$, is already a difference operator. To get a more accurate result, we decided to use same level for the oil price variable.

7.2 OVERVIEW OF DATA

We have graphed all our data used in our estimations of both expectation and house price models to get an overall view and understanding of the variables, before estimating and modelling in our empirical analysis. See appendix 6.1.

7.3 DESCRIPTIVE ANALYSIS OF DATA RESULTS

The definition of descriptive analysis is "*a set of brief descriptive coefficients that summarizes a given data set, which can either be a representation of the entire population or a sample. The measures used to describe the data set are measures of central tendency and measures of variability or dispersion".*[81]

Measurements for the central tendency include the mean, median and mode, while the standard deviation (or the variance), the minimum and maximum, kurtosis and skewness, are measurements for the variability.

We have made a descriptive analysis for the variables used in our estimations for Norway and each of our selected cities, Oslo, Bergen, Stavanger, Trondheim and Tromsø. For a more detailed overview of each variable, refer to appendix 6.2.

[81] http://www.investopedia.com/terms/d/descriptive_statistics.asp

	Bergen		Oslo		Stavanger		Trondheim		Tromsø		Norway	
Variable	Skewness	Kurtosis	Skewness	Kurtosis	Skewness	Kurtosis	Skewness	Kurtosis	Skewness	Kurtosis	Skewness	Kurtosis
$\Delta house\ price_t$	-1.3538	5.4943	-1.1434	4.5626	-0.5675	3.7912	-1.2150	4.5818	-1.5248	6.4720	-1.1648	5.0081
$\Delta income$	2.5262	8.5920	2.5262	8.5920	2.5262	8.5920	2.5262	8.5920	2.5262	8.5920	2.5262	8.5920
$\Delta(INTEREST\ RATE(1-\tau))_t$	-3.1261	15.6092	-3.1261	15.6092	-3.1261	15.6092	-3.1261	15.6092	-3.1261	15.6092	-3.1261	15.6092
$\Delta(INTEREST\ RATE(1-\tau)_{t-1}$	-3.1874	15.9399	-3.1874	15.9399	-3.1874	15.9399	-3.1874	15.9399	-3.1874	15.9399	-3.1874	15.9399
$EXPEC_t$	-2.9006	12.2882	-2.0723	8.2666	-2.9269	12.1486	-2.5270	9.7877	-1.6559	5.9283	-1.5544	5.5054
$\lambda house\ price_{t-1}$	0.1187	1.7390	0.1945	1.7127	-0.3505	2.0969	0.3003	1.6160	0.8640	3.0545	0.0477	1.7762
$(INTEREST\ RATE(1-\tau)_{t-1}$	1.5389	4.3325	1.5389	4.3325	1.5389	4.3325	1.5389	4.3325	1.5389	4.3325	1.5389	4.3325
$unemployment_t$	-0.4087	2.3664	-0.9772	2.9381	-0.5373	2.4600	0.2966	1.8435	-0.1457	2.3381	-1.0785	3.0411
$(income - housingstock)_{t-1}$	-1.4499	3.8254	-1.4499	3.8254	-1.4499	3.8254	-1.4499	3.8254	-1.4499	3.8254	-1.4499	3.8254
$oil\ price$	-0.5151	2.0558	-0.5151	2.0558	-0.5151	2.0558	-0.5151	2.0558	-0.5151	2.0558	-0.5151	2.0558
$S1$	1.2928	2.6713	1.2928	2.6713	1.2928	2.6713	1.2928	2.6713	1.2928	2.6713	1.2928	2.6713
$S2$	1.1113	2.2350	1.1113	2.2350	1.1113	2.2350	1.1113	2.2350	1.1113	2.2350	1.1113	2.2350
$S3$	1.1113	2.2350	1.1113	2.2350	1.1113	2.2350	1.1113	2.2350	1.1113	2.2350	1.1113	2.2350

Table 5: An overview of Skewness and Kurtosis in the variables included in the house price model with oil price variable
Source: Self estimated in Eviews, Appendix 6.3 for Skewness and 6.4 for Kurtosis

Skewness is defined as "*a measurement of the symmetry of the probability distribution of a real valued random variable about its mean*".[82] Table 5 shows that most of the variables have negative skewness, which indicates that the tail of the left hand side of the distribution is fatter than the right hand side.

The definition of kurtosis is "*A statistical measure used to describe the distribution of observed data around the mean".*[83] As table 5 shows, all variables have positive kurtosis, which indicates heavy tails in the distribution. Briefly said, both kurtosis and skewness indicate that the variables are not normally distributed, this is a sign of heteroscedasticity.

7.4 CORRELATION MATRIX

The correlation matrix clearly indicates correlation between house prices, interest rates and unemployment. See appendix 6.5 for an overview of the correlation matrix. These independent variables are statistically significant at 1% confidence level in almost every city. An exception is unemployment in Stavanger and Tromsø, which are statistically significant at 5% confidence level.

[82] http://en.wikipedia.org/wiki/Skewness
[83] http://www.investopedia.com/terms/k/kurtosis.asp

Furthermore, the correlation matrix shows that interest rate has a correlation with household expectation with 1% confidence level in every city, and 5% significance in Norway. In overall, seasonal variables have a significant correlation with house prices.

7.5 AUGMENTED DICKEY FULLER TEST

In this section, we present the results from the Augmented Dickey Fuller test.

Variable	H0: Unit-root	H1: Stationary
$\Delta house\ price\ Bergen$		X
$\Delta house\ price\ Norway$		X
$\Delta house\ price\ Oslo$		X
$\Delta house\ price\ Stavanger$		X
$\Delta house\ price\ Tromsø$		X
$\Delta house\ price\ Trondheim$		X
$\Delta income_t$		X
$\Delta(INTEREST\ RATE(1-\tau))_t$	X	
$\Delta(INTEREST\ RATE(1-\tau))_{t-1}$	X	
$EXPEC_t\ Bergen$		X
$EXPEC_t\ Norway$		X
$EXPEC_t\ Oslo$	X	
$EXPEC_t\ Stavanger$		X
$EXPEC_t\ Tromsø$	X	
$EXPEC_t\ Trondheim$	X	
$(INTEREST\ RATE(1-\tau))_{t-1}$	X	
$\lambda[houce\ price]_{t-1}\ Bergen$	X	
$\lambda[houce\ price]_{t-1}\ Norway$	X	
$\lambda[houce\ price]_{t-1}\ Oslo$	X	
$\lambda[houce\ price]_{t-1}\ Stavanger$	X	
$\lambda[houce\ price]_{t-1}\ Tromsø$	X	
$\lambda[houce\ price]_{t-1}\ Trondheim$	X	
$unemployment_t\ Bergen$		X
$unemployment_t\ Norway$	X	
$unemployment_t\ Oslo$		X
$unemployment_t\ Stavanger$		X
$unemployment_t\ Trondheim$		X
$unemployment_t\ Tromsø$	X	
$(income - housingstock)_{t-1}$	X	
oil price	X	
Δoil price	X	

Table 6: Overview of ADF test
Source: Self estimated in Eviews, Appendix 6.6

Table 6 shows a summary of the results from the Augmented Dickey Fuller test. We chose to consider 5% confidence level in this ADF test. If the t-value is less than the critical value on

5% confidence level, we reject the null hypothesis of unit-root, and conclude stationarity. See appendix 6.6 for a detailed overview of the results.

The results from the ADF test shows that most of the variables test positively for unit root, which means that our dataset contains more non-stationary variables. Moreover, as mentioned in section 5.1.6, the most common transformation of variables to stationary is to use the difference operator:

$$\Delta X_t = X_t - X_{t-1}.$$

The variables $\Delta(INTEREST\ RATE(1-\tau))_t$, $\Delta(INTEREST\ RATE(1-\tau))_{t-1}$, and $\Delta oil\ price$ are non-stationary. Meaning that these transformed variables are not stationary after the first differentiation. If the variable becomes stationary after differentiating once then it is said to be integrated of first order, as the other differenced house price variables are in the table above.

8 RESULTS

8.1 RE-ESTIMATION OF EXPECTATION MODEL

The following table shows the results from the re-estimation of Jacobsen and Naug expectation model.

Method	Least Squared											
Sample (adjusted)	Quarter 1 2002 – Quarter 4 2014											
Included observations	52 Observations after adjustments											
Dependent variable	The difference operator of expectation ΔE_t											
ΔE_t	**Bergen**		**Oslo**		**Stavanger**		**Trondheim**		**Tromsø**		**Norway**	
Variable	**Coeff**	**t-Stat**	**Coeff**	**t-Stat**	**Coeff**	**t-Stat**	**Coeff**	**t-Stat**	**Coeff**	**t-Stat**	**Coeff**	**t-Stat**
α	0.2402	1.4511	0.3103	1.8320	0.2654	2.2944	0.1419	0.7676	0.1291	0.6056	0.2089	1.2361
$\Delta(INTEREST\ RATE(1-\tau))_t$	-5.4129	-1.1502	-3.3234	-0.7181	-3.7770	-0.8421	-7.0135	-1.4734	-6.4774	-1.4828	-5.8213	-1.3109
$\Delta unemployment_t$	**-0.3693**	-2.0827	**-0.5938**	-2.6349	**-0.3105**	-2.3525	**-0.5310**	-2.2239	**-0.4582**	-2.9290	**-0.6397**	-3.5241
E_{t-1}	**-0.4025**	-2.7010	**-0.5521**	-3.4277	**-0.5058**	-3.2712	**-0.3711**	-2.5648	**-0.3550**	-2.5889	**-0.4700**	-3.3478
$(INTEREST\ RATE(1-\tau)_{t-1}$	**-3.2933**	-3.0901	-2.1551	-1.8857	**-3.5686**	-3.4361	**-2.8581**	-2.5590	**-2.4350**	-2.1168	**-2.2982**	-2.2242
$unemployment_{t-1}$	0.0375	1.0209	0.0679	1.4382	0.0267	1.2352	0.0260	0.6332	0.0249	0.4343	0.0398	0.9428
$S1$	**0.1730**	4.2386	**0.1775**	4.8398	**0.1200**	4.5868	**0.2299**	3.8058	**0.2214**	4.7918	**0.2220**	5.5036
$S2$	**0.0681**	2.5845	**0.0848**	3.0871	**0.0414**	1.6557	**0.0918**	2.9483	**0.0929**	3.2734	**0.0504**	2.1630
$S3$	**0.1448**	3.5603	**0.1737**	3.9908	**0.1062**	3.8205	**0.1791**	3.4407	**0.1790**	4.2571	**0.1759**	4.8642
R-squared	0.57		0.58		0.58		0.57		0.59		0.63	
R-squared adjusted	0.49		0.51		0.50		0.49		0.51		0.56	
Durbin Watson statistics	1.82		1.70		1.70		1.84		1.83		1.85	
P-value	5% significance = Numbers highlighted in bold											

Table 7: Results from the re-estimation of household expectation model
Source: Self estimated in Eviews

The estimation results show that when unemployment increases, the dependent variable ΔE_t decreases. The variable $\Delta uneployment_t$ is significant for all cities on 5% confidence level and is therefore important in the short term. When looking at Norway, if unemployment rises by 1 percent, the dependent variable ΔE_t declines by 0.6397 percent. This implies that an increase in unemployment has a negative effect on the households' expectation on its own financial position and country's economy.

An increase in the lagged interest rate, $(INTEREST\ RATE(1-\tau)_{t-1}$ has a negative effect on the households' expectations on own financial position and the country's economy. This variable is statistically significant in Bergen, Stavanger, Trondheim, Tromsø and Norway on 5% confidence level. Stavanger is the city with the highest coefficient -3.56 , meaning that an increase in interest rate by 1% in period t-1, would lead to a decrease of ΔE_t by 3.56% in period t. The more the interest rates increases, the higher is the repayment of mortgages, which would weaken household`s expectations on their own and the country`s economy.

The explanatory power for all cities ranges from 57 percent to 59 percent. If we look at Norway, the variables interest rate after tax and unemployment are both significant, and this is in line with the results from Jacobsen and Naug. If we look at Norway, the expectation model explains 63 percent of the variation in the dependent variable (ΔE_t). The Durbin Watson test is close to 2, which indicates that there is close to no autocorrelation in the residuals.

8.2 RE-ESTIMATION OF THE HOUSE PRICE MODEL

In our re-estimation of the house price model, we carry out a regression analysis of each city and Norway, and implement the expectation variable $EXPEC_t$.

Method	Least Squared											
Sample (adjusted)	Quarter 2 2006 – Quarter 4 2014											
Included observations	35 Observations after adjustments											
Dependent variable	The difference operator of $\Delta house\ price$											
$\Delta house\ price$	**Bergen**		**Oslo**		**Stavanger**		**Trondheim**		**Tromsø**		**Norway**	
Variable	**Coeff**	**t-Stat**	**Coeff**	**t-Stat**	**Coeff**	**t-Stat**	**Coeff**	**t-Stat**	**Coeff**	**t-Stat**	**Coeff**	**t-Stat**
Short term coefficients												
$\Delta income$	0.1903	1.1455	0.1083	0.4937	0.2390	1.2581	0.1796	1.0241	0.0959	0.6069	0.0741	0.4392
$\Delta(INTEREST\ RATE(1-\tau))_t$	**-3.7394**	-3.8516	**-5.3102**	-3.9741	**-3.5820**	-3.2551	**-4.1143**	-3.9325	**-4.8865**	-4.9900	**-3.8231**	-3.5800
$\Delta(INTEREST\ RATE(1-\tau)_{t-1}$	0.4542	0.6144	0.0708	0.0727	1.4857	1.7519	-0.2921	-0.3819	-1.3281	-1.9724	-0.5822	-0.7860
$EXPEC_t$	**0.0156**	2.1745	0.0058	0.4256	**0.0168**	2.0725	0.0101	1.3749	0.0193	1.8035	0.0039	0.3586
Adjustment parameter (λ)												
$house\ price_{t-1}$	-0.0229	-1.2309	-0.0274	-1.2046	**-0.1099**	-5.3199	**-0.0615**	-2.6738	0.0423	1.8425	-0.0166	-0.8063
Long term coefficients												
$(INTEREST\ RATE(1-\tau)_{t-1}$	**-3.2356**	-5.0634	**-5.2302**	-5.7954	**-4.4273**	-5.7415	**-3.6367**	-6.1621	**-3.2213**	-6.8184	**-3.8518**	-5.5930
$unemployment_t$	-0.0062	-0.2279	**-0.0985**	-2.9795	**-0.0505**	-2.7284	-0.0569	-1.8467	**-0.0729**	-2.8660	**-0.0744**	-2.8154
$(income-housingstock)_{t-1}$	-0.1162	-1.7429	0.0205	0.2157	0.1771	1.5340	0.0446	0.6456	-0.0806	-1.2893	-0.0267	-0.3266
$Constant$	-0.0404	-0.0187	0.0235	0.0883	**0.8889**	2.8466	0.3204	1.6075	**-0.5409**	-3.0765	-0.1082	-0.4454
$S1$	**0.0287**	3.2013	**0.0354**	3.0491	**0.0301**	3.1110	**0.0355**	3.7196	**0.0445**	5.2543	**0.0460**	4.9364
$S2$	**0.0212**	4.3764	**0.0197**	3.2960	**0.0221**	4.1728	**0.0255**	4.9701	**0.0276**	5.7577	**0.0271**	5.8498
$S3$	**0.0149**	2.6650	**0.0243**	3.7435	**0.0117**	2.2768	**0.0234**	3.7978	**0.0254**	4.4728	**0.0202**	3.9501
R-squared	0.92		0.86		0.91		0.90		0.92		0.90	
R-squared adjusted	0.89		0.79		0.87		0.85		0.89		0.85	
Durbin Watson statistics	1.50		1.23		1.19		1.30		2.07		1.55	
P-value	5% significance = Numbers highlighted in bold											

Table 8: Results from the re-estimation of house price model by Jacobsen and Naug
Source: Self estimated in Eviews

Our model shows that income is not significant on 5% confidence level, meaning that there is no statistical evidence of a relation between income and house prices. As mentioned in section

3.1.4, the household`s income has an effect on the debt level a bank is willing to provide to the household, and income affects the household`s ability to pay back the mortgage. The household`s income should have an effect on the house prices, this indicates that the dataset of income used in our model is biased. This is a weakness of our re-estimated model, we will discuss this in chapter 9.

The result shows that in short term, increased interest rates have a negative effect on the house prices. The variable $\Delta(INTEREST\ RATE(1-\tau))_t$ is significant on 5% confidence level for all cities and Norway. If we look at Oslo, which has the highest coefficient, an increase of interest rate by 1 percent reduces the house prices with 5.31 percent.

The short-term variable expectation $EXPEC_t$ is significant in Bergen and Stavanger on 5% confidence level. An increase of 1 percent in household expectation in Bergen and Stavanger will increase the house price with 0.0156 percent and 0.0168 percent. This indicates that the household's expectations have an effect in Bergen and Stavanger and no evidence of an effect in the other cities.

The adjustment parameter λ estimates rapidity of reversion back to equilibrium after a deviation from the equilibrium between the independent variables and the dependent variable. The results show that the adjustment parameter λ is significant on 5% confidence level in Stavanger and Trondheim. The parameter λ is statistically significant and negative in Stavanger and Trondheim, this implies that there is a statistically significant pull back effect. The coefficient in Stavanger is -0.1099 meaning that the house prices increase (decrease) with 0.1099 percent in period t, if the house prices is 1 percent below (above) the estimated long-term relationship in period *t-1*, all other variables kept constant. The coefficient -0.0615 is significant in Trondheim, meaning that the house prices increase (decrease) with 0.0615 percent in period *t* if the house prices are 1 percent below (above) the estimated long-term relationship in period *t-1*, all other variables kept constant. Our result shows also that in the long term, if interest rate increase, house prices decline.

The long-term variable $(INTEREST\ RATE(1-\tau)_{t-1}$ is significant on 5% confidence level for all cities and Norway. Oslo is the city with the highest lagged interest rate coefficient, if it rises by 1 percent in period *t-1*, then house price decline with 5.23 percent in period t. Oslo has the highest growth rate in population, which connects to the growth rate in the demand for houses. This implies that if the lagged interest rate increase, Oslo is more exposed to negative effect in house prices in period t.

The long-term variable $unemployment_t$ is significant in Oslo, Stavanger, Tromsø and Norway on 5% confidence level. Oslo has the highest coefficient, and an increase in unemployment by 1 percent would lead to a reduction of house prices by 0.0985 percent. When looking at Norway, if unemployment rises by 1 percent, house prices declines with 0.0744 percent. In overall when unemployment increases, it has a negative effect on the house prices in the long run.

The dummy variables are inserted in the model to adjust for seasonal effects, and have the value zero or one to distinguish between quarters. In our model all the dummy variables are significant, which indicates that seasonality have an effect on the increase in house prices.

The explanatory power for all cities and Norway are high and range from 86% to 92%. The Durbin Watson test shows tendency of a positive autocorrelation for all cities and Norway, except Tromsø, which has a value of 2.07 and it suggest no autocorrelation.

8.2.1 HOUSE PRICE MODEL – SHORT TERM EFFECT

We have split the house price equation into two separate models. In this subsection, we will present results from the short-term variables in the house price model.

