Handelshøyskolen BI

GRA 19703 Master Thesis

Thesis Master of Science 100% - W

Predefinert informasjon

Startdato:	16-01-2022 09:00	**Termin:**	202210
Sluttdato:	01-07-2022 12:00	**Vurderingsform:**	Norsk 6-trinns skala (A-F)
Eksamensform:	T		
Flowkode:	202210||10936||IN00||W||T		
Intern sensor:	(Anonymisert)		

Deltaker

Snorre Hveding Hamang, Simen Embret Weberg

Informasjon fra deltaker

Tittel *:	Do loan-to-value requirements matter for local house prices in Norway?
Navn på veileder *:	Plamen Nenov

Inneholder besvarelsen konfidensielt materiale?:	Nei	**Kan besvarelsen offentliggjøres?:**	Ja

Gruppe

Gruppenavn:	(Anonymisert)
Gruppenummer:	293
Andre medlemmer i gruppen:	

BI Norwegian Business School – Master Thesis 2022

Do loan-to-value requirements matter for local house prices in Norway?

Campus:

Norwegian Business School BI, Oslo

Study Programme:

Master of Science in Business, major in Economics

Supervisor:

Plamen Nenov

Acknowledgements

This master thesis completes the degree MSc in Business-Economics at BI Norwegian Business School (Handelshøyskolen BI).

We are grateful and would like to thank Plamen Nenov for excellent guidance with our master thesis.

Abstract

In this thesis we look at the effect of loan-to-value (LTV) requirements on the Norwegian housing market during 2010-2013. We test how and to what extend this macroprudential policy would affect local areas with typically many first-time buyers, relative to areas with fewer first-time buyers. The data consists of house price information on Oslo and Bærum, Bergen, Stavanger and Trondheim, with their surrounding municipalities.

The research is conducted using a flexible difference-in-differences model. We conclude that house prices relatively increased in areas with a high share of first-time buyers, compared to areas with a low share of first-time buyers, following the 2010 LTV regulation. The thesis will present two possible explanations for this relative price increase, which will be presented in the discussion.

Using theory that links credit, leverage regulation and house prices. We conclude that the reallocation of demand of first-time buyers, is the reason for the observed relative price increase in local housing markets with a high share of first-time buyers versus a low share of first-time buyers.

Contents

Figures and Tables

1.0 Introduction

1.1 Research question and motivation

- *Do loan-to-value requirements matter for local house prices in Norway during the time period 2010 - 2013?*

Stricter regulation on financial institutions and lenders may harm and make it harder for first-time buyers to enter the housing market (Cerutti, Claessens, & Laeven, 2017). Even though the changes in regulations may increase financial stability and prevent drastically increasing housing prices, it may also make it harder for first-time buyers to enter the housing market. Policy changes such as those who were implemented in 2010, 2011, 2014, 2015 and 2017, will either decrease financial institution's ability to give out mortgage loans, or reduce prospective home buyers' ability to borrow (Norges Bank, 2022). This might make it more difficult especially for first-time buyers to enter the housing market (Johnson, 2020). Johnson (2020) measured the effect of mortgage debt-to-income restrictions on house prices and found that locations with tighter debt-to-income requirements were more affected. First-time buyers usually do not have the economical capacity to comply with these types of stricter requirements on their own. Now first-time buyers are more dependent on parental resources to meet these requirements (Halvorsen & Lindquist, 2017). According to Carl Geving, the director of Norway's real estate association "Norges Eindomsmeglerforbundet", 51% of first-time buyers in Oslo, in the age range of 20 to 29 years old had to rely on economic support from their parents. However, this support is not available for everyone. Carl Geving further states that nationally only 41 % of first-time buyers in Norway relied on economic support from their parents. Carl Geving is referring to the analysis done by "Samfunnsøkonomisk Analyse AS" that use data from SSB (Wig, 2021).