Method	Least Squared											
Sample (adjusted)	Quarter 2 2006 – Quarter 4 2014											
Included observations	35 Observations after adjustment											
Dependent variable	The difference operator of $\Delta house\ price$											
$\Delta house\ price$	**Bergen**		**Oslo**		**Stavanger**		**Trondheim**		**Tromsø**		**Norway**	
Variable	**Coeff**	**t-Stat**	**Coeff**	**t-Stat**	**Coeff**	**t-Stat**	**Coeff**	**t-Stat**	**Coeff**	**t-Stat**	**Coeff**	**t-Stat**
$\Delta income$	0.0757	0.2102	0.1144	0.3030	0.2712	0.6816	0.0081	0.0265	-0.0438	-0.1362	0.0797	0.2690
$\Delta(INTEREST\ RATE(1-\tau))_t$	-0.6389	-0.3409	-0.3388	-0.1631	1.0947	0.5113	-0.4636	-0.2961	-0.8071	-0.4887	0.8818	0.5899
$\Delta(INTEREST\ RATE(1-\tau)_{t-1}$	-2.1503	-1.3964	-2.4830	-1.5276	-1.7609	-1.0283	**-2.8813**	-2.2388	-2.5885	-1.9648	**-2.6418**	-2.1253
$EXPEC_t$	**0.0319**	2.0859	0.0254	1.0943	0.0148	0.8624	0.0217	1.6416	**0.0495**	2.1796	0.0084	0.4184
$Constant$	-0.0001	-0.0154	-0.0021	-0.2595	0.0006	0.0735	-0.0020	-0.2910	-0.0018	-0.2449	-0.0059	-0.9141
$S1$	0.0320	1.6492	0.0313	1.5384	0.0316	1.4818	**0.0378**	2.3122	**0.0388**	2.2605	**0.0403**	2.5385
$S2$	0.0184	1.6581	0.0199	1.7582	**0.0275**	2.2597	**0.0210**	2.2414	0.0183	1.8132	**0.0267**	2.9840
$S3$	0.0112	1.0279	0.0146	1.3064	0.0100	0.8376	0.0141	1.5401	0.0119	1.2193	0.0125	1.4151
R-squared	0.48		0.41		0.42		0.56		0.54		0.55	
R-squared adjusted	0.35		0.25		0.26		0.45		0.42		0.43	
Durbin Watson statistics	0.56		0.58		0.52		0.67		0.89		0.89	
P-value	5% significance = Numbers highlighted in bold											

Table 9 :Results from the re-estimation of house price model - short-term variables
Source: Self estimated in Eviews

The house price model with only short-term variables shows that Trondheim is the city with the highest explanatory power of 56%.

The model shows that the coefficients of the lagged interest rate after tax are relatively same for all cities and Norway. If the lagged variable, $\Delta(INTEREST\ RATE(1-\tau)_{t-1}$ increases by 1 percent in period *t-1*, the house price variable $\Delta house\ price$ in Trondheim will reduce by 2.8813 percent in period *t*. On the national level, if the lagged interest rate after tax increases by 1 percent in period *t-1*, the house price variable would decrease by 2.6418 percent in period t.

The short-term variable $EXPEC_t$ is significant in Bergen and Tromsø. If $EXPEC_t$ increases by 1 percent, the variable $\Delta house\ price$ will increase by 0.0319% in Bergen and 0.0495% in Tromsø.

The dummy variable S1 is significant in Trondheim, Tromsø and Norway. S2 is significant in Stavanger, Trondheim, Tromsø and Norway. The explanatory power is nearly halved compared to the complete house price model, and the Durbin Watson tests shows strong positive autocorrelation in the residuals.

8.2.2 HOUSE PRICE MODEL – LONG TERM EFFECT

In this subsection, we present the results from the long-term variables in the house price model.

Method	Least Squared											
Sample (adjusted)	Quarter 2 2006 – Quarter 4 2014											
Included observations	35 Observations after adjustment											
Dependent variable	The difference operator of $\Delta house\ price$											
$\Delta house\ price$	**Bergen**		**Oslo**		**Stavanger**		**Trondheim**		**Tromsø**		**Norway**	
Variable	**Coeff**	**t-Stat**	**Coeff**	**t-Stat**	**Coeff**	**t-Stat**	**Coeff**	**t-Stat**	**Coeff**	**t-Stat**	**Coeff**	**t-Stat**
$\lambda house\ price_{t-1}$	-0.0126	-0.5739	-0.0446	-1.6883	**-0.0913**	-4.3170	-0.0194	-0.7293	**0.0966**	2.8858	-0.0405	-1.7408
$(INTEREST\ RATE(1-\tau)_{t-1}$	**-2.1394**	-3.9310	**-2.5746**	-3.3161	**-3.4011**	-5.4172	**-2.1792**	-3.9616	**-1.6053**	-3.1692	**-1.8701**	-3.3954
$unemployment_t$	**0.0494**	2.0784	0.0070	0.2442	-0.0270	-1.6573	0.0378	1.3443	0.0437	1.6810	0.0127	0.6242
$(income - housingstock)_{t-1}$	-0.0582	-0.8519	-0.0074	-0.0648	0.1018	0.8937	0.0836	1.0247	-0.1591	-1.7140	-0.0407	-0.4259
$Constant$	0.2199	1.0604	0.3288	1.1100	**0.7013**	2.3078	0.4721	2.0382	**-0.5826**	-2.1869	0.2415	0.9217
$S1$	**0.0377**	5.9835	**0.0392**	4.8651	**0.0447**	7.5110	**0.0387**	5.4515	**0.0421**	5.4371	**0.0422**	6.5142
$S2$	**0.0225**	3.9123	**0.0226**	2.9684	**0.0255**	4.3803	**0.0239**	3.7185	**0.0261**	3.6654	**0.0282**	4.8998
$S3$	0.0095	1.5345	0.0149	1.9020	0.0113	1.9798	0.0119	1.6957	0.0103	1.3413	**0.0126**	2.1335
R-squared	0.86		0.72		0.86		0.80		0.76		0.81	
R-squared adjusted	0.82		0.65		0.83		0.74		0.70		0.76	
Durbin Watson statistics	1.71		1.18		1.51		1.28		1.47		1.47	
P-value	5% significance = Numbers highlighted in bold											

Table 10: Results from the re-estimation of house price model - long-term variables
Source: Self estimated in Eviews

Investigating the house price model with focus on the long term, Stavanger and Bergen are the cities with the highest explanatory power of 86 percent.

The long-term model shows that the adjustment variable $house\ price_{t-1}$ has a negative effect on the variable $\Delta house\ price$ in Stavanger by 0.0913 at period t, if house price increases by 1% in period t-1. In Tromsø, an increase of 1% in house prices in period t-1 has a positive effect on the house prices in period t by 0.0966%.

The long-term variable $(INTEREST\ RATE(1-\tau)_{t-1}$ is significant for all cities and Norway. If $(INTEREST\ RATE(1-\tau)_{t-1}$ increases by 1 percent, then there is a negative effect in the long term on the dependent variable, $\Delta house\ price$. Stavanger has the highest coefficient with a negative effect by 3.4011%.

The model shows that in long-term the variable $unemployment_t$ is significant in Bergen. An increase of 1 percent in unemployment in Bergen would lead to positive effect in $\Delta house\ price$ by 0.0494%.

The dummy variables S1 and S2 are significant in all cities and Norway. S3 is only significant in Norway. The explanatory power in the long-term context is relatively high for all cities and Norway, and the Durbin Watson results vary between 1 and 2, meaning there is some positive autocorrelation in the residuals.

8.3 THE RELATIONSHIP BETWEEN OIL PRICES AND HOUSE PRICES

To analyse the relationship between house prices and oil prices we use the following simple regression model.

Method	Least Squared											
Sample (adjusted)	2003M2–2014M12											
Included observations	143 Observations after adjustment											
Dependent variable	The difference operator of $\Delta house\ price$											
$\Delta house\ price$	**Bergen**		**Oslo**		**Stavanger**		**Trondheim**		**Tromsø**		**Norway**	
Variable	**Coeff**	**t-Stat**	**Coeff**	**t-Stat**	**Coeff**	**t-Stat**	**Coeff**	**t-Stat**	**Coeff**	**t-Stat**	**Coeff**	**t-Stat**
$Constant$	**0.0061**	5.4670	**0.0050**	4.6558	**0.0070**	6.1890	**0.0056**	5.2828	**0.0061**	5.3661	**0.0051**	4.7722
$\Delta oil\ price$	**0.0461**	3.0866	**0.0398**	2.7390	**0.0457**	2.9934	**0.0430**	2.9943	**0.0441**	2.8986	**0.0406**	2.8330
R-squared	0.0633		0.0505		0.0598		0.0598		0.0562		0.0539	
R-squared adjusted	0.0566		0.0438		0.0531		0.0531		0.0495		0.0471	
Durbin Watson statistics	1.4593		1.4112		1.5962		1.5090		1.5284		1.6927	
P-value	5% significance = Numbers highlighted in bold											

Table 11: Results of the relationship between house prices and oil prices
Source: Self estimated in Eviews

The estimation result indicates that both the constant term and the oil price variable are statistically significant at 5% confidence level in Norway and all of our selected cities. It shows that oil prices slightly explain some of the variation in the dependent variable, $\Delta house\ price$. This gives a significant signal of a relationship between oil prices and house prices. Further, we can say that oil prices has significant direct connection on house prices, since no other independent factors and variables are included when modelling the regression. We can especially see that Bergen and Stavanger have the largest oil price coefficient 0.0461 and 0.0457 respectively. This can be explained by that they are both oil cities that are more directly exposed than other cities. Oslo has the lowest oil price coefficient 0.0398. Among all those cities, Bergen has the highest R-squared by 0.0633 and adjusted R-squared by 0.0566, meaning that it has the best-fitted model. The Durbin Watson test shows weak positive autocorrelation in the residuals.

8.4 ESTIMATION OF THE HOUSE PRICE MODEL WITH OIL PRICE VARIABLE

The table below shows the house price model with oil prices.

Method	Least Squared											
Sample (adjusted)	Quarter 2 2006 – Quarter 4 2014											
Included observations	35 Observations after adjustments											
Dependent variable	The difference operator of $\Delta house\ price$											
$\Delta house\ price$	**Bergen**		**Oslo**		**Stavanger**		**Trondheim**		**Tromsø**		**Norway**	
Variable	**Coeff**	**t-Stat**	**Coeff**	**t-Stat**	**Coeff**	**t-Stat**	**Coeff**	**t-Stat**	**Coeff**	**t-Stat**	**Coeff**	**t-Stat**
Short term coefficients												
$\Delta income$	0.2087	1.2693	0.1362	0.6541	0.2726	1.4235	0.2011	1.1906	0.0962	0.5953	0.1080	0.6806
$\Delta(INTEREST\ RATE(1-\tau))_t$	**-4.2783**	-4.0963	**-6.2176**	-4.6021	**-4.0999**	-3.4407	**-4.7607**	-4.4363	**-4.8980**	-4.8323	**-4.7422**	-4.3363
$\Delta(INTEREST\ RATE(1-\tau)_{t-1}$	0.3781	0.5171	-0.0880	-0.0951	1.4095	1.6644	-0.4026	-0.5459	-1.3336	-1.9256	-0.6616	-0.9531
$EXPEC_t$	**0.0146**	2.0522	0.0058	0.4471	0.0160	1.9691	0.0091	1.2958	0.0194	1.7556	0.0055	0.5354
Adjustment parameter (λ)												
$house\ price_{t-1}$	-0.0417	-1.7803	**-0.0584**	-2.1680	**-0.1275**	-4.8977	**-0.0817**	-3.2636	0.0418	1.7201	-0.0483	-1.9641
Long term coefficients												
$(INTEREST\ RATE(1-\tau)_{t-1}$	**-3.3346**	-5.2541	**-5.2432**	-6.1364	**-4.5262**	-5.8577	**-3.6528**	-6.4442	**-3.2056**	-6.0551	**-3.9540**	-6.1184
$unemployment_t$	-0.0099	-0.3702	**-0.0981**	-3.1333	**-0.0518**	-2.8083	-0.0530	-1.7874	**-0.0721**	-2.5216	**-0.0767**	-3.0997
$(income - housingstock)_{t-1}$	**-0.1635**	-2.1720	-0.0599	-0.6027	0.1751	1.5237	-0.0183	-0.2415	-0.0856	-0.9145	-0.0694	-0.8769
$oil\ price$	0.0205	0.0159	0.0367	1.9132	0.0199	1.1035	0.0285	1.7146	0.0011	0.0726	**0.0306**	2.0673
$Constant$	-0.1309	-0.5577	-0.1930	-0.6995	**0.8559**	2.7413	0.1458	0.6727	**-0.5521**	-2.3308	-0.2191	-0.9378
$S1$	**0.0268**	0.0089	**0.0314**	2.8092	**0.0275**	2.7849	**0.0322**	3.4373	**0.0442**	4.8555	**0.0422**	4.7256
$S2$	**0.0195**	0.0050	**0.0160**	2.6672	**0.0199**	3.5413	**0.0226**	4.3220	**0.0274**	5.0114	**0.0237**	5.1252
$S3$	**0.0139**	0.0006	**0.0215**	3.3900	0.0103	1.9491	**0.0208**	3.4114	**0.0252**	3.8749	**0.0180**	3.6955
R-squared	0.9290		0.8809		0.9151		0.9123		0.9231		0.9157	
R-squared adjusted	0.8902		0.8159		0.8688		0.8645		0.8811		0.8697	
Durbin Watson statistics	1.5387		1.3348		1.2223		1.4351		2.0592		1.5629	
P-value	5% significance = Numbers highlighted in bold											

Table 12: Results from the re-estimation of house price model with oil price variable
Source: Self estimated in Eviews

The result shows that the model has the highest R-squared in Bergen. This means that the model captures the variation of $\Delta house\ price$ best in Bergen. The rest of the cities had also quite good R-Squared statistics.

When it comes to interest rate variables in the house price model, both $\Delta(INTEREST\ RATE(1-\tau))_t$ and $(INTEREST\ RATE(1-\tau)_{t-1}$ are statistically significant in every city and Norway. This shows that interest rate has a strong explanatory effect on house prices, this corresponds to the result found by Jacobsen and Naug. Coefficients in both interest variables have negative signs. This indicates that when the interest rate decreases, house prices will increase in both long and short term. This can be linked to the situation in 2014. House prices skyrocketed, when the interest rate was downscaled after the decrease of oil prices, as mentioned earlier in section 3.1.3. This can also provide long-term impact on house prices if the interest rate continues to be low.

To capture the effect the oil price variable has on the interest rate, we made a simple comparison of the results from the house price model, both with and without the oil price factor. As shown in tables 8 and 12, we can clearly see that oil prices has a quick effect on interest rates both in short and long term. The interest rate coefficients in each of our selected cities increased when the oil price variable was included. In other words, by including oil price variable in the housing model, the interest rates were affected negatively. Oslo had the largest short-term reduction in interest rate $\Delta(INTEREST\ RATE(1-\tau))_t$ by a change from -5.31 to -6.22 percent. In long term, Stavanger had the largest increase in $(INTEREST\ RATE(1-\tau)_{t-1}$ from -4.42 to -4.53.

The long-term unemployment coefficients are significant at 5% confidence level in Oslo, Stavanger, Tromsø and Norway. After the oil price variable was included to the model, there was only minor changes in the unemployment coefficients in Oslo, Stavanger, Tromsø and Norway. In Norway, the unemployment coefficient changed from -0.07 to -0.08. That means that the added oil price variable has a significant effect and increased the unemployment in Norway, which could be explained by the drop of oil prices during 2014.

The oil price coefficients are statistically significant only in Norway. This indicates that if oil prices increases by 1%, house prices will increase by 0.03%. This is possibly an indirect effect, because the oil price variable goes through explanatory factors like changes in interest rate, unemployment etc before reaching the house prices. Moreover, this result shows that oil prices have a significantly effect on the Norwegian house prices. The Durbin Watson test shows weak positive autocorrelation in the residuals in all cities and Norway, except Tromsø with 2.0562, which indicate that there exist no autocorrelation.

8.4.1 HOUSE PRICE MODEL WITH OIL PRICE VARIABLE – SHORT TERM EFFECT

We estimate the house price model with only short-term variables and include the oil price variable.

Method	Least Squared
Sample (adjusted)	Quarter 2 2006 – Quarter 4 2014
Included observations	35 Observations after adjustment
Dependent variable	The difference operator of $\Delta house\ price$

$\Delta house\ price$	**Bergen**		**Oslo**		**Stavanger**		**Trondheim**		**Tromsø**		**Norway**	
Variable	**Coeff**	**t-Stat**	**Coeff**	**t-Stat**	**Coeff**	**t-Stat**	**Coeff**	**t-Stat**	**Coeff**	**t-Stat**	**Coeff**	**t-Stat**
$\Delta income$	-0.0552	-0.1489	0.0196	0.0501	-0.0670	-0.1913	-0.0383	-0.1187	0.0275	0.0810	-0.0152	-0.0497
$\Delta(INTEREST\ RATE(1-\tau))_t$	-0.3095	-0.1653	-0.1431	-0.0684	1.7146	0.9429	-0.3234	-0.2008	-1.0689	-0.6266	1.1949	0.7899
$\Delta(INTEREST\ RATE(1-\tau)_{t-1}$	-1.8694	-1.2143	-2.2407	-1.3588	-0.9333	-0.6362	**-2.7992**	-2.1294	**-2.6624**	-1.9968	**-2.4800**	-1.9921
$EXPEC_t$	**0.0369**	2.3607	0.0314	1.3001	**0.0301**	1.9825	0.0232	1.6923	**0.0474**	2.0521	0.0130	0.6373
$oil\ price$	-0.0246	-1.2610	-0.0193	-0.9417	**-0.0640**	-3.4367	-0.0087	-0.5160	0.0125	0.7181	-0.0179	-1.1308
$Constant$	0.1533	1.2573	0.1183	0.9234	**0.4001**	3.4353	0.0520	0.4961	-0.0795	-0.7328	0.1057	1.0693
$S1$	0.0372	1.8949	0.0352	1.6908	**0.0450**	2.4428	**0.0398**	2.3382	**0.0356**	1.9927	**0.0444**	2.7397
$S2$	0.0195	1.7692	0.0210	1.8440	**0.0305**	2.9601	**0.0215**	2.2478	0.0176	1.7208	**0.0278**	3.1033
$S3$	0.0123	1.1436	0.0158	1.4013	0.0131	1.2925	0.0146	1.5616	0.0111	1.1292	0.0136	1.5374
R-squared	0.51		0.43		0.60		0.57		0.55		0.57	
R-squared adjusted	0.36		0.25		0.47		0.44		0.41		0.44	
Durbin Watson statistics	0.5724		0.5789		0.5656		0.6662		0.8878		0.9351	
P-value	5% significance = Numbers highlighted in bold											

Table 13: Results from the re-estimation of house price model with oil price variable short-term
Source: Self estimated in Eviews

The interest rate variable $\Delta(INTEREST\ RATE(1-\tau)_{t-1}$ is statistical significant in Trondheim, Tromsø and Norway with 5% confidence level. In these cities, reduced interest rate increases house prices. Meanwhile, the expectation variable is statistically significant in Bergen, Tromsø and Stavanger. A positive change in the expectation of the household`s own and the country`s economy will increase house prices. More precisely, if expectation increases by 1 percent, the house prices will increase by 0.0369%, 0.0301% and 0.0474% respectively in Bergen, Tromsø and Trondheim.

The oil price variable was statistically significant only in Stavanger, with a coefficient of -0.0640. This indicates that if oil prices reduces by 1 percent, the house prices will increase by 0.0640 percent in short term. This is because a drop of oil prices will reduce the interest rates, which again leads to increased demand and higher prices in the housing market. We can relate this to the situation in 2014 after the decline in oil price.

Some of the seasonal variables are significant in Stavanger, Tromsø, Trondheim and Norway, which indicates that they have some positive effect on the house prices. Further, the constant term is significant only in Stavanger, which means that the average value of the dependent variable, when all the other independent variables are equal to zero is statistically different from zero.

Stavanger has the highest R-squared by 60% and indicates that the regression line in Stavanger fits better to the data compared to other cities. Stavanger has also the highest adjusted R-squared of 47%. The Durbin Watson test shows positive autocorrelation for all cities and Norway.

8.4.2 HOUSE PRICE MODEL WITH OIL PRICE VARIABLE – LONG TERM EFFECT

We estimate the house price model with only long-term variables and include the oil price variable.

Method	Least Squared											
Sample (adjusted)	Quarter 2 2006 – Quarter 4 2014											
Included observations	35 Observations after adjustment											
Dependent variable	The difference operator of $\Delta house\ price$											
$\Delta house\ price$	**Bergen**		**Oslo**		**Stavanger**		**Trondheim**		**Tromsø**		**Norway**	
Variable	**Coeff**	**t-Stat**	**Coeff**	**t-Stat**	**Coeff**	**t-Stat**	**Coeff**	**t-Stat**	**Coeff**	**t-Stat**	**Coeff**	**t-Stat**
$\lambda house\ price_{t-1}$	-0.0039	-0.1402	-0.0345	-0.9737	**-0.0880**	-3.2542	-0.0145	-0.5066	**0.1039**	3.0433	-0.0328	-1.0271
$(INTEREST\ RATE(1-\tau)_{t-1}$	**-2.2289**	-3.8544	**-2.7093**	-3.1987	**-3.4325**	-5.2203	**-2.2847**	-3.8407	**-2.0078**	-3.1608	**-1.9440**	-3.2593
$unemployment_t$	0.0449	1.7479	0.0011	0.0358	-0.0281	-1.6141	0.0297	0.9099	0.0193	0.5548	0.0091	0.3960
$(income - housingstock)_{t-1}$	-0.0451	-0.6124	0.0159	0.1235	0.1008	0.8678	0.1028	1.1311	-0.0475	-0.3360	-0.0304	-0.2992
$oil\ price$	-0.0092	-0.5171	-0.0103	-0.4347	-0.0035	-0.2042	-0.0104	-0.5100	-0.0250	-1.0469	-0.0065	-0.3595
$Constant$	0.2416	1.1270	0.3692	1.1728	**0.7001**	2.2619	**0.5210**	2.0537	-0.3361	-0.9462	0.2507	0.9370
$S1$	**0.0387**	5.8142	**0.0401**	4.7517	**0.0449**	7.3200	**0.0401**	5.2090	**0.0465**	5.2864	**0.0430**	6.1739
$S2$	**0.0236**	3.8233	**0.0235**	2.9389	**0.0258**	4.2244	**0.0253**	3.5850	**0.0297**	3.7584	**0.0289**	4.7099
$S3$	0.0107	1.5982	0.0162	1.9069	0.0116	1.9316	0.0138	1.7225	0.0155	1.6969	**0.0134**	2.0917
R-squared	0.86		0.72		0.86		0.80		0.77		0.81	
R-squared adjusted	0.81		0.64		0.82		0.74		0.70		0.75	
Durbin Watson statistics	0.56		0.58		0.52		0.67		0.89		0.89	
P-value	5% significance = Numbers highlighted in bold											

Table 14: Results from the re-estimation of house price model with oil price variable long-term
Source: Self estimated in Eviews

The results show that house prices from the previous period *(t-1)* have a significant effect in period *t* both in Tromsø and in Stavanger. This means that if the house prices in Stavanger from the previous period increased by 1 percent, then the house price will decline by 0.0880% in period t.

Interest rate variable is also statistically significant in every city. Stavanger has the largest negative interest rate coefficient among the cities, -3.4325. An increase in interest rate in period *t-1* will decrease the interest rate by 3.4325 in period *t*.

Stavanger has the highest R-squared by explaining 86% of the variances of the dependent variable $\Delta house\ price$, it has also the highest adjusted R-squared of 82%.

Seasonal variables and the constant variable are statistically significant in some of the cities. Stavanger and Trondheim are statistically significant with the seasonal variables and the constant terms, expect from S3 (seasonal dummy variable for quarter 3). The Durbin Watson test shows positive autocorrelation for all cities and Norway.

9 DISCUSSION

We spent a considerable amount of time searching for accurate data for the selected cities and Norway. The numbers of observations in the datasets were limited. In our house price model, we were able to retrieve only 36 observations. In the expectation model, we retrieve 53 observations. The highest observation found was in the model for house prices and oil prices in section 8.3, were the model had 144 observations. Consequently, it is difficult to verify normal distribution and it is reasonable to question the validity of our results. Because we wanted to investigate regional differences, we decided to continue the research with few observations so that we would be able to analyse and compare them.

One of the disadvantages in our model are the results from the Augmented Dickey Fuller test. Over half of the variables test positively for unit root. Earlier we mentioned that strictly stationarity is difficult to prove, therefore we consider weak stationarity in the variables that were significantly stationary. The variables $\Delta(INTEREST\ RATE(1-\tau))_t$, $\Delta(INTEREST\ RATE(1-\tau))_{t-1}$, and $\Delta oil\ price$ are transformed variables by that they have been differentiated ($\Delta\beta t = \beta t - \beta t\text{-}1$) . Nevertheless, results from the ADF test shows that unit root still exists. Consequently, the regression we have done is likely to be spurious.

In our estimation of the house price model with and without oil, we find that one of the fundamental factors, income, is not statistically significant in any of the cities or Norway. This is a weakness of our analysis. The reason for this is possibly due to the data we used are household`s annual income from employment, obtained from Statistics Norway. We converted the annual employment income to quarterly, and therefore the dataset of household`s income consist of small variations. In theory and practice, income has a significant impact on house prices. Income is one of the key factors on the amount of debt a bank is willing to entrust a household with. Consequently, this affects the house prices. The problem of small variations in the dataset of household`s income might be the reason for insignificantly income in our estimations, both with and without oil factor included. Moreover, our results of the estimations might be influenced of this existence of poor household income data.

We discovered some possible endogeneity problems in our estimations. As mentioned in the theory part in section 5.1.8, endogeneity arises from measurement error; autoregression with autocorrelated errors, simultaneity, or omitted variables. Omitted variable means incorrectly leaving out one or more important factors when the model was created. We find a possible endogeneity problem in the fundamental factor, household income. This can be explained by that the income factor is an omitted variable that lies in the error term and is correlated with other parameters.

One of the common causes of endogeneity is when there is a loop of causality between the independent and dependent variables in the model. It also shows possible endogeneity problems in the empirical model developed by Jacobsen and Naug, both the expectation model and the house price model. The same variable occurs on both sides of the equality sign, as a part of the dependent variable on the left side, and as an independent explanatory variable on the right side. The dependent variable in the expectation model is a transformed and differentiated variable, $\Delta E_t = (E_t - E_{t-1})$. Thereby, in the expectation model, it occurs an endogeneity problem by having ΔE_t as the dependent variable and E_{t-1} as the independent variable. The house price model has the same problem of repeated variable on both sides with $\Delta house\ price$ as the independent variable and houce price_{t-1} as the independent variable. We would suggest this endogeneity problem in the empirical model by Jacobsen and Naug as a further study to remedy this problem.

In our re-estimation of Jacobsen and Naug expectation model we find that an increase in unemployment, the lagged expectation, or the lagged interest rate after tax have a negative effect on the households expectation. Our results are in agreement with Jacobsens and Naugs findings. An increase in unemployment leads to lower expectations of wage growth and increases uncertainty about the ability to repay debt, which reduces the supply of credit to households. An increase in interest rate leads to expectation of falling house prices, oppositely a decrease leads to expectation of increasing house prices, and the belief that its better to buy now rather than later[84]. Thus, household's expectation has an effect on the fluctuations in house prices, and is the psychological aspect of the behaviour on both the demand and supply side in regards to buying or selling houses.

We find evidence that oil prices have a significant effect on house prices on a national level. Moreover, the results show that in the short-term equation, oil prices have a direct effect on

[84] http://www.norges-bank.no/Upload/import/english/publications/economic_bulletin/2005-01/jacobsen.pdf

the house prices only in Stavanger. This can be explained by the fact that Stavanger is the major oil city in Norway, with the most oil related industry. Therefore, Stavanger would be affected at a higher degree and at a faster rate by oil price fluctuations, compared to the other cities due to its dependency with the oil sector. Oil prices might affect the other cities, but at a slower rate due to the lower degree of dependency towards the oil sector. Results shows that oil prices affect other cities indirectly through the fundamental factors, hence it can take longer time before the downturn in oil prices reaches the house prices in these cities.

10 CONCLUSION

The purpose of this master thesis was to investigate if there is a significant effect between oil prices and house prices, and how oil prices affect prices in the Norwegian housing market.

Findings indicate that oil prices have a significant direct effect on house prices, which supports that there is a link between oil prices and house prices. However, the results indicates that there is only a slightly direct link between oil prices and house prices. Further, results shows that oil cities like Bergen and Stavanger have especially larger oil price coefficients than other cities, which means that house prices in these oil cities have a larger direct effect by oil price fluctuations.

Moreover, our study and results support that oil prices have a larger indirect influence on house prices. Oil prices affect fundamental factors that determine house prices. We find that interest rates, unemployment, and household expectation are the fundamental factors that were affected the most by the oil prices. Interest rate reacts quickly and strongly to oil price fluctuations, and gives house prices a fast impact. Interest rates and unemployment are the most important fundamental factors that explain the house prices. We find no evidence that household income has a significant correlation with house prices in our estimations.

Oil prices are statistically significant in the Norwegian house prices. In short term, results show that Stavanger was the only city where house prices were affected by the oil price decline in 2014. Findings indicate an inertia on the other cities, Bergen, Oslo, Tromsø and Trondheim. House prices in these cities are affected in an indirect manner. The indirect effect goes through the fundamental factors, therefore it might takes time before the effect of oil prices appears in the house prices. Inertia could be the reason for that house prices still increases in Bergen, Oslo, Tromsø, and Trondheim, but not in Stavanger.

11 REFERENCES

Abcnyheter. *Arbeidsledighet.*
http://www.abcnyheter.no/bolig/faktainnhold/090106/arbeidsledighet

Aftenposten. *Hvorfor er boligprisene så høye.*
http://www.aftenposten.no/okonomi/Hvorfor-er-boligprisene-sa-hoye-7690498.html

All Business. *Housing Stock.*
http://www.allbusiness.com/barrons_dictionary/dictionary-housing-stock-4964200-1.html

Aure, Ann Kristin. 2012. *Boble i Boligmarkedet?*
https://bora.uib.no/bitstream/handle/1956/6122/97362087.pdf

Bernhardsen, Tom and Øistein Røisland. 2000. *Hvilke faktorer påvirker kronekursen?*
http://www.norges-bank.no/Upload/import/publikasjoner/penger_og_kreditt/2000-03/bernh.pdf

Bie, Ana Swierstra. 1998. Homelessness in Norway Osman is not alone in his plight
http://www.share-international.org/archives/homelessness/hl-asbNorway.htm

Bjørnland, Hilde C. and Leif A.Thorsund. 2015. *Applied Time Series for Macroeconomics.* 2nd edition. Oslo: Gyldendal Norsk Forlag.

Dagens Næringsliv. 2015. *Husholdninger låner mer.*
http://www.dn.no/nyheter/2015/03/02/1042/husholdningene-lner-mer

Dagens Næringsliv. 2014. *Hvis det hadde vært ubalanse i boligmarkedet burde leieprisene vært høyere.*
http://www.dn.no/nyheter/okonomi/2014/05/15/Boligpriser/-hvis-det-hadde-vrt-ubalanse-i-boligmarkedet-burde-leieprisene-vrt-hyere

Dagens Næringsliv. 2015. *Liten økning i arbeidsledigheten.*

http://www.dn.no/nyheter/naringsliv/2015/01/30/1014/liten-kning-i-arbeidsledigheten

Dagens Næringsliv. 2015. *Mange tåler ikke en eneste renteøkning.* http://www.dn.no/privat/privatokonomi/2015/01/20/0949/mange-tler-ikke-en-eneste-rentekning

Dagens Næringsliv. 2014. *Nå er dette et av verdens sterkeste boligmarkeder.* http://www.dn.no/nyheter/utenriks/2014/12/10/1905/Boligpriser/n-er-dette-et-av-verdens-sterkeste-boligmarkeder

Dagens Næringsliv. 2014. *Slik rammes du av kronefallet.* http://www.dn.no/privat/privatokonomi/2014/12/08/1838/Valuta/slik-rammes-du-av-kronefallet

Dagens Næringsliv. 2014. *Tilbud og etterspørsel.* http://www.dn.no/meninger/kommentarer/2014/05/09/Med-egne-ord/tilbud-og-ettersprsel

Dagens Næringsliv. 2015. *Renterenn hos bankene.* http://www.dn.no/nyheter/finans/2015/01/19/2200/Renten/renterenn-hos-bankene

Dagens Næringsliv. 2015. *Utviklingen vi ser i boligpriser og husholdningens gjeld gir grunn til uro.* http://www.dn.no/nyheter/okonomi/2015/03/03/0801/Finanstilsynet/-utviklingen-vi-ser-i-boligpriser-og-husholdningsgjeld-gir-grunn-til-uro

Dagens Næringsliv. 2014. *Varsler boligprisfall.* http://www.dn.no/privat/eiendom/2014/06/12/Bolig/varsler-boligprisfall

DNB. 2015. *Valutakurser og renter.* https://www.dnb.no/bedrift/markets/valuta-renter/valutakurser-og-renter/historiske/hovedvalutaer.html

Dybendal, Kirsten. 2015. *Key figures for the population.*

https://www.ssb.no/en/befolkning/nokkeltall

e24. *Boligprisene steg i januar*.
http://e24.no/privat/eiendom/boligprisene-steg-i-januar/23388510

e24. *DNB sjefen til norges bank ikke kutt renten*
http://e24.no/privat/penger/dnb-sjefen-til-norges-bank-ikke-kutt-renten/23378850

Fidjestøl, Ane. 2012. *Bolig for alle.*
http://arkiv2.sv.no/Fylkes-og-lokallag/Oslo/Nyheter/Bolig-for-alle

Finans Norge. *Bakgrunn og formål med undersøkelsen.*
https://www.fno.no/aktuelt/sporreundersokelser/forventningsbarometeret1/bakgrunn-og-formal-med-undersokelsen/

Finanstilsynet. *Finansielle utviklingstrekk 2014.*
http://www.finanstilsynet.no/PageFiles/44069/Finansielle_utviklingstrekk_2014_rapport.pdf?epslanguage=no

Finanstilsynet. 2015. *Husholdningens kredittvekst*
http://www.finanstilsynet.no/Global/Venstremeny/Brev_vedlegg/2015/Husholdningenes_kredittvekst_16_03_2015.pdf

Finans Norge. 2013. *Lavere optimisme og rekordhøy sparevilje.*
https://www.fno.no/aktuelt/sporreundersokelser/forventningsbarometeret1/forventningsbarometeret-2013/lavere-optimisme-og-rekordhoy-sparevilje/

Finans Norge. 2014. *Noe økt optimisme etter fem kvartaler med fall.*
https://www.fno.no/aktuelt/sporreundersokelser/forventningsbarometeret1/forventningsbarometeret-2014/noe-okt-optimisme-etter-fem-kvartaler-med-fall/

Finans Norge. 2014. *Nordmenn har aldri vært sterkere i troen på egen økonomi.*
https://www.fno.no/aktuelt/sporreundersokelser/forventningsbarometeret1/forventningsbarometeret-2014/nordmenn-har-aldri-vart-sterkere-i-troen-pa-egen-okonomi/

Finans Norge. 2014. *Vi har mistet troen på landets økonomi*

https://www.fno.no/aktuelt/sporreundersokelser/forventningsbarometeret1/forventningsbarometeret-2014/nordmenn-har-aldri-vart-sterkere-i-troen-pa-egen-okonomi/

Finanstilsynet. 2014. *Økonomisk usikkerhet forsterkes av høy husholdningsgjeld og høye boligpriser*

http://www.finanstilsynet.no/no/Artikkelarkiv/Pressemeldinger/2014/4_kvartal/Okonomisk-usikkerhet-forsterkes-av-hoy-husholdningsgjeld-og-hoye-boligpriser/

FNO. *Forventningsbarometeret.*

https://www.fno.no/aktuelt/sporreundersokelser/forventningsbarometeret1/bakgrunn-og-formal-med-undersokelsen/

FNO. Lavere optimisme og rekordhøy sparevilje.

https://www.fno.no/aktuelt/sporreundersokelser/forventningsbarometeret1/forventningsbarometeret-2013/lavere-optimisme-og-rekordhoy-sparevilje/

FNO. *Vi har mistet troen på landets økonomi*

https://www.fno.no/aktuelt/sporreundersokelser/forventningsbarometeret1/forventningsbarometeret-2014/vi-har-mistet-troen-pa-landets-okonomi

Fractional Flow. 2014. *Norwegian Crude Oil Reserves and Extraction per 2014.*

http://fractionalflow.com/2015/03/10/norwegian-crude-oil-reserves-and-extraction-per-2014/

Fredriksen, Heidi. 2007. *En kritisk gjennomgang av Jacobsen og Naug sin modell for hva som driver boligprisene.*

http://brage.bibsys.no/xmlui/bitstream/handle/11250/167773/1/Fredriksen%20Heidi%202007.pdf,%20https://bora.uib.no/bitstream/handle/1956/6122/97362087.pdf

Halvorsen, Marit Tronier. 2014. *Hvis det hadde vært ubalanse i boligmarkedet, burde leieprisene vært høyere.*

http://www.dn.no/nyheter/okonomi/2014/05/15/Boligpriser/-hvis-det-hadde-vrt-ubalanse-i-boligmarkedet-burde-leieprisene-vrt-hyere

Hartwig, Kathinka. 2014. *Slik rammes du av kronefallet.* http://www.dn.no/privat/privatokonomi/2014/12/08/1838/Valuta/slik-rammes-du-av-kronefallet

Heiskontrollen. *Gjeldende byggeteknisk forskrift (TEK10)* http://heiskontrollen.no/index.php?option=com_content&view=article&id=85:gjeldende-byggteknisk-forskrift-tek10&catid=45:languages&Itemid=56

Husbanken. *Boligpolitikk.* http://www.husbanken.no/boligpolitikk/

International Energy Agency. 2014. *Key World Energy Statistics.* http://www.iea.org/publications/freepublications/publication/keyworld2014.pdf

International Energy Agency. *Oil Market Report* https://www.iea.org/oilmarketreport/omrpublic/

Investopedia. *Consumer Price Index CPI* http://www.investopedia.com/terms/c/consumerpriceindex.asp

Investopedia. *Currency.* http://www.investopedia.com/terms/c/currency.asp

Investopedia. *Durbin Watson Statistic* http://www.investopedia.com/terms/d/durbin-watson-statistic.asp

Investopedia. *Global Strategic Petroleum Reserves - GSPR.* http://www.investopedia.com/terms/g/global-strategic-petroleum-reserves.asp

Investopedia. *Kurtosis.* http://www.investopedia.com/terms/k/kurtosis.asp

Jacobsen, Dag Henning and Bjørn E. Naug. 2004. *What drives house prices?* http://www.norges-bank.no/Upload/import/english/publications/economic_bulletin/2005-01/jacobsen.pdf

KPMG. 2015. *Petroleumsbeskatning.* http://verdtavite.kpmg.no/petroleumsbeskatning.aspx

Krogrud, Cecilie Krogrud and Quach, Nancy. 2014. On the Stability Way

Monsrud, Inger Jorun and Mona Takle. 2015. *House Price Index, Q1 2015* https://www.ssb.no/en/priser-og-prisindekser/statistikker/bpi/kvartal

Lokalavisen. *Kamp mellom rente og ledighet.* http://www.lokal-avisen.no/info.php?id=5214

Nettavisen. *Boligprisvinnere og taperne i 2014* *h*ttp://www.nettavisen.no/na24/smartepenger/boligprisvinnerne-og--taperne-i-2014/8527204.html

Nettavisen. *Hvorfor stiger boligprisene.* http://www.nettavisen.no/na24/565859.html

Nettavisen. *Nye radikale krav til boliglån.* http://www.nettavisen.no/na24/nye-radikale-krav-til-boliglan/8555529.html

Nissen-Meyer, Jostein. 2015. *Statens Oljeinntekter Kollapser med Dagens Oljepris* http://e24.no/energi/statens-oljeinntekter-kollapser-med-dagens-oljepris/23374213

Norges Bank Investment Management. *Government Pension Fund Global* http://www.nbim.no/en/the-fund/

Norges Bank Investment Management. *Market Value* http://www.nbim.no/en/the-fund/market-value/

Norges Bank Investment Management. *Oljefondets Markedsverdi*
www.nbim.no

Norges Bank. *Om Norges Bank*
www.norges-bank.no

Norges Bank. *Styringsrenten.*
http://www.norges-bank.no/pengepolitikk/Styringsrenten/

Ormseth Geir. 2015. *Boligprisvinnere i 2014.*
http://www.smartepenger.no/2197-dette-er-boligprisvinnerne-i-2014

OPEC. 2014. *Brief History.*
http://www.opec.org/opec_web/en/about_us/24.htm

OPEC. 2014. *World Oil Outlook.*
http://www.opec.org/opec_web/static_files_project/media/downloads/publications/WOO_2014.pdf

Petoro. *About Petoro.*
https://www.petoro.no/about-petoro

Regjeringen. *Nasjonalbudsjettet 2015.05.29*
https://www.regjeringen.no/nb/dokumenter/Meld-St-1-20142015/id2005410/?docId=STM201420150001000DDDEPIS&q=4%&navchap=1&ch=1)

Regjeringen. *Staten har Nådd 67 Prosent Eierandel i StatoilHydro.*
https://www.regjeringen.no/nb/aktuelt/staten-har-nadd-67-prosent-eierandel-i-s/id547947/