This possible exclusion of first-time buyers may affect housing prices, due to a decrease in demand. We would like to test how and to what degree the 2010 introduction of loan-to-value requirement would affect local areas with typically many first-time buyers, relative to areas with fewer first-time buyers. Further, we want to compare local housing markets with different shares of first-time buyers, before and after the regulations were implemented. We will look at a quasi-

experimental method, using a flexible difference-in-differences model. With this model we may isolate the effect from the policy regulation on first-time buyers, that potentially will have an impact on house prices. (Angrist & Pischke, 2014)

1.2 Norwegian housing prices and market

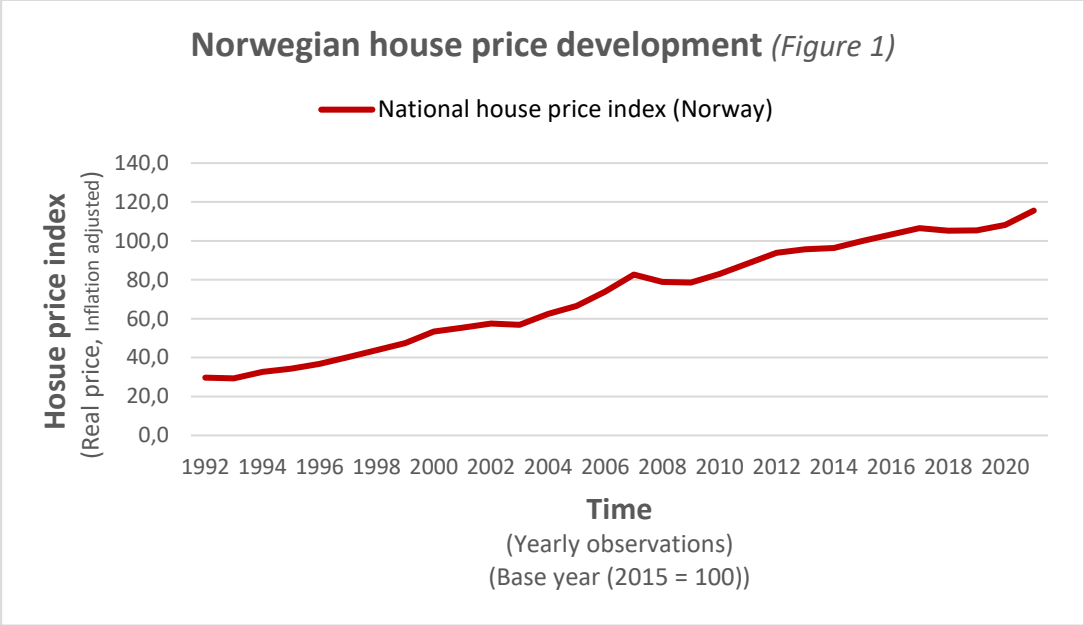

Figure 1: Norwegian house price development.

Sources: https://www.ssb.no/statbank/table/07230/ , https://www.ssb.no/statbank/table/08184

In *Figure 1* we plot the national Norwegian house price index adjusted for inflation, in the period 1992 to 2021 (Statistics Norway, 2022a; Statistics Norway, 2022b). The price development account for the real house prices, we can then compare how the house price index has developed relative to the consumer price index over time. We can overall see a relatively steady increase over this time period. Most of the volatility we observe in the graph comes from the financial crash in 2008. During the period 2007 to 2009 the Norwegian real house prices had the largest decline in our timeline. However, we also have some setback from the Dot-com bubble in 2000 to 2002, the oil price crash in 2014 to 2016 and possibly the policy regulation implemented in the period 2010-2017.