Regjeringen. 2014. *Statens Inntekter fra Petroleumsvirksomheten* https://www.regjeringen.no/nb/tema/energi/olje-og-gass/statens-inntekter-fra-petroleumsverksemda/id2076770/

Scheele, Marius, Achraf Bourgroug, Nils Amdal and Tore Halvorsen. 2015. *Quarterly non-financial sector accounts, national accounts, Q1 2015.* https://ssb.no/en/nasjonalregnskap-og-konjunkturer/statistikker/knri

Sjøberg, Jeanette and Lars Magne Sunnanå. 2014. *Hvorfor er boligprisene så høye?* http://www.aftenposten.no/okonomi/Hvorfor-er-boligprisene-sa-hoye-7690498.html

Smarte Penger. *Boligpriser malt av Statistisk Sentralbyrå.* http://www.smartepenger.no/faktabank/boligokonomi/96-bolig/475-boligpriser-malt-av-statistisk-sentralbyra

Smarte penger. *Hva bestemmer boligprisene.* http://www.smartepenger.no/boligokonomi/436-hva-bestemmer-boligprisene

Smith, Lydia. 2014. *How Much Oil is Left and How Long Will it Last?* http://www.ibtimes.co.uk/world-energy-day-2014-how-much-oil-left-how-long-will-it-last-1471200

Statistics Norway. 2015. *General government revenue and expenditure, 2014* http://www.ssb.no/en/offentlig-sektor/statistikker/offinnut

Statistics Norway. 2014. *Income and wealth statistics for households, 2013.* https://www.ssb.no/en/inntekt-og-forbruk/statistikker/ifhus/aar/2014-12-17

Statistics Norway. *Inntekt og forbruk.* http://www.ssb.no/inntekt-og-forbruk/artikler-og-publikasjoner/_attachment/221180?_ts=14c08f02c60

Statsbudsjettet. 2013. *The National Budget 2014.* http://www.statsbudsjettet.no/Statsbudsjettet-2014/Satsinger/?pid=59865

Statsbudsjettet. 2014. *The National Budget 2015.*
http://www.statsbudsjettet.no/Upload/Statsbudsjett_2015/dokumenter/pdf/national_budget2015.pdf

Statistics Norway. 2014. *Økonomiske analyser*.
https://www.ssb.no/nasjonalregnskap-og-konjunkturer/oa/_attachment/209620?_ts=14a1040b5e0

Statistics How to. *R-squared, Adjusted R-squared*
http://www.statisticshowto.com/adjusted-r2/

Store Norske Leksikon. *Boligpolitikk.*
https://snl.no/boligpolitikk

Store Norske Leksikon. *Handlingsregelen.*
https://snl.no/Handlingsregelen

Store Norske Leksikon. *Inflasjon.*
https://snl.no/inflasjon

Store Norske Leksikon. *Statoil ASA.*
https://snl.no/Statoil_ASA

The Economist. 2014. *Why the oil price is falling.*
http://www.economist.com/blogs/economist-explains/2014/12/economist-explains-4

The Financial Supervisory Authority of Norway. 2014. *Finansielle utviklingstrekk.*
http://www.finanstilsynet.no/PageFiles/44069/Finansielle_utviklingstrekk_2014_rapport.pdf?epslanguage=no

Trading Economics. *Brent Crude Oil.*
http://www.tradingeconomics.com/commodity/brent-crude-oil

Tsay, Ruey S. 2010. *Analysis of Financial Time Series.*

3rd edition. Wiley.

U.S. Energy Information Administration. 2015. *Today in Energy*. http://www.eia.gov/todayinenergy/detail.cfm?id=20572

U.S. Energy Information Administration. 2015. *Supply and Disposition.* http://www.eia.gov/dnav/pet/PET_SUM_SND_A_EPC0_MBBLPD_A_CUR.htm

U.S. Energy Information Administration. 2015. *What Drives Crude Oil Prices?* http://www.eia.gov/finance/markets/supply-opec.cfm

UIO. *Analyse av det norske boligmarkedet.* https://www.duo.uio.no/bitstream/handle/10852/17080/AnalysexavxDetxNorskexboligmarkedet.pdf?sequence=2

Wikipedia. *Skewnes.* http://en.wikipedia.org/wiki/Skewness

APPENDIX

APPENDIX 1.1 WHAT DRIVES HOUSE PRICES? BY JACOBSEN & NAUG

Source: Norges Bank

http://www.norges-bank.no/Upload/import/english/publications/economic_bulletin/2005-01/jacobsen.pdf

APPENDIX 1.2 BOBLE I BOLIGMARKEDET?

https://bora.uib.no/bitstream/handle/1956/6122/97362087.pdf

APPENDIX 2.1 HOUSE PRICE PER SQUARE METER

Figure 2: The development of house prices per square meter

Source: Norwegian Association of Real Estate Agents

http://www.nef.no/xp/pub/topp/boligprisstatistikk

APPENDIX 2.2 HOUSE PRICE DEVELOPMENT BY REGION

Figure 3: The development of house prices in Bergen, Oslo, Stavanger, Tromsø, Trondheim and Norway.

Source: Real Estate Norway

http://eiendomnorge.no/boligprisstatistikken/

APPENDIX 2.3 OVERVIEW OF PERCENTAGE CHANGES IN HOUSE PRICE 2014

Sortert etter endring	Endring	Alfabetisk sortert	Endring
Tromsø	10,8%	Norge	2,2%
Troms	9,3%	Akershus	2,5%
Sør-Trøndelag utenom Trondheim	6,0%	Asker	2,0%

Bodø	5,4%	Aust-Agder	-0,9%
Troms utenom Trømsø	5,4%	Bergen	4,0%
Sarpsborg	5,1%	Bergen: Arna og Åsane	3,7%
Nordland	5,0%	Bergen: Bergenhus og Årstad	4,8%
Hamar	4,9%	Bergen: Fana og Ytrebygda	3,4%
Østfold, resten	4,8%	Bergen: Fyllingsdalen og Laksevåg	3,4%
Telemark utenom Skien, Porsgr	4,8%	Bodø	5,4%
Bergen: Bergenhus og Årstad	4,8%	Buskerud	2,5%
Nordland utenom Bodø	4,8%	Buskerud utenom Drammen	3,0%
Hedmark	4,5%	Bærum	1,4%
Østfold	4,4%	Drammen	1,6%
Hedmark utenom Hamar	4,4%	Finnmark	1,5%
Tønsberg	4,0%	Follo	1,8%
Bergen	4,0%	Hamar	4,9%
Hordaland	3,9%	Haugesund	2,0%
Øvre Romerike	3,8%	Hedmark	4,5%
Bergen: Arna og Åsane	3,7%	Hedmark utenom Hamar	4,4%
Hordaland utenom Bergen	3,6%	Hordaland	3,9%
Moss	3,5%	Hordaland utenom Bergen	3,6%
Bergen: Fana og Ytrebygda	3,4%	Kristiansand	-1,5%
Bergen: Fyllingsdalen og Laksevåg	3,4%	Larvik	1,8%
Oppland utenom Lillehammer	3,3%	Lillehammer	0,8%
Vestfold utenom Tønsb, Sandefj, Larvik	3,1%	Moss	3,5%
Sogn & Fjordane	3,1%	Møre & Romsdal	2,3%
Nedre Romerike	3,0%	Møre og Romsdal utenom Ålesund	2,4%
Buskerud utenom Drammen	3,0%	Nedre Romerike	3,0%
Trondheim: Saupstad og Heimdal	2,9%	Nord-Trøndelag	2,7%
Sør-Trøndelag	2,9%	Nordland	5,0%
Vestfold	2,7%	Nordland utenom Bodø	4,8%
Nord-Trøndelag	2,7%	Oppland	2,6%
Oppland	2,6%	Oppland utenom Lillehammer	3,3%
Akershus	2,5%	Oslo	0,5%
Buskerud	2,5%	Oslo: Grorud	0,4%
Trondheim: Sentrum og Byåsen	2,5%	Oslo: Nordre Aker	0,8%

Telemark	2,4%	Oslo: Søndre Nordstrand	1,5%
Møre og Romsdal utenom Ålesund	2,4%	Oslo: Ullern	1,1%
Møre & Romsdal	2,3%	Oslo: Vestre Aker	-0,3%
Norge	2,2%	Oslo: Østensjø	1,0%
Ålesund	2,2%	Oslo: Alna	0,2%
Vest-Agder utenom Kristiansand	2,1%	Oslo: Bjerke	0,3%
Trondheim	2,1%	Oslo: Frogner	0,0%
Asker	2,0%	Oslo: Gamle Oslo	0,8%
Haugesund	2,0%	Oslo: Grünerløkka	0,5%
Follo	1,8%	Oslo: Nordstrand	1,4%
Larvik	1,8%	Oslo: Sagene	-0,1%
Drammen	1,6%	Oslo: St.Hanshaugen	0,0%
Skien	1,6%	Oslo: Stovner	1,5%
Oslo: Stovner	1,5%	Porsgrunn	1,0%
Oslo: Søndre Nordstrand	1,5%	Rogaland	-0,4%
Sandefjord	1,5%	Rogaland utenom Stav, Sand, Haug	0,9%
Finnmark	1,5%	Sandefjord	1,5%
Bærum	1,4%	Sandnes	-2,1%
Oslo: Nordstrand	1,4%	Sarpsborg	5,1%
Trondheim: Strindheim og Nardo	1,2%	Skien	1,6%
Oslo: Ullern	1,1%	Sogn & Fjordane	3,1%
Oslo: Østensjø	1,0%	Stavanger	-1,6%
Porsgrunn	1,0%	Sør-Trøndelag	2,9%
Rogaland utenom Stav, Sand, Haug	0,9%	Sør-Trøndelag utenom Trondheim	6,0%
Oslo: Gamle Oslo	0,8%	Telemark	2,4%
Oslo: Nordre Aker	0,8%	Telemark utenom Skien, Porsgr	4,8%
Lillehammer	0,8%	Troms	9,3%
Oslo: Grünerløkka	0,5%	Troms utenom Trømsø	5,4%
Oslo	0,5%	Tromsø	10,8%
Oslo: Grorud	0,4%	Trondheim	2,1%
Oslo: Bjerke	0,3%	Trondheim: Saupstad og Heimdal	2,9%
Oslo: Alna	0,2%	Trondheim: Sentrum og Byåsen	2,5%
Oslo: St.Hanshaugen	0,0%	Trondheim: Strindheim og Nardo	1,2%

Oslo: Frogner	0,0%	Tønsberg	4,0%
Oslo: Sagene	-0,1%	Vest-Agder	-0,2%
Vest-Agder	-0,2%	Vest-Agder utenom Kristiansand	2,1%
Oslo: Vestre Aker	-0,3%	Vestfold	2,7%
Rogaland	-0,4%	Vestfold utenom Tønsb, Sandefj, Larvik	3,1%
Aust-Agder	-0,9%	Østfold	4,4%
Kristiansand	-1,5%	Østfold, resten	4,8%
Stavanger	-1,6%	Øvre Romerike	3,8%
Sandnes	-2,1%	Ålesund	2,2%
Kilde: Eiendom Norge, FINN, Eiendomsverdi AS.			

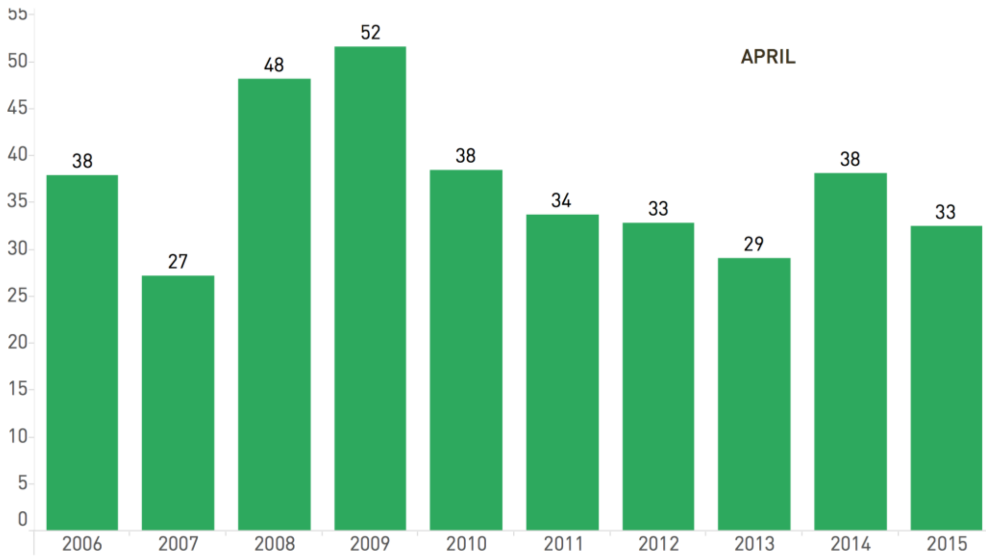
Source: Smarte Penger

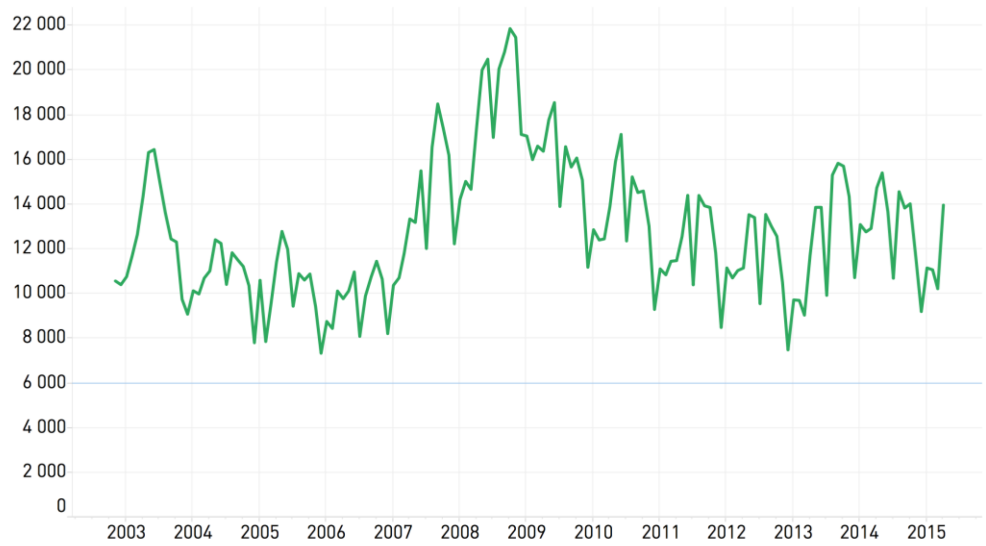
http://www.smartepenger.no/2197-dette-er-boligprisvinnerne-i-2014

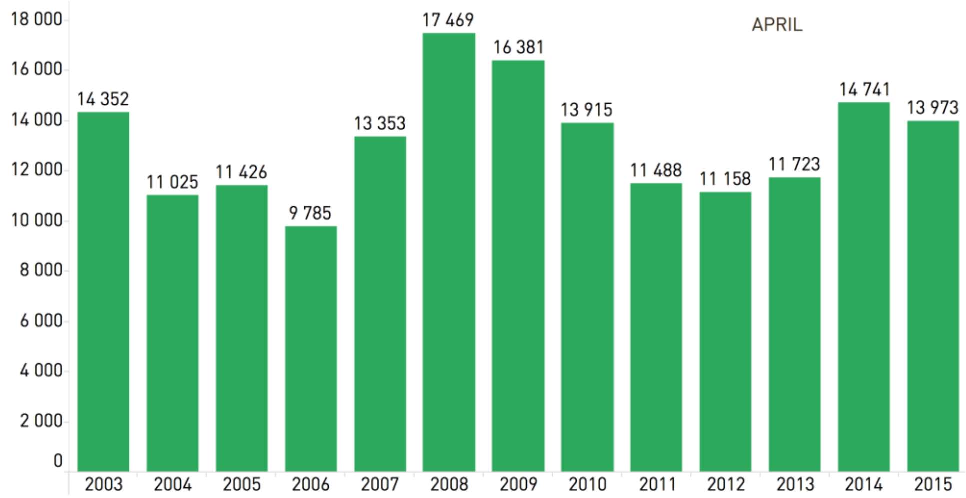
APPENDIX 2.4 SALE PERIOD AND NUMBER OF ACTIVE ADS

Source: Real Estate Norway

http://eiendomnorge.no/wp-content/uploads/2015/05/Eiendom-Norges-boligprisstatistikk-april-2015.pdf







APPENDIX 3.1 HOUSEHOLD EXPECTATION

Figure 4: Development of Household Expectation quarterly

Source: Finance Norway

https://www.fno.no

APPENDIX 3.2 DEVELOPMENT OF THE HOUSEHOLDS SAVINGS

Figure 5: Development of the households' savings

Table: 10799 Årlig inntekts- og kapitalregnskap, etter sektor (mill. Kr) https://www.ssb.no/statistikkbanken/selectvarval/Define.asp?subjectcode=&ProductId=&MainTable=NRI&nvl=&PLanguage=0&nyTmpVar=true&CMSSubjectArea=nasjonalregnskap-og-konjunkturer&KortNavnWeb=nri&StatVariant=&checked=true

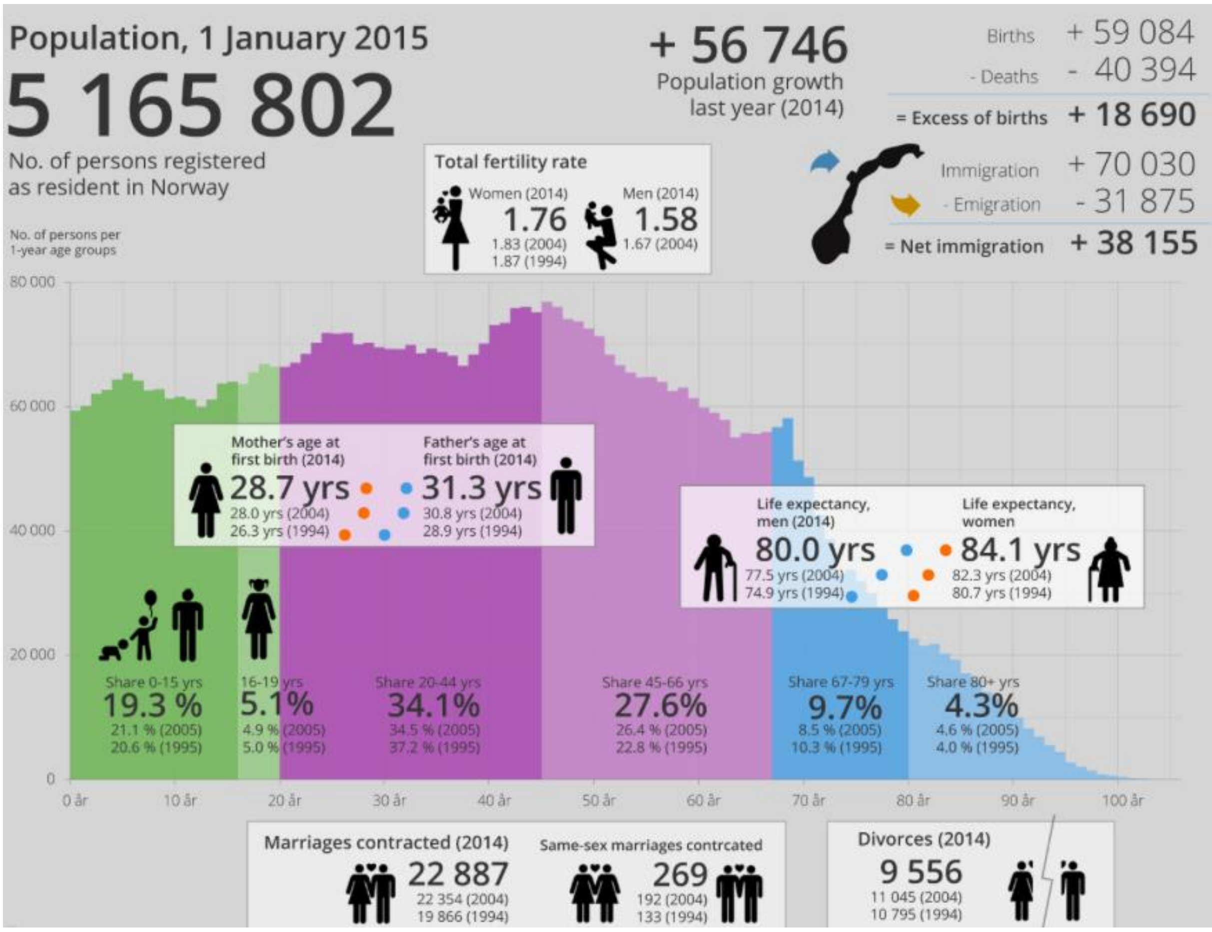
APPENDIX 3.3 POPULATION GROWTH IN NORWAY

Figure 6: Population growth in Norway

Source: Statistics Norway

http://www.ssb.no/folkendrkv

APPENDIX 3.4 POPULATION GROWTH IN NORWAY



Source: Statistics Norway

https://www.ssb.no/en/befolkning/nokkeltall

APPENDIX 3.5 POPULATION GROWTH

Figure 7: Quarterly Population Growth

Table: 01222 Population and changes during the quarter (M)

Source: Statistics Norway

http://www.ssb.no/folkendrkv

APPENDIX 3.6 IMMIGRATION IN NORWAY

Figure 8: The development of immigration

Table: 01222 Population and changes during the quarter (M)

Source: Statistics Norway

http://www.ssb.no/folkendrkv

APPENDIX 3.7 EMIGRATION IN NORWAY

Figure 9: The development of emigration

Table: 01222 Population and changes during the quarter (M)

Source: Statistics Norway

http://www.ssb.no/folkendrkv

APPENDIX 3.8 IMMIGRATION AND EMIGRATION IN REGIONS AND NORWAY

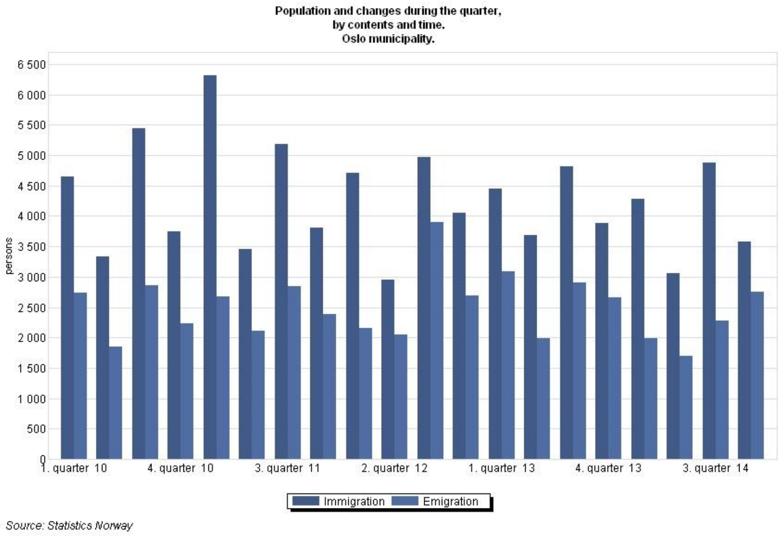
Table: 01222 Population and changes during the quarter (M)

Source: Statistics Norway

http://www.ssb.no/folkendrkv

Oslo

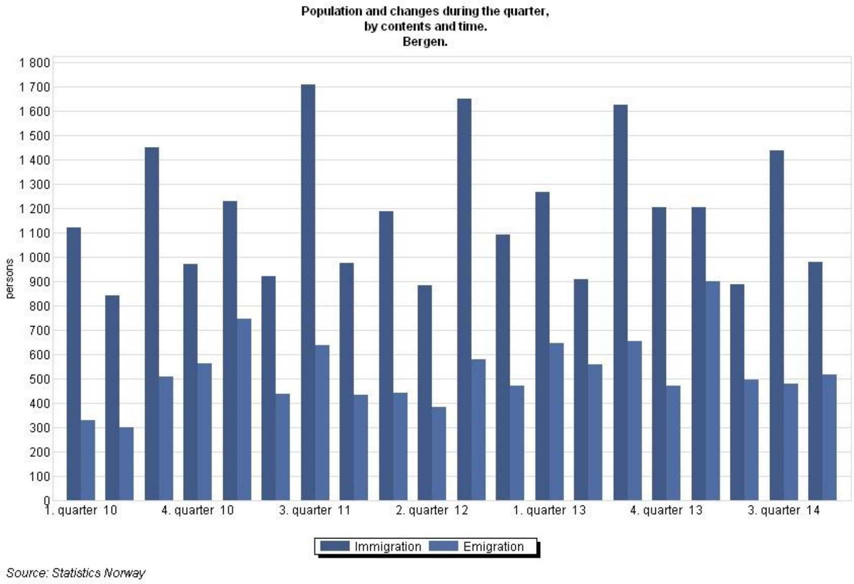
In Oslo 15 799 people immigrated during 2014, 8 715 people emigrated which leaves a net of 7 084 people.



Immigration and Emigration in Oslo

Bergen

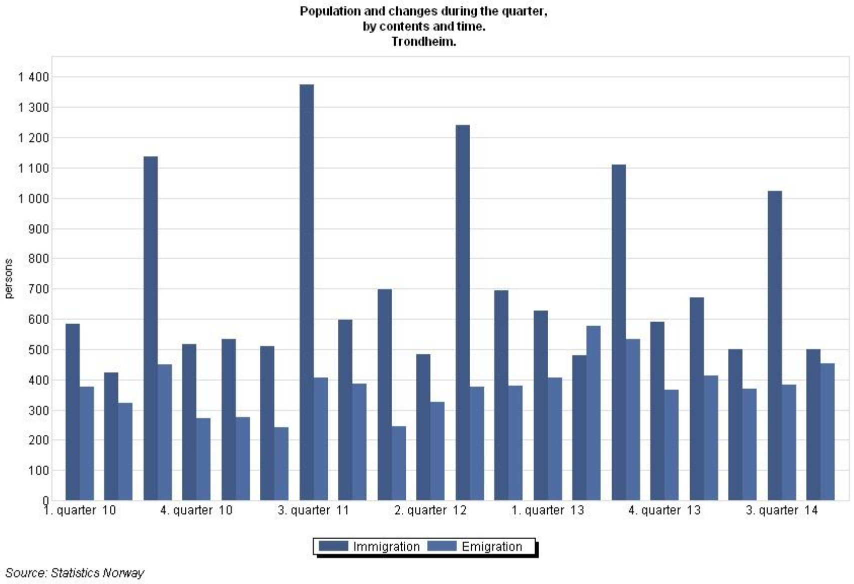
In Bergen 4 506 people immigrated during 2014, 2 393 people emigrated which leaves a net of 2 113 people.



Immigration and Emigration Bergen

Trondheim

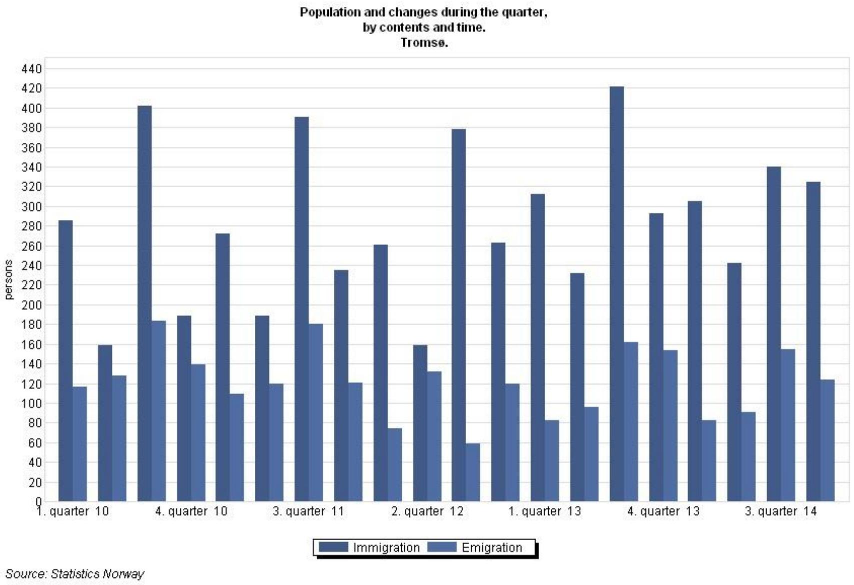
In Trondheim 2 692 people immigrated during 2014, 1 620 people emigrated which leaves a net of 1 072 people.



Immigration and emigration in Trondheim

Tromsø

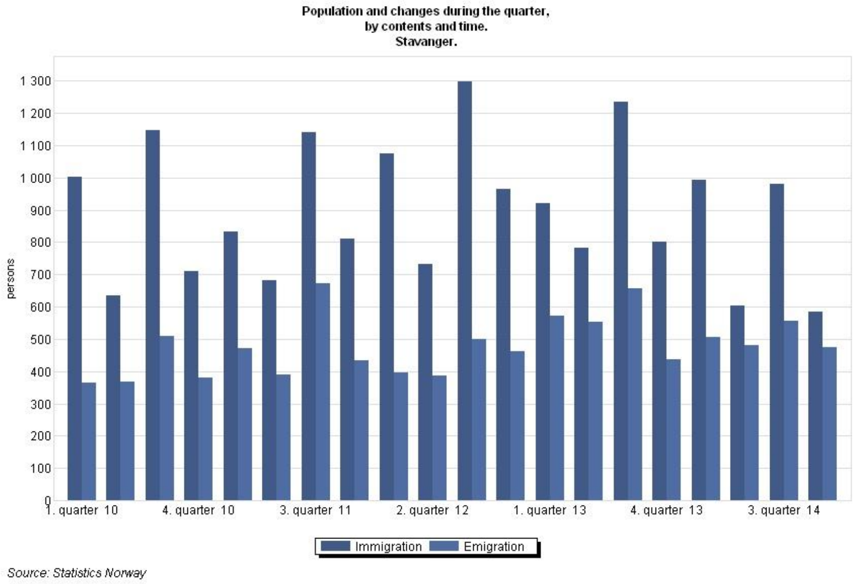
In Tromsø 1 211 people immigrated during 2014, and 452 people emigrated which leaves a net of 750 people.



Immigration and emigration in Tromsø

Stavanger

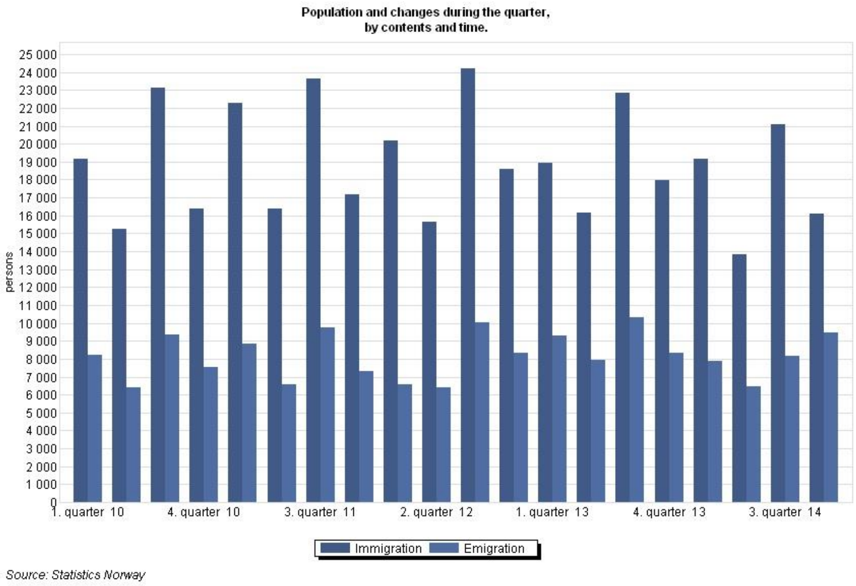
In Stavanger 3 161 people immigrated during 2014, 2 017 people emigrated which leaves a net of 1 144 people.



Immigration and emigration in Stavanger

<u>Norway</u>

In Norway during 2014, 70030 people immigrated, 31875 people emigrated which leaves a net of 38155 people.



Immigration and emigration in Norway

APPENDIX 3.9 DISPOSABLE REAL INCOME

Figure 10: Disposable real income seasonally adjusted 2009 = 100

Source: Statistics Norway

https://ssb.no/en/nasjonalregnskap-og-konjunkturer/statistikker/knri

APPENDIX 3.10 REGISTERED UNEMPLOYED IN NORWAY

Figure 11: Registered Unemployed in Norway

Table: 10540 Unemployed persons registered at the Employment Office 15-74 years, by age (per cent) (M)

Source: Statistics Norway

https://www.ssb.no/en/arbeid-og-lonn/statistikker/regledig

APPENDIX 3.11 REGISTERED UNEMPLOYED REGION

Figure 12: Registered unemployed in Oslo, Stavanger, Bergen, Trondheim and Tromsø

Table: 10540 Unemployed persons registered at the Employment Office 15-74 years, by age (percent) (M)

Source: Statistics Norway

https://www.ssb.no/en/arbeid-og-lonn/statistikker/regledig

APPENDIX 3.12 HOUSEHOLD'S DEBT

Figure 13: The development of household's debt

Table: 06715Gross domestic debt, by borrower and broken down by NOK and foreign exchange (NOK million)

Source: Statistics Norway

https://www.ssb.no/en/bank-og-finansmarked/statistikker/k2

APPENDIX 3.13 KEY POLICY RATE EFFECT ON INFLATION

Figure 14: Key Policy Rate Effect on Inflation

Source: The Central Bank of Norway

http://www.norges-bank.no/Upload/import/pengepolitikk/rentevirkninger/animasjon_11.pdf

APPENDIX 3.14 CONSUMER PRICE INDEX

Figure 15: Consumer Price Index

Table: 03013 Consumer Price Index

Source: The Central Bank of Norway

https://www.ssb.no/en/priser-og-prisindekser/statistikker/kpi

APPENDIX 3.15 SUPPLY AND DEMAND IN THE NORWEGIAN MARKET

Figure 16: Supply and Demand in the Norwegian Market

Table: 03723 Building statistics. Dwellings and utility floor space in dwellings. Preliminary

Table: 06071 Persons, by sex, age and type of household

Source: Statistics Norway

https://www.ssb.no/en/bygg-bolig-og-eiendom/statistikker/byggeareal/aar

https://www.ssb.no/en/familie

APPENDIX 3.16 BUILDING COST INDEX

Figure 17: Building Cost Index

Table: 08651 Construction cost index for residential buildings

Source: Statistics Norway

http://www.ssb.no/en/priser-og-prisindekser/statistikker/bkibol

APPENDIX 4.1 THE DEVELOPMENT OF BRENT CRUDE OIL PRICE

Figure 18: The development of oil prices, 1970 – 2015

Source: Tradingeconomics.com

http://www.tradingeconomics.com/commodity/brent-crude-oil

APPENDIX 4.2 WORLD OIL DEMAND

Figure 19: World Oil Demand

Source: International Energy Agency

https://www.iea.org/oilmarketreport/omrpublic/

APPENDIX 4.3 OIL SUPPLY

Figure 20: World Oil Supply

Source: International Energy Agency

https://www.iea.org/oilmarketreport/omrpublic/

APPENDIX 4.4 DEVELOPMENT BRENT OIL PRICE MONTHLY

Figure 21: Development of oil price monthly

Source: www.fred.org

http://research.stlouisfed.org/fred2/series/DCOILBRENTEU

APPENDIX 4.5 U.S PETROLEUM PRODUCTION

Figure 22: Annual change in U.S field production of crude oil

Source: U.S Energy Information, Petroleum Supply Monthly

http://www.eia.gov/todayinenergy/detail.cfm?id=20572

APPENDIX 4.6 THE NATIONAL ACCOUNTS QUARTERLY

Table 2: The National Accounts Quarterly Norway

Source: Statistics Norway

https://www.ssb.no/en/nasjonalregnskap-og-konjunkturer/statistikker/knr/

APPENDIX 4.7 REVENUES IN THE NATIONAL BUDGET

Figure 23: The National Accounts Quarterly Norway Revenues

Source: The National Budget

www.statsbudsjettet.no

APPENDIX 4.8 EXPENSES IN THE NATIONAL BUDGET

Figure 24: The National Accounts Quarterly Norway Expenses

Source: The National Budget

www.statsbudsjettet.no

APPENDIX 4.9 MARKET VALUE OF THE OIL FUND

Figure 25: Market value development of the Government Pension Fund Global (The Oil Fund)

Source: Norges Bank

http://www.nbim.no/en/

APPENDIX 5.1 TNS GALLUP EXPECTAION BAROMETER

Source: TNS GALLUP

http://www.tns-gallup.no

Expectation Survey is a nationwide representative survey (about 1,000 people) conducted by telephone every quarter.

Expectation Survey consist of 6 questions, the first 5 are part of Trend indicator:

1. Would you say that the economy in your household is better or worse than a year ago or is there no difference?
2. Do you think that the economics of your household going to be better or worse in a year or there will not be any difference?
3. If we look at the economic situation of the entire Norway, would you say that the economy of the country in general are better or worse than a year ago or is there no difference?
4. Do you think the economic situation in Norway is going to be better or worse in a year or there will not be any difference?
5. Do you think that now is a good time for the general population to purchase larger household items or do you think it is a bad time?

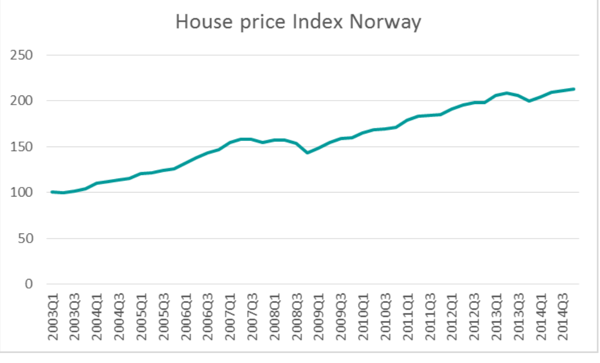
Trend indicator = difference between the percentage of optimistic and pessimistic responses for each question are summed and divided by 5.

Trend indicator complemented by a 6 question that called for industry indicator.

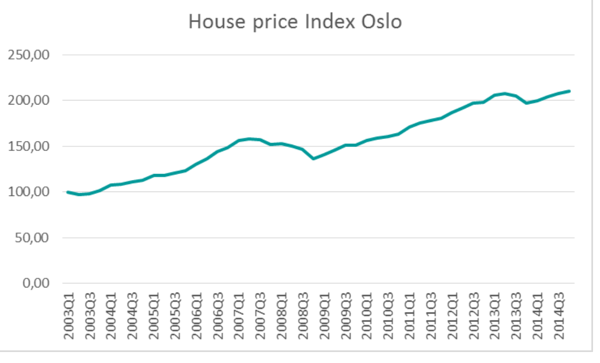
6. If the economy in your household was better, what would you spend the money?

APPENDIX 6.1 OVERVIEW VARIABLES

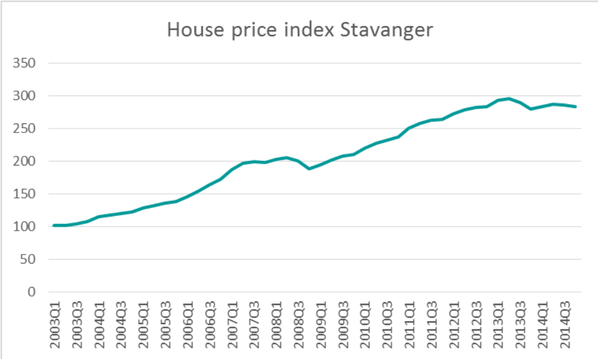
Source: Real Estate Norway
http://eiendomnorge.no/boligprisstatistikken/



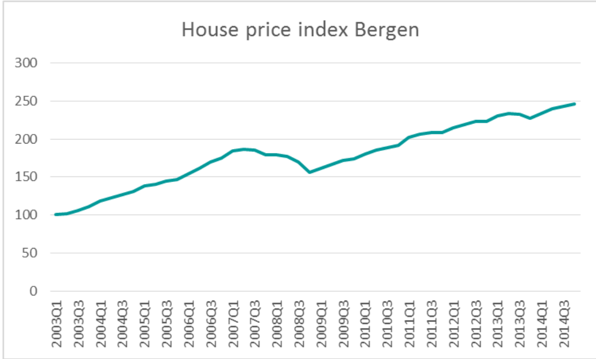
House Price Index Norway



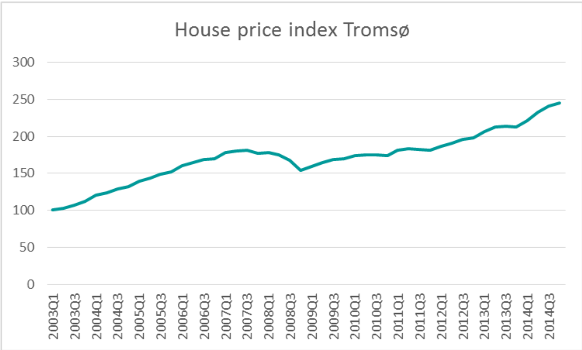
House Price Index Oslo



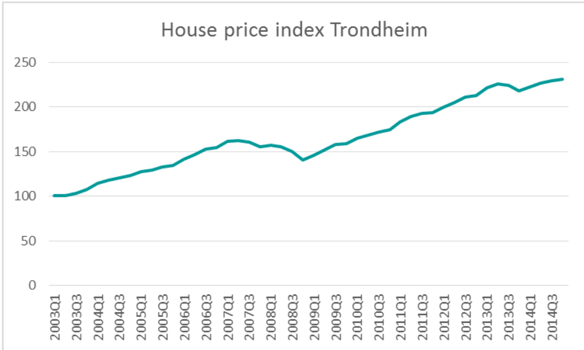
House Price Index Stavanger



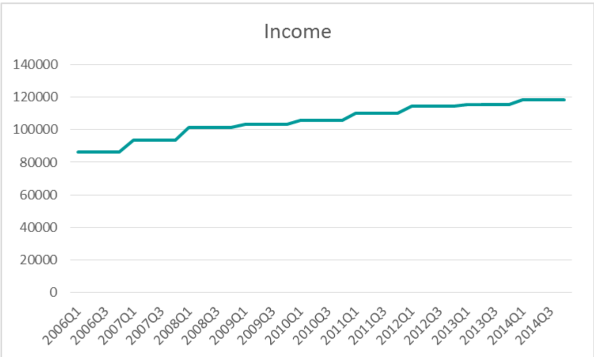
House Price Index Bergen



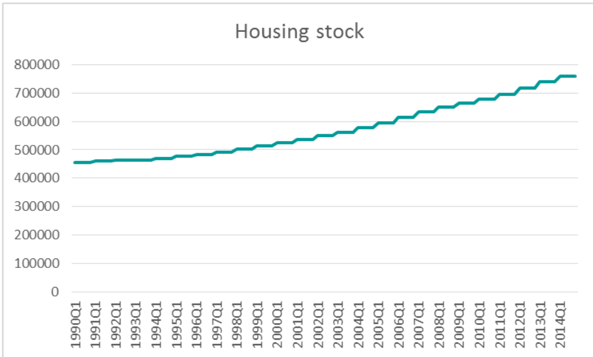
House Price Index Tromsø



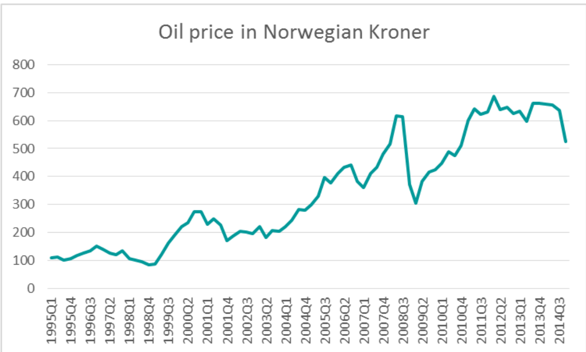
House Price Index Trondheim



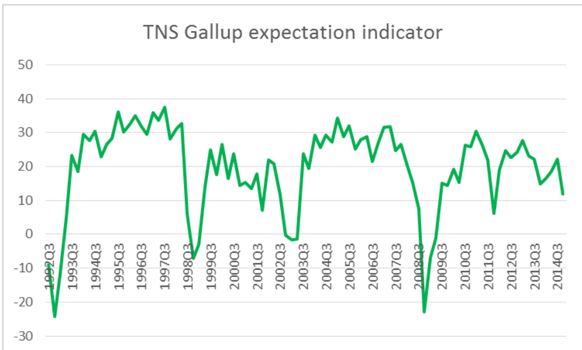
Income



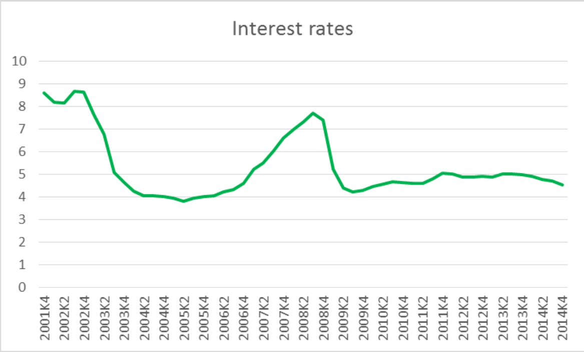
Housing Stock



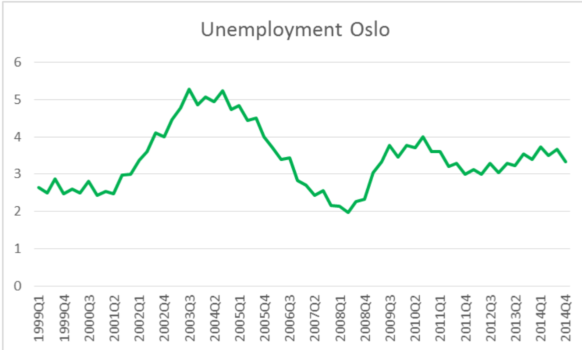
Oil Price in Norwegian Kroner



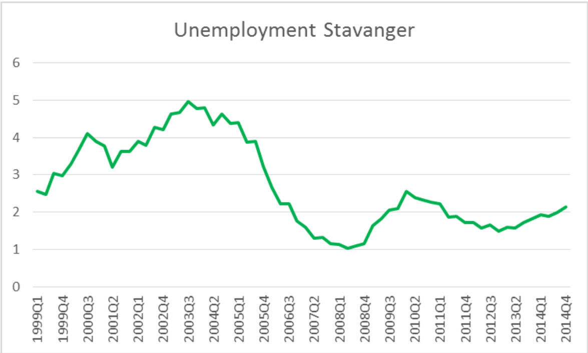
TNS Gallup Expectation Indicator



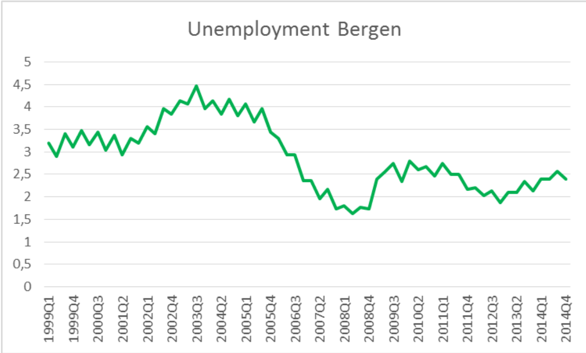
Interest Rates



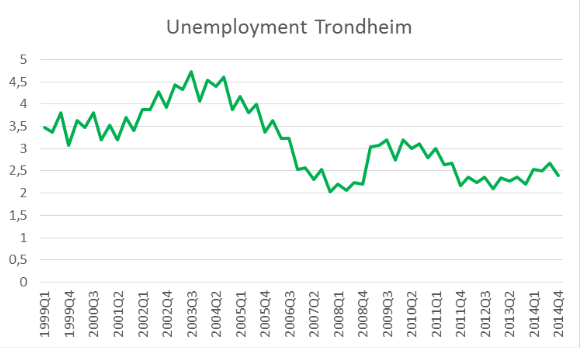
Unemployment Oslo



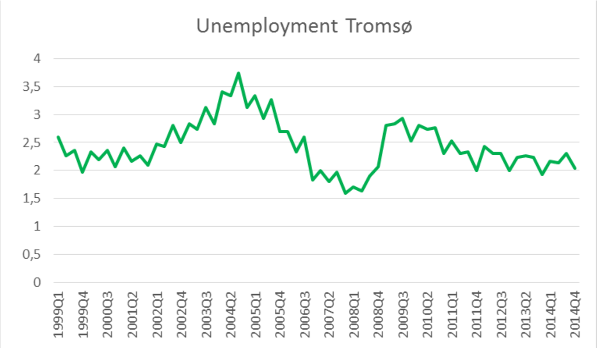
Unemployment Stavanger



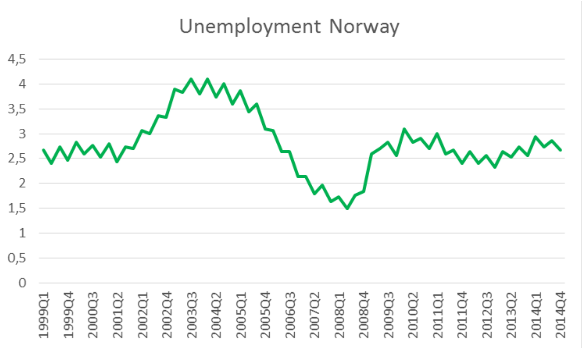
Unemployment Bergen



Unemployment Trondheim



Unemployment Tromsø



Unemployment Norway

APPENDIX 6.2 DESCRIPTIVE ANALYSIS

Date: 05/08/15 Time: 15:47
Sample: 1990Q1 2014Q4

Norway	DeltaHouse	Delta Income	Delta Interest rate after tax	Delta Interest rate after tax lag	EXPEC	House price	Interest rate after tax lag	Unemployment	Oil price	(Income-Housing stock)lag	C	S1	S2	S3
Mean	0.013628	0.009038	0.000114	0.000155	-0.027363	5.143107	0.036928	-3.719267	6.253910	-1.872426	1.000000	0.228571	0.257143	0.257143
Median	0.018338	0.000000	0.000288	0.000288	0.020800	5.125575	0.034992	-3.649659	6.263491	-1.858963	1.000000	0.000000	0.000000	0.000000
Maximum	0.052297	0.082200	0.004320	0.004320	0.243100	5.353828	0.055512	-3.473768	6.530650	-1.835047	1.000000	1.000000	1.000000	1.000000
Minimum	-0.068440	0.000000	-0.015768	-0.015768	-0.569600	4.883171	0.029088	-4.199705	5.721799	-1.962315	1.000000	0.000000	0.000000	0.000000
Std. Dev.	0.024523	0.020743	0.003361	0.003352	0.189862	0.137287	0.006813	0.188958	0.224925	0.038639	0.000000	0.426043	0.443440	0.443440
Skewness	-1.164821	2.526185	-3.126057	-3.187365	-1.554351	0.047702	1.538902	-1.078491	-0.515102	-1.449944	NA	1.292786	1.111325	1.111325
Kurtosis	5.008095	8.591965	15.60917	15.93989	5.505407	1.776226	4.332457	3.041145	2.055777	3.825409	NA	2.671296	2.235043	2.235043
Jarque-Bera	13.79536	82.82826	288.8669	303.4470	23.24743	2.197308	16.40380	6.787474	2.847944	13.25719	NA	9.906796	8.057774	8.057774
Probability	0.001010	0.000000	0.000000	0.000000	0.000009	0.333319	0.000274	0.033583	0.240756	0.001322	NA	0.007059	0.017794	0.017794
Sum	0.476974	0.316347	0.003981	0.005439	-0.957700	180.0087	1.292470	-130.1743	218.8869	-65.53491	35.00000	8.000000	9.000000	9.000000
Sum Sq. Dev.	0.020447	0.014630	0.000384	0.000382	1.225613	0.640821	0.001578	1.213974	1.720101	0.050762	0.000000	6.171429	6.685714	6.685714
Observations	35	35	35	35	35	35	35	35	35	35	35	35	35	35

Descriptive statistics of Norway

Date: 05/08/15 Time: 15:47
Sample: 1990Q1 2014Q4

Oslo	DeltaHouse	Delta Income	Delta Interest rate after tax	Delta Interest rate after tax lag	EXPEC	House price	Interest rate after tax lag	Unemployment	Oil price	(Income-Housing stock)lag	C	S1	S2	S3
Mean	0.013778	0.009038	0.000114	0.000155	-0.029943	5.117179	0.036928	-3.474051	6.253910	-1.872426	1.000000	0.228571	0.257143	0.257143
Median	0.016374	0.000000	0.000288	0.000288	0.010100	5.068726	0.034992	-3.411248	6.263491	-1.858963	1.000000	0.000000	0.000000	0.000000
Maximum	0.054503	0.082200	0.004320	0.004320	0.349700	5.335548	0.055512	-3.218876	6.530650	-1.835047	1.000000	1.000000	1.000000	1.000000
Minimum	-0.072503	0.000000	-0.015768	-0.015768	-0.875900	4.867911	0.029088	-3.928830	5.721799	-1.962315	1.000000	0.000000	0.000000	0.000000
Std. Dev.	0.027080	0.020743	0.003361	0.003352	0.227050	0.143320	0.006813	0.184308	0.224925	0.038639	0.000000	0.426043	0.443440	0.443440
Skewness	-1.143439	2.526185	-3.126057	-3.187365	-2.072315	0.194536	1.538902	-0.977198	-0.515102	-1.449944	NA	1.292786	1.111325	1.111325
Kurtosis	4.562641	8.591965	15.60917	15.93989	8.266600	1.712723	4.332457	2.938149	2.055777	3.825409	NA	2.671296	2.235043	2.235043
Jarque-Bera	11.18783	82.82826	288.8669	303.4470	65.50109	2.637336	16.40380	5.575922	2.847944	13.25719	NA	9.906796	8.057774	8.057774
Probability	0.003720	0.000000	0.000000	0.000000	0.000000	0.267491	0.000274	0.061547	0.240756	0.001322	NA	0.007059	0.017794	0.017794
Sum	0.482220	0.316347	0.003981	0.005439	-1.048000	179.1013	1.292470	-121.5918	218.8869	-65.53491	35.00000	8.000000	9.000000	9.000000
Sum Sq. Dev.	0.024933	0.014630	0.000384	0.000382	1.752762	0.698381	0.001578	1.154965	1.720101	0.050762	0.000000	6.171429	6.685714	6.685714
Observations	35	35	35	35	35	35	35	35	35	35	35	35	35	35

Descriptive statistics of Oslo

Bergen	DeltaHouse	Delta Income	Delta Interest rate after tax	Delta Interest rate after tax lag	EXPEC	House price	Interest rate after tax lag	Unemployment	Oil price	(Income-Housing stock)lag	C	S1	S2	S3
Mean	0.013283	0.009038	0.000114	0.000155	-0.056057	5.266194	0.036928	-3.783421	6.253910	-1.872426	1.000000	0.228571	0.257143	0.257143
Median	0.016048	0.000000	0.000288	0.000288	0.000000	5.230610	0.034992	-3.743688	6.263491	-1.858963	1.000000	0.000000	0.000000	0.000000
Maximum	0.054932	0.082200	0.004320	0.004320	0.292800	5.494010	0.055512	-3.529031	6.530650	-1.835047	1.000000	1.000000	1.000000	1.000000
Minimum	-0.082499	0.000000	-0.015768	-0.015768	-1.446700	5.039373	0.029088	-4.114547	5.721799	-1.962315	1.000000	0.000000	0.000000	0.000000
Std. Dev.	0.027962	0.020743	0.003361	0.003352	0.318275	0.136314	0.006813	0.156096	0.224925	0.038639	0.000000	0.426043	0.443440	0.443440
Skewness	-1.353830	2.526185	-3.126057	-3.187365	-2.900591	0.118679	1.538902	-0.408692	-0.515102	-1.449944	NA	1.292786	1.111325	1.111325
Kurtosis	5.494265	8.591965	15.60917	15.93989	12.28818	1.738961	4.332457	2.366400	2.055777	3.825409	NA	2.671296	2.235043	2.235043
Jarque-Bera	19.76447	82.82826	288.8669	303.4470	174.8893	2.401228	16.40380	1.559785	2.847944	13.25719	NA	9.906796	8.057774	8.057774
Probability	0.000051	0.000000	0.000000	0.000000	0.000000	0.301009	0.000274	0.458455	0.240756	0.001322	NA	0.007059	0.017794	0.017794
Sum	0.464903	0.316347	0.003981	0.005439	-1.962000	184.3168	1.292470	-132.4197	218.8869	-65.53491	35.00000	8.000000	9.000000	9.000000
Sum Sq. Dev.	0.026584	0.014630	0.000384	0.000382	3.444158	0.631770	0.001578	0.828441	1.720101	0.050762	0.000000	6.171429	6.685714	6.685714
Observations	35	35	35	35	35	35	35	35	35	35	35	35	35	35

Descriptive statistics of Bergen

Stavanger	DeltaHouse	Delta Income	Delta Interest rate after tax	Delta Interest rate after tax lag	EXPEC	House price	Interest rate after tax lag	Unemployment	Oil price	(Income-Housing stock)lag	C	S1	S2	S3
Mean	0.018984	0.009038	0.000114	0.000155	-0.055951	5.426277	0.036928	-4.057515	6.253910	-1.872426	1.000000	0.228571	0.257143	0.257143
Median	0.017488	0.000000	0.000288	0.000288	0.032700	5.427272	0.034992	-4.036076	6.263491	-1.858963	1.000000	0.000000	0.000000	0.000000
Maximum	0.078630	0.082200	0.004320	0.004320	0.292800	5.690146	0.055512	-3.662562	6.530650	-1.835047	1.000000	1.000000	1.000000	1.000000
Minimum	-0.065092	0.000000	-0.015768	-0.015768	-1.446700	4.981032	0.029088	-4.572380	5.721799	-1.962315	1.000000	0.000000	0.000000	0.000000
Std. Dev.	0.029084	0.020743	0.003361	0.003352	0.321687	0.201811	0.006813	0.240360	0.224925	0.038639	0.000000	0.426043	0.443440	0.443440
Skewness	-0.567492	2.526185	-3.126057	-3.187365	-2.926934	-0.350536	1.538902	-0.537272	-0.515102	-1.449944	NA	1.292786	1.111325	1.111325
Kurtosis	3.791180	8.591965	15.60917	15.93989	12.14864	2.096938	4.332457	2.460024	2.055777	3.825409	NA	2.671296	2.235043	2.235043
Jarque-Bera	2.791473	82.82826	288.8669	303.4470	172.0330	1.906073	16.40380	2.109070	2.847944	13.25719	NA	9.906796	8.057774	8.057774
Probability	0.247651	0.000000	0.000000	0.000000	0.000000	0.385568	0.000274	0.348354	0.240756	0.001322	NA	0.007059	0.017794	0.017794
Sum	0.664454	0.316347	0.003981	0.005439	-1.958300	189.9197	1.292470	-142.0130	218.8869	-65.53491	35.00000	8.000000	9.000000	9.000000
Sum Sq. Dev.	0.028760	0.014630	0.000384	0.000382	3.518411	1.384736	0.001578	1.964273	1.720101	0.050762	0.000000	6.171429	6.685714	6.685714
Observations	35	35	35	35	35	35	35	35	35	35	35	35	35	35

Tromsø	DeltaHouse	Delta Income	Delta Interest rate after tax	Delta Interest rate after tax lag	EXPEC	House price	Interest rate after tax lag	Unemployment	Oil price	(Income-Housing stock)lag	C	S1	S2	S3
Mean	0.012247	0.009038	0.000114	0.000155	-0.034517	5.210835	0.036928	-3.808118	6.253910	-1.872426	1.000000	0.228571	0.257143	0.257143
Median	0.014425	0.000000	0.000288	0.000288	-0.010100	5.183858	0.034992	-3.786860	6.263491	-1.858963	1.000000	0.000000	0.000000	0.000000
Maximum	0.050138	0.082200	0.004320	0.004320	0.292800	5.484285	0.055512	-3.529031	6.530650	-1.835047	1.000000	1.000000	1.000000	1.000000
Minimum	-0.085207	0.000000	-0.015768	-0.015768	-0.569600	5.038689	0.029088	-4.135167	5.721799	-1.962315	1.000000	0.000000	0.000000	0.000000
Std. Dev.	0.026706	0.020743	0.003361	0.003352	0.191873	0.108645	0.006813	0.160475	0.224925	0.038639	0.000000	0.426043	0.443440	0.443440
Skewness	-1.524822	2.526185	-3.126057	-3.187365	-1.655904	0.863962	1.538902	-0.145672	-0.515102	-1.449944	NA	1.292786	1.111325	1.111325
Kurtosis	6.472038	8.591965	15.60917	15.93989	5.928292	3.054469	4.332457	2.338133	2.055777	3.825409	NA	2.671296	2.235043	2.235043
Jarque-Bera	31.14326	82.82826	288.8669	303.4470	28.50016	4.358501	16.40380	0.762634	2.847944	13.25719	NA	9.906796	8.057774	8.057774
Probability	0.000000	0.000000	0.000000	0.000000	0.000001	0.113126	0.000274	0.682961	0.240756	0.001322	NA	0.007059	0.017794	0.017794
Sum	0.428645	0.316347	0.003981	0.005439	-1.208100	182.3792	1.292470	-133.2841	218.8869	-65.53491	35.00000	8.000000	9.000000	9.000000
Sum Sq. Dev.	0.024250	0.014630	0.000384	0.000382	1.251718	0.401324	0.001578	0.875576	1.720101	0.050762	0.000000	6.171429	6.685714	6.685714
Observations	35	35	35	35	35	35	35	35	35	35	35	35	35	35

Descriptive statistics of Tromsø

Trondheim	DeltaHouse	Delta Income	Delta Interest rate after tax	Delta Interest rate after tax lag	EXPEC	House price	Interest rate after tax lag	Unemployment	Oil price	(Income-Housing stock)lag	C	S1	S2	S3
Mean	0.014022	0.009038	0.000114	0.000155	-0.058451	5.178257	0.036928	-3.670133	6.253910	-1.872426	1.000000	0.228571	0.257143	0.257143
Median	0.017108	0.000000	0.000288	0.000288	0.010100	5.128941	0.034992	-3.675634	6.263491	-1.858963	1.000000	0.000000	0.000000	0.000000
Maximum	0.049366	0.082200	0.004320	0.004320	0.349700	5.435872	0.055512	-3.431657	6.530650	-1.835047	1.000000	1.000000	1.000000	1.000000
Minimum	-0.069205	0.000000	-0.015768	-0.015768	-1.284800	4.944206	0.029088	-3.895494	5.721799	-1.962315	1.000000	0.000000	0.000000	0.000000
Std. Dev.	0.025827	0.020743	0.003361	0.003352	0.305185	0.161313	0.006813	0.143804	0.224925	0.038639	0.000000	0.426043	0.443440	0.443440
Skewness	-1.214998	2.526185	-3.126057	-3.187365	-2.527003	0.300308	1.538902	0.296600	-0.515102	-1.449944	NA	1.292786	1.111325	1.111325
Kurtosis	4.581834	8.591965	15.60917	15.93989	9.787687	1.615996	4.332457	1.843462	2.055777	3.825409	NA	2.671296	2.235043	2.235043
Jarque-Bera	12.26033	82.82826	288.8669	303.4470	104.4395	3.319467	16.40380	2.463803	2.847944	13.25719	NA	9.906796	8.057774	8.057774
Probability	0.002176	0.000000	0.000000	0.000000	0.000000	0.190190	0.000274	0.291737	0.240756	0.001322	NA	0.007059	0.017794	0.017794
Sum	0.490770	0.316347	0.003981	0.005439	-2.045800	181.2390	1.292470	-128.4547	218.8869	-65.53491	35.00000	8.000000	9.000000	9.000000
Sum Sq. Dev.	0.022679	0.014630	0.000384	0.000382	3.166693	0.884739	0.001578	0.703110	1.720101	0.050762	0.000000	6.171429	6.685714	6.685714
Observations	35	35	35	35	35	35	35	35	35	35	35	35	35	35

Descriptive statistics of Trondheim

APPENDIX 6.3 SKEWNESS

Table 5: Overview of Skewness

Source: Self made, estimated by using Eviews

APPENDIX 6.4 KURTOSIS

Table 5: Overview of Kurtosis

Source: Self made, estimated by using Eviews

APPENDIX 6.5 CORRELATION MATRIX

Source: Self made, estimated by using SPSS

Program: SPSS

		ln_bpi_norge_diff	ln_inntekt_diff	rente_etter_skatt1_diff	rente_etter_skatt_diff_lag1	expecnorge	ln_bpi_norge_t-1	rente_etter_skatt1_lag1	ln_led_norge	inntekt_boligmasse_lag	s1	s2	s3
ln_bpi_norge_diff	Pearson Correlation	1	,243	-,140	-,305	,159	-,274	-,539**	,473**	,242	,512**	,198	-,170
	Sig. (2-tailed)		,154	,415	,071	,356	,106	,001	,004	,156	,001	,247	,321
	N	36	36	36	36	36	36	36	36	36	36	36	36
ln_inntekt_diff	Pearson Correlation	,243	1	,002	,018	-,189	-,357*	-,194	,205	1,000**	,294	-,098	-,098
	Sig. (2-tailed)	,154		,992	,918	,271	,033	,256	,229	,000	,082	,570	,570
	N	36	36	36	36	36	36	36	36	36	36	36	36
rente_etter_skatt1_diff	Pearson Correlation	-,140	,002	1	,525**	,386*	,024	-,272	-,346*	,001	-,170	-,030	,135
	Sig. (2-tailed)	,415	,992		,001	,020	,889	,109	,039	,996	,320	,860	,432
	N	36	36	36	36	36	36	36	36	36	36	36	36
rente_etter_skatt_diff_lag1	Pearson Correlation	-,305	,018	,525**	1	-,044	,012	,202	-,458**	,017	,093	-,180	-,039
	Sig. (2-tailed)	,071	,918	,001		,798	,943	,237	,005	,921	,591	,294	,819
	N	36	36	36	36	36	36	36	36	36	36	36	36
expecnorge	Pearson Correlation	,159	-,189	,386*	-,044	1	,307	-,290	,035	-,189	-,003	,095	,032
	Sig. (2-tailed)	,356	,271	,020	,798		,068	,087	,837	,271	,984	,580	,851
	N	36	36	36	36	36	36	36	36	36	36	36	36
ln_bpi_norge_t-1	Pearson Correlation	-,274	-,357*	,024	,012	,307	1	-,103	,249	-,355*	-,165	-,017	,076
	Sig. (2-tailed)	,106	,033	,889	,943	,068		,551	,142	,034	,337	,920	,660
	N	36	36	36	36	36	36	36	36	36	36	36	36
rente_etter_skatt1_lag1	Pearson Correlation	-,539**	-,194	-,272	,202	-,290	-,103	1	-,683**	-,194	,038	-,035	-,039
	Sig. (2-tailed)	,001	,256	,109	,237	,087	,551		,000	,257	,825	,842	,819
	N	36	36	36	36	36	36	36	36	36	36	36	36
ln_led_norge	Pearson Correlation	,473**	,205	-,346*	-,458**	,035	,249	-,683**	1	,206	,203	-,092	,092
	Sig. (2-tailed)	,004	,229	,039	,005	,837	,142	,000		,227	,234	,593	,592
	N	36	36	36	36	36	36	36	36	36	36	36	36
inntekt_boligmasse_lag	Pearson Correlation	,242	1,000**	,001	,017	-,189	-,355*	-,194	,206	1	,293	-,098	-,098
	Sig. (2-tailed)	,156	,000	,996	,921	,271	,034	,257	,227		,083	,571	,571
	N	36	36	36	36	36	36	36	36	36	36	36	36
s1	Pearson Correlation	,512**	,294	-,170	,093	-,003	-,165	,038	,203	,293	1	-,333*	-,333*
	Sig. (2-tailed)	,001	,082	,320	,591	,984	,337	,825	,234	,083		,047	,047
	N	36	36	36	36	36	36	36	36	36	36	36	36
s2	Pearson Correlation	,198	-,098	-,030	-,180	,095	-,017	-,035	-,092	-,098	-,333*	1	-,333*
	Sig. (2-tailed)	,247	,570	,860	,294	,580	,920	,842	,593	,571	,047		,047
	N	36	36	36	36	36	36	36	36	36	36	36	36
s3	Pearson Correlation	-,170	-,098	,135	-,039	,032	,076	-,039	,092	-,098	-,333*	-,333*	1
	Sig. (2-tailed)	,321	,570	,432	,819	,851	,660	,819	,592	,571	,047	,047	
	N	36	36	36	36	36	36	36	36	36	36	36	36

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

		ln_bpi_oslo_diff	ln_inntekt_diff	rente_etter_skatt1_diff	rente_etter_skatt_diff_lag1	expecoslo	ln_bpi_oslo_t-1	rente_etter_skatt1_lag1	ln_led_oslo	inntekt_boligmasse_lag	s1	s2	s3
ln_bpi_oslo_diff	Pearson Correlation	1	,237	-,149	-,325	,222	-,216	-,627**	,502**	,236	,413*	,105	-,064
	Sig. (2-tailed)		,165	,385	,053	,193	,206	,000	,002	,166	,012	,542	,713
	N	36	36	36	36	36	36	36	36	36	36	36	36
ln_inntekt_diff	Pearson Correlation	,237	1	,002	,018	-,098	-,336*	-,194	,160	1,000**	,294	-,098	-,098
	Sig. (2-tailed)	,165		,992	,918	,568	,045	,256	,350	,000	,082	,570	,570
	N	36	36	36	36	36	36	36	36	36	36	36	36
rente_etter_skatt1_diff	Pearson Correlation	-,149	,002	1	,525**	,491**	,080	-,272	-,265	,001	-,170	-,030	,135
	Sig. (2-tailed)	,385	,992		,001	,002	,644	,109	,119	,996	,320	,860	,432
	N	36	36	36	36	36	36	36	36	36	36	36	36
rente_etter_skatt_diff_lag1	Pearson Correlation	-,325	,018	,525**	1	-,022	,066	,202	-,437**	,017	,093	-,180	-,039
	Sig. (2-tailed)	,053	,918	,001		,900	,703	,237	,008	,921	,591	,294	,819
	N	36	36	36	36	36	36	36	36	36	36	36	36
expecoslo	Pearson Correlation	,222	-,098	,491**	-,022	1	,331*	-,433**	,121	-,099	,007	,072	,038
	Sig. (2-tailed)	,193	,568	,002	,900		,049	,008	,482	,567	,968	,675	,824
	N	36	36	36	36	36	36	36	36	36	36	36	36
ln_bpi_oslo_t-1	Pearson Correlation	-,216	-,336*	,080	,066	,331*	1	-,116	,212	-,334*	-,150	-,017	,060
	Sig. (2-tailed)	,206	,045	,644	,703	,049		,499	,216	,046	,381	,922	,726
	N	36	36	36	36	36	36	36	36	36	36	36	36
rente_etter_skatt1_lag1	Pearson Correlation	-,627**	-,194	-,272	,202	-,433**	-,116	1	-,739**	-,194	,038	-,035	-,039
	Sig. (2-tailed)	,000	,256	,109	,237	,008	,499		,000	,257	,825	,842	,819
	N	36	36	36	36	36	36	36	36	36	36	36	36
ln_led_oslo	Pearson Correlation	,502**	,160	-,265	-,437**	,121	,212	-,739**	1	,161	,072	-,083	,153
	Sig. (2-tailed)	,002	,350	,119	,008	,482	,216	,000		,348	,674	,631	,374
	N	36	36	36	36	36	36	36	36	36	36	36	36
inntekt_boligmasse_lag	Pearson Correlation	,236	1,000**	,001	,017	-,099	-,334*	-,194	,161	1	,293	-,098	-,098
	Sig. (2-tailed)	,166	,000	,996	,921	,567	,046	,257	,348		,083	,571	,571
	N	36	36	36	36	36	36	36	36	36	36	36	36
s1	Pearson Correlation	,413*	,294	-,170	,093	,007	-,150	,038	,072	,293	1	-,333*	-,333*
	Sig. (2-tailed)	,012	,082	,320	,591	,968	,381	,825	,674	,083		,047	,047
	N	36	36	36	36	36	36	36	36	36	36	36	36
s2	Pearson Correlation	,105	-,098	-,030	-,180	,072	-,017	-,035	-,083	-,098	-,333*	1	-,333*
	Sig. (2-tailed)	,542	,570	,860	,294	,675	,922	,842	,631	,571	,047		,047
	N	36	36	36	36	36	36	36	36	36	36	36	36
s3	Pearson Correlation	-,064	-,098	,135	-,039	,038	,060	-,039	,153	-,098	-,333*	-,333*	1
	Sig. (2-tailed)	,713	,570	,432	,819	,824	,726	,819	,374	,571	,047	,047	
	N	36	36	36	36	36	36	36	36	36	36	36	36

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Correlations

		ln_bpi_bergen_diff	ln_inntekt_diff	rente_etter_skatt1_diff	rente_etter_skatt_diff_lag1	expecbergen	ln_bpi_bergen_t-1	rente_etter_skatt1_lag1	ln_led_bergen	inntekt_boligmasse_lag	s1	s2	s3
ln_bpi_bergen_diff	Pearson Correlation	1	,222	-,119	-,310	,394*	-,170	-,699**	,759**	,221	,428**	,125	-,094
	Sig. (2-tailed)		,193	,489	,066	,017	,321	,000	,000	,195	,009	,467	,587
	N	36	36	36	36	36	36	36	36	36	36	36	36
ln_inntekt_diff	Pearson Correlation	,222	1	,002	,018	-,057	-,326	-,194	,374*	1,000**	,294	-,098	-,098
	Sig. (2-tailed)	,193		,992	,918	,743	,052	,256	,025	,000	,082	,570	,570
	N	36	36	36	36	36	36	36	36	36	36	36	36
rente_etter_skatt1_diff	Pearson Correlation	-,119	,002	1	,525**	,427**	,126	-,272	-,199	,001	-,170	-,030	,135
	Sig. (2-tailed)	,489	,992		,001	,009	,465	,109	,245	,996	,320	,860	,432
	N	36	36	36	36	36	36	36	36	36	36	36	36
rente_etter_skatt_diff_lag1	Pearson Correlation	-,310	,018	,525**	1	-,057	,117	,202	-,382*	,017	,093	-,180	-,039
	Sig. (2-tailed)	,066	,918	,001		,742	,495	,237	,021	,921	,591	,294	,819
	N	36	36	36	36	36	36	36	36	36	36	36	36
expecbergen	Pearson Correlation	,394*	-,057	,427**	-,057	1	,282	-,452**	,095	-,057	,025	,124	,064
	Sig. (2-tailed)	,017	,743	,009	,742		,095	,006	,581	,742	,885	,473	,712
	N	36	36	36	36	36	36	36	36	36	36	36	36
ln_bpi_bergen_t-1	Pearson Correlation	-,170	-,326	,126	,117	,282	1	-,114	-,268	-,324	-,160	-,016	,068
	Sig. (2-tailed)	,321	,052	,465	,495	,095		,507	,114	,053	,351	,926	,694
	N	36	36	36	36	36	36	36	36	36	36	36	36
rente_etter_skatt1_lag1	Pearson Correlation	-,699**	-,194	-,272	,202	-,452**	-,114	1	-,719**	-,194	,038	-,035	-,039
	Sig. (2-tailed)	,000	,256	,109	,237	,006	,507		,000	,257	,825	,842	,819
	N	36	36	36	36	36	36	36	36	36	36	36	36
ln_led_bergen	Pearson Correlation	,759**	,374*	-,199	-,382*	,095	-,268	-,719**	1	,374*	,185	-,041	,149
	Sig. (2-tailed)	,000	,025	,245	,021	,581	,114	,000		,025	,281	,813	,386
	N	36	36	36	36	36	36	36	36	36	36	36	36
inntekt_boligmasse_lag	Pearson Correlation	,221	1,000**	,001	,017	-,057	-,324	-,194	,374*	1	,293	-,098	-,098
	Sig. (2-tailed)	,195	,000	,996	,921	,742	,053	,257	,025		,083	,571	,571
	N	36	36	36	36	36	36	36	36	36	36	36	36
s1	Pearson Correlation	,428**	,294	-,170	,093	,025	-,160	,038	,185	,293	1	-,333*	-,333*
	Sig. (2-tailed)	,009	,082	,320	,591	,885	,351	,825	,281	,083		,047	,047
	N	36	36	36	36	36	36	36	36	36	36	36	36
s2	Pearson Correlation	,125	-,098	-,030	-,180	,124	-,016	-,035	-,041	-,098	-,333*	1	-,333*
	Sig. (2-tailed)	,467	,570	,860	,294	,473	,926	,842	,813	,571	,047		,047
	N	36	36	36	36	36	36	36	36	36	36	36	36
s3	Pearson Correlation	-,094	-,098	,135	-,039	,064	,068	-,039	,149	-,098	-,333*	-,333*	1
	Sig. (2-tailed)	,587	,570	,432	,819	,712	,694	,819	,386	,571	,047	,047	
	N	36	36	36	36	36	36	36	36	36	36	36	36

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Correlations

		ln_bpi_stavanger_diff	ln_inntekt_diff	rente_etter_skatt1_diff	rente_etter_skatt_diff_lag1	expecstavanger	ln_bpi_stavanger_t-1	rente_etter_skatt1_lag1	ln_led_stavanger	inntekt_boligmasse_lag	s1	s2	s3
ln_bpi_stavanger_diff	Pearson Correlation	1	,210	,046	-,135	,255	-,514**	-,512**	,402*	,209	,433**	,188	-,169
	Sig. (2-tailed)		,218	,790	,432	,133	,001	,001	,015	,222	,008	,272	,323
	N	36	36	36	36	36	36	36	36	36	36	36	36
ln_inntekt_diff	Pearson Correlation	,210	1	,002	,018	-,185	-,387*	-,194	,291	1,000**	,294	-,098	-,098
	Sig. (2-tailed)	,218		,992	,918	,280	,020	,256	,085	,000	,082	,570	,570
	N	36	36	36	36	36	36	36	36	36	36	36	36
rente_etter_skatt1_diff	Pearson Correlation	,046	,002	1	,525**	,480**	-,051	-,272	-,167	,001	-,170	-,030	,135
	Sig. (2-tailed)	,790	,992		,001	,003	,768	,109	,329	,996	,320	,860	,432
	N	36	36	36	36	36	36	36	36	36	36	36	36
rente_etter_skatt_diff_lag1	Pearson Correlation	-,135	,018	,525**	1	-,028	-,039	,202	-,335*	,017	,093	-,180	-,039
	Sig. (2-tailed)	,432	,918	,001		,872	,822	,237	,046	,921	,591	,294	,819
	N	36	36	36	36	36	36	36	36	36	36	36	36
expecstavanger	Pearson Correlation	,255	-,185	,480**	-,028	1	,266	-,415*	,067	-,185	-,044	,104	,093
	Sig. (2-tailed)	,133	,280	,003	,872		,117	,012	,697	,279	,800	,547	,591
	N	36	36	36	36	36	36	36	36	36	36	36	36
ln_bpi_stavanger_t-1	Pearson Correlation	-,514**	-,387*	-,051	-,039	,266	1	-,038	-,029	-,385*	-,133	-,019	,060
	Sig. (2-tailed)	,001	,020	,768	,822	,117		,827	,868	,020	,441	,910	,726
	N	36	36	36	36	36	36	36	36	36	36	36	36
rente_etter_skatt1_lag1	Pearson Correlation	-,512**	-,194	-,272	,202	-,415*	-,038	1	-,793**	-,194	,038	-,035	-,039
	Sig. (2-tailed)	,001	,256	,109	,237	,012	,827		,000	,257	,825	,842	,819
	N	36	36	36	36	36	36	36	36	36	36	36	36
ln_led_stavanger	Pearson Correlation	,402*	,291	-,167	-,335*	,067	-,029	-,793**	1	,292	,119	-,077	,031
	Sig. (2-tailed)	,015	,085	,329	,046	,697	,868	,000		,084	,488	,655	,857
	N	36	36	36	36	36	36	36	36	36	36	36	36
inntekt_boligmasse_lag	Pearson Correlation	,209	1,000**	,001	,017	-,185	-,385*	-,194	,292	1	,293	-,098	-,098
	Sig. (2-tailed)	,222	,000	,996	,921	,279	,020	,257	,084		,083	,571	,571
	N	36	36	36	36	36	36	36	36	36	36	36	36
s1	Pearson Correlation	,433**	,294	-,170	,093	-,044	-,133	,038	,119	,293	1	-,333*	-,333*
	Sig. (2-tailed)	,008	,082	,320	,591	,800	,441	,825	,488	,083		,047	,047
	N	36	36	36	36	36	36	36	36	36	36	36	36
s2	Pearson Correlation	,188	-,098	-,030	-,180	,104	-,019	-,035	-,077	-,098	-,333*	1	-,333*
	Sig. (2-tailed)	,272	,570	,860	,294	,547	,910	,842	,655	,571	,047		,047
	N	36	36	36	36	36	36	36	36	36	36	36	36
s3	Pearson Correlation	-,169	-,098	,135	-,039	,093	,060	-,039	,031	-,098	-,333*	-,333*	1
	Sig. (2-tailed)	,323	,570	,432	,819	,591	,726	,819	,857	,571	,047	,047	
	N	36	36	36	36	36	36	36	36	36	36	36	36

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Correlations

		ln_bpi_trondheim_diff	ln_inntekt_diff	rente_etter_skatt1_diff	rente_etter_skatt_diff_lag1	expectrondheim	ln_bpi_trondheim_t-1	rente_etter_skatt1_lag1	ln_led_trond	inntekt_boligmasse_lag	s1	s2	s3
ln_bpi_trondheim_diff	Pearson Correlation	1	,213	-,230	-,417*	,303	-,098	-,611**	,649**	,213	,450**	,152	-,084
	Sig. (2-tailed)		,212	,177	,011	,073	,568	,000	,000	,213	,006	,377	,625
	N	36	36	36	36	36	36	36	36	36	36	36	36
ln_inntekt_diff	Pearson Correlation	,213	1	,002	,018	-,002	-,277	-,194	,385*	1,000**	,294	-,098	-,098
	Sig. (2-tailed)	,212		,992	,918	,990	,102	,256	,020	,000	,082	,570	,570
	N	36	36	36	36	36	36	36	36	36	36	36	36
rente_etter_skatt1_diff	Pearson Correlation	-,230	,002	1	,525**	,428**	,072	-,272	-,295	,001	-,170	-,030	,135
	Sig. (2-tailed)	,177	,992		,001	,009	,675	,109	,081	,996	,320	,860	,432
	N	36	36	36	36	36	36	36	36	36	36	36	36
rente_etter_skatt_diff_lag1	Pearson Correlation	-,417*	,018	,525**	1	-,037	,051	,202	-,414*	,017	,093	-,180	-,039
	Sig. (2-tailed)	,011	,918	,001		,831	,767	,237	,012	,921	,591	,294	,819
	N	36	36	36	36	36	36	36	36	36	36	36	36
expectrondheim	Pearson Correlation	,303	-,002	,428**	-,037	1	,248	-,440**	,012	-,002	,011	,128	,048
	Sig. (2-tailed)	,073	,990	,009	,831		,146	,007	,946	,989	,951	,457	,779
	N	36	36	36	36	36	36	36	36	36	36	36	36
ln_bpi_trondheim_t-1	Pearson Correlation	-,098	-,277	,072	,051	,248	1	-,193	-,481**	-,275	-,141	-,017	,059
	Sig. (2-tailed)	,568	,102	,675	,767	,146		,260	,003	,104	,412	,920	,731
	N	36	36	36	36	36	36	36	36	36	36	36	36
rente_etter_skatt1_lag1	Pearson Correlation	-,611**	-,194	-,272	,202	-,440**	-,193	1	-,489**	-,194	,038	-,035	-,039
	Sig. (2-tailed)	,000	,256	,109	,237	,007	,260		,002	,257	,825	,842	,819
	N	36	36	36	36	36	36	36	36	36	36	36	36
ln_led_trond	Pearson Correlation	,649**	,385*	-,295	-,414*	,012	-,481**	-,489**	1	,385*	,223	-,020	,162
	Sig. (2-tailed)	,000	,020	,081	,012	,946	,003	,002		,020	,191	,910	,346
	N	36	36	36	36	36	36	36	36	36	36	36	36
inntekt_boligmasse_lag	Pearson Correlation	,213	1,000**	,001	,017	-,002	-,275	-,194	,385*	1	,293	-,098	-,098
	Sig. (2-tailed)	,213	,000	,996	,921	,989	,104	,257	,020		,083	,571	,571
	N	36	36	36	36	36	36	36	36	36	36	36	36
s1	Pearson Correlation	,450**	,294	-,170	,093	,011	-,141	,038	,223	,293	1	-,333*	-,333*
	Sig. (2-tailed)	,006	,082	,320	,591	,951	,412	,825	,191	,083		,047	,047
	N	36	36	36	36	36	36	36	36	36	36	36	36
s2	Pearson Correlation	,152	-,098	-,030	-,180	,128	-,017	-,035	-,020	-,098	-,333*	1	-,333*
	Sig. (2-tailed)	,377	,570	,860	,294	,457	,920	,842	,910	,571	,047		,047
	N	36	36	36	36	36	36	36	36	36	36	36	36
s3	Pearson Correlation	-,084	-,098	,135	-,039	,048	,059	-,039	,162	-,098	-,333*	-,333*	1
	Sig. (2-tailed)	,625	,570	,432	,819	,779	,731	,819	,346	,571	,047	,047	
	N	36	36	36	36	36	36	36	36	36	36	36	36

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Correlations

		ln_bpi_tromso_diff	ln_inntekt_diff	rente_etter_skatt1_diff	rente_etter_skatt_diff_lag1	expectromsø	ln_bpi_tromso_t-1	rente_etter_skatt1_lag1	ln_led_troms	inntekt_boligmasse_lag	s1	s2	s3
ln_bpi_tromso_diff	Pearson Correlation	1	,227	-,188	-,350*	,311	,114	-,584**	,417*	,227	,462**	,139	-,110
	Sig. (2-tailed)		,182	,273	,037	,065	,508	,000	,011	,183	,005	,419	,523
	N	36	36	36	36	36	36	36	36	36	36	36	36
ln_inntekt_diff	Pearson Correlation	,227	1	,002	,018	-,085	-,278	-,194	,202	1,000**	,294	-,098	-,098
	Sig. (2-tailed)	,182		,992	,918	,623	,101	,256	,237	,000	,082	,570	,570
	N	36	36	36	36	36	36	36	36	36	36	36	36
rente_etter_skatt1_diff	Pearson Correlation	-,188	,002	1	,525**	,493**	,142	-,272	-,503**	,001	-,170	-,030	,135
	Sig. (2-tailed)	,273	,992		,001	,002	,409	,109	,002	,996	,320	,860	,432
	N	36	36	36	36	36	36	36	36	36	36	36	36
rente_etter_skatt_diff_lag1	Pearson Correlation	-,350*	,018	,525**	1	,074	,124	,202	-,571**	,017	,093	-,180	-,039
	Sig. (2-tailed)	,037	,918	,001		,668	,471	,237	,000	,921	,591	,294	,819
	N	36	36	36	36	36	36	36	36	36	36	36	36
expectromsø	Pearson Correlation	,311	-,085	,493**	,074	1	,262	-,317	-,187	-,085	-,011	,173	,031
	Sig. (2-tailed)	,065	,623	,002	,668		,123	,059	,274	,622	,951	,314	,856
	N	36	36	36	36	36	36	36	36	36	36	36	36
ln_bpi_tromso_t-1	Pearson Correlation	,114	-,278	,142	,124	,262	1	-,078	-,324	-,276	-,199	-,017	,086
	Sig. (2-tailed)	,508	,101	,409	,471	,123		,653	,054	,103	,245	,921	,616
	N	36	36	36	36	36	36	36	36	36	36	36	36
rente_etter_skatt1_lag1	Pearson Correlation	-,584**	-,194	-,272	,202	-,317	-,078	1	-,431**	-,194	,038	-,035	-,039
	Sig. (2-tailed)	,000	,256	,109	,237	,059	,653		,009	,257	,825	,842	,819
	N	36	36	36	36	36	36	36	36	36	36	36	36
ln_led_troms	Pearson Correlation	,417*	,202	-,503**	-,571**	-,187	-,324	-,431**	1	,203	,181	-,003	,186
	Sig. (2-tailed)	,011	,237	,002	,000	,274	,054	,009		,235	,291	,985	,278
	N	36	36	36	36	36	36	36	36	36	36	36	36
inntekt_boligmasse_lag	Pearson Correlation	,227	1,000**	,001	,017	-,085	-,276	-,194	,203	1	,293	-,098	-,098
	Sig. (2-tailed)	,183	,000	,996	,921	,622	,103	,257	,235		,083	,571	,571
	N	36	36	36	36	36	36	36	36	36	36	36	36
s1	Pearson Correlation	,462**	,294	-,170	,093	-,011	-,199	,038	,181	,293	1	-,333*	-,333*
	Sig. (2-tailed)	,005	,082	,320	,591	,951	,245	,825	,291	,083		,047	,047
	N	36	36	36	36	36	36	36	36	36	36	36	36
s2	Pearson Correlation	,139	-,098	-,030	-,180	,173	-,017	-,035	-,003	-,098	-,333*	1	-,333*
	Sig. (2-tailed)	,419	,570	,860	,294	,314	,921	,842	,985	,571	,047		,047
	N	36	36	36	36	36	36	36	36	36	36	36	36
s3	Pearson Correlation	-,110	-,098	,135	-,039	,031	,086	-,039	,186	-,098	-,333*	-,333*	1
	Sig. (2-tailed)	,523	,570	,432	,819	,856	,616	,819	,278	,571	,047	,047	
	N	36	36	36	36	36	36	36	36	36	36	36	36

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

APPENDIX 6.6 AUGMENTED DICKEY FULLER TEST

Table 6: Augmented Dickey Fuller Test for stationarity

ADF-test for all variables

Program: SPSS

Null Hypothesis: EXPECBERGEN has a unit root

Exogenous: Constant, Linear Trend

Lag Length: 9 (Automatic - based on AIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.078784	0.0183
Test critical values:	1% level	-4.356068	
	5% level	-3.595026	
	10% level	-3.233456	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: DFEXPECNORGE has a unit root

Exogenous: Constant, Linear Trend

Lag Length: 9 (Automatic - based on AIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.386368	0.0093
Test critical values:	1% level	-4.356068	
	5% level	-3.595026	
	10% level	-3.233456	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: EXPECOSLO has a unit root

Exogenous: Constant, Linear Trend

Lag Length: 7 (Automatic - based on AIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.495965	0.0593
Test critical values:	1% level	-4.323979	

	5% level	-3.580623	
	10% level	-3.225334	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: EXPECSTAVANGER has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 9 (Automatic - based on AIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.175466	0.0149
Test critical values:	1% level	-4.356068	
	5% level	-3.595026	
	10% level	-3.233456	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: EXPECTROMSO has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 7 (Automatic - based on AIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.417761	0.0692
Test critical values:	1% level	-4.323979	
	5% level	-3.580623	
	10% level	-3.225334	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: EXPECTRONDHEIM has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 7 (Automatic - based on AIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.518318	0.0567
Test critical values:	1% level	-4.323979	
	5% level	-3.580623	
	10% level	-3.225334	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: INNTEKT_BOLIGMASSE_LAG1 has a unit root

Exogenous: Constant, Linear Trend

Lag Length: 0 (Automatic - based on AIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.622089	0.7629
Test critical values:	1% level	-4.252879	
	5% level	-3.548490	
	10% level	-3.207094	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LN_BPI_BERGEN_DIFF has a unit root

Exogenous: Constant, Linear Trend

Lag Length: 4 (Automatic - based on AIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.018037	0.0185
Test critical values:	1% level	-4.284580	
	5% level	-3.562882	
	10% level	-3.215267	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LN_BPI_BERGEN_T_1 has a unit root

Exogenous: Constant, Linear Trend

Lag Length: 6 (Automatic - based on AIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.146293	0.1150
Test critical values:	1% level	-4.309824	
	5% level	-3.574244	
	10% level	-3.221728	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LN_BPI_NORGE_DIFF has a unit root

Exogenous: Constant, Linear Trend

Lag Length: 4 (Automatic - based on AIC, maxlag=9)

		t-Statistic	Prob.*

Augmented Dickey-Fuller test statistic		-3.848336	0.0271
Test critical values:	1% level	-4.284580	
	5% level	-3.562882	
	10% level	-3.215267	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LN_BPI_NORGE_T_1 has a unit root

Exogenous: Constant, Linear Trend

Lag Length: 5 (Automatic - based on AIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.389814	0.3770
Test critical values:	1% level	-4.296729	
	5% level	-3.568379	
	10% level	-3.218382	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LN_BPI_OSLO_DIFF has a unit root

Exogenous: Constant, Linear Trend

Lag Length: 4 (Automatic - based on AIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.952178	0.0215
Test critical values:	1% level	-4.284580	
	5% level	-3.562882	
	10% level	-3.215267	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LN_BPI_OSLO_T_1 has a unit root

Exogenous: Constant, Linear Trend

Lag Length: 5 (Automatic - based on AIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.521540	0.3162
Test critical values:	1% level	-4.296729	
	5% level	-3.568379	
	10% level	-3.218382	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LN_BPI_STAVANGER_DIFF has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 4 (Automatic - based on AIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.918758	0.0232
Test critical values:	1% level	-4.284580	
	5% level	-3.562882	
	10% level	-3.215267	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LN_BPI_STAVANGER_T_1 has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 5 (Automatic - based on AIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.531780	0.7955
Test critical values:	1% level	-4.296729	
	5% level	-3.568379	
	10% level	-3.218382	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LN_BPI_TROMSO_DIFF has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 9 (Automatic - based on AIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.642780	0.0005
Test critical values:	1% level	-4.356068	
	5% level	-3.595026	
	10% level	-3.233456	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LN_BPI_TROMSO_T_1 has a unit root
Exogenous: Constant, Linear Trend

Lag Length: 5 (Automatic - based on AIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.421020	0.9819
Test critical values:	1% level	-4.296729	
	5% level	-3.568379	
	10% level	-3.218382	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LN_BPI_TRONDHEIM_DIFF has a unit root

Exogenous: Constant, Linear Trend

Lag Length: 4 (Automatic - based on AIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.782131	0.0313
Test critical values:	1% level	-4.284580	
	5% level	-3.562882	
	10% level	-3.215267	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LN_BPI_TRONDHEIM_T_1 has a unit root

Exogenous: Constant, Linear Trend

Lag Length: 6 (Automatic - based on AIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.022235	0.1436
Test critical values:	1% level	-4.309824	
	5% level	-3.574244	
	10% level	-3.221728	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LN_INNTEKT_DIFF has a unit root

Exogenous: Constant, Linear Trend

Lag Length: 3 (Automatic - based on AIC, maxlag=9)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-7.674670	0.0000

Test critical values:	1% level	-4.273277	
	5% level	-3.557759	
	10% level	-3.212361	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LN_LED_BERGEN1 has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 8 (Automatic - based on AIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.719255	0.0382
Test critical values:	1% level	-4.339330	
	5% level	-3.587527	
	10% level	-3.229230	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LN_LED_NORGE1 has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 8 (Automatic - based on AIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.627266	0.2721
Test critical values:	1% level	-4.339330	
	5% level	-3.587527	
	10% level	-3.229230	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LN_LED_OSLO1 has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 6 (Automatic - based on AIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.414432	0.0078
Test critical values:	1% level	-4.309824	
	5% level	-3.574244	
	10% level	-3.221728	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LN_LED_STAVANGER1 has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 6 (Automatic - based on AIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.339649	0.0093
Test critical values:	1% level	-4.309824	
	5% level	-3.574244	
	10% level	-3.221728	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LN_LED_TROND1 has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 8 (Automatic - based on AIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.697909	0.0044
Test critical values:	1% level	-4.339330	
	5% level	-3.587527	
	10% level	-3.229230	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LN_LED_TROMS1 has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 9 (Automatic - based on AIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.293743	0.4224
Test critical values:	1% level	-4.356068	
	5% level	-3.595026	
	10% level	-3.233456	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LN_OIL_NOK_ has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 3 (Automatic - based on AIC, maxlag=9)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-2.465701	0.3416

Test critical values:	1% level	-4.273277
	5% level	-3.557759
	10% level	-3.212361

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: RENTE_ETTER_SKATT1_DIFF has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on AIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.460647	0.0601
Test critical values:	1% level	-4.252879	
	5% level	-3.548490	
	10% level	-3.207094	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: RENTE_ETTER_SKATT_DIFF_L has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on AIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.475730	0.0583
Test critical values:	1% level	-4.252879	
	5% level	-3.548490	
	10% level	-3.207094	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: RENTE_ETTER_SKATT1_LAG1 has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on AIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.158698	0.1097
Test critical values:	1% level	-4.252879	
	5% level	-3.548490	
	10% level	-3.207094	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LN_ENDRING_OLJEPRIS has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on AIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-13.32297	0.0000
Test critical values:	1% level	-3.997083	
	5% level	-3.428819	
	10% level	-3.137851	

*MacKinnon (1996) one-sided p-values.

APPENDIX 7.1 DATA

Completed housing units

Table: 06512 Building statistics. Dwellings and dwelling units

Source: Statistics Norway

https://www.ssb.no/statistikkbanken/selecttable/hovedtabellHjem.asp?KortNavnWeb=byggeareal&CMSSubjectArea=bygg-bolig-og-eiendom&PLanguage=1&checked=true

Crude Oil Prices Brent Europe USD Monthly 1987-2015

Source: Economic Research

http://research.stlouisfed.org/fred2/series/MCOILBRENTEU

Expectations. Accessed 04.03.2015

Source: TNS Gallup (the consumer confidence indicator)

https://www.fno.no/Hoved/Aktuelt/Sporreundersokelser/Forventningsbarometeret/forventningsbarometeret-2015/nordmenn-forbereder-seg-pa-toffere-tider/

House Price Index Real Estate Norway Monthly 2003-2015

Source: Real Estate Norway

http://eiendomnorge.no/boligprisstatistikken/

Housing stock

Source: Statistics Norway

Table: 03723 Byggeareal. Boliger og bruksareal til bolig. Foreløpige tall (F)

https://www.ssb.no/statistikkbanken/selectvarval/define.asp?SubjectCode=01&ProductId=01&MainTable=Byggeareal&contents=BoligIgang&PLanguage=0&Qid=0&nvl=True&mt=1&pm=&SessID=4441765&FokusertBoks=1&gruppe1=Hele&gruppe2=Hele&VS1=Landet&VS2=&CMSSubjectArea=bygg-bolig-og-eiendom&KortNavnWeb=byggeareal&StatVariant=&Tabstrip=SELECT&aggresetnr=1&checked=true

Income

Source: Statistics Norway

Table: 09175 Lønn, sysselsetting og produktivitet etter næring. Ujustert og sesongjustert.

https://www.ssb.no/statistikkbanken/SelectVarVal/Define.asp?MainTable=KNRLonnSyssel&KortNavnWeb=knr&PLanguage=0&checked=true

Interest rates. Accessed 04.03.2015

Source: Statistics Norway

Table: 07200 Renter på utestående utlån, etter långiver, utlånstype og sektor.

https://www.ssb.no/statistikkbanken/SelectVarVal/define.asp?SubjectCode=01&ProductId=01&MainTable=Renteorbof1&contents=Utlaan&PLanguage=0&Qid=0&nvl=True&mt=1&pm=&SessID=4446025&FokusertBoks=2&gruppe1=Hele&gruppe2=Hele&gruppe3=Hele&gruppe4=Hele&VS1=Laangiver02&VS2=Utlanstyper6&VS3=SektorFinans8&VS4=&CMSSubjectArea=&KortNavnWeb=orbofrent&StatVariant=&Tabstrip=SELECT&aggresetnr=2&checked=true

Tax. Accessed 04.03.2015

Source: Skatteetaten

http://www.skatteetaten.no/no/Tabeller-og-satser/Alminnelig-inntekt/?ssy=2014#formulaDiv

Unemployment SSB Monthly 1990-2014

Source: Statistics Norway

Table 10539: Registrerte arbeidsledige 15-74 år, etter alder (K) (1990M01 - 2014M12)

https://www.ssb.no/statistikkbanken/selectvarval/Define.asp?subjectcode=&ProductId=&MainTable=ArbLedAld&nvl=&PLanguage=0&nyTmpVar=true&CMSSubjectArea=arbeid-og-lonn&KortNavnWeb=regledig&StatVariant=&checked=true