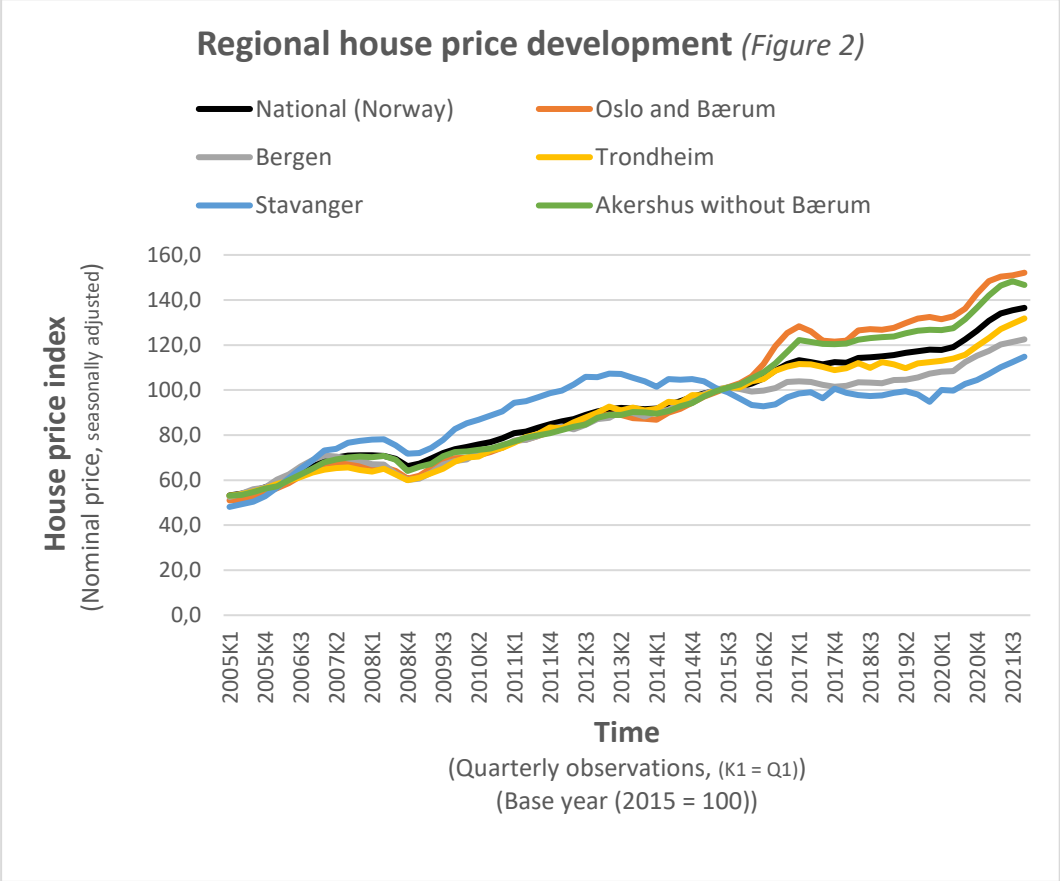

Figure 2: Regional house price development.

Sources: https://www.ssb.no/statbank/table/07221/

From *Figure 2* we can observe the regional house price index development in nominal and seasonally adjusted prices, with quarterly observations in the period from 2005 to 2021 (Statistics Norway, 2022c). From the start of the time horizon, there is a steady growth in prices from all the cites and at a national level until the start of 2008. Then all the areas got a dip from the financial crisis in 2008 and the reduction was ongoing until the start of 2009. Then all the areas steady picked back up again and prices grew until the start of 2014. Before 2014 we can observe that Stavanger had the highest price growth, however this changed when the oil price drastically fell in 2014 to 2016. This had a severe economic impact on the workforce in the oil industry, the housing market in Stavanger and the surrounding area in the same time period.

Furthermore, we can see a joint crossing point in the start of 2015. Where the house price index for Stavanger declines significantly and Oslo and Bærum drastically rises, with Akershus without Bærum following close by. From this crossing point we can also observe a slight increase and nearly a flat price development for Bergen, Trondheim and the national average until 2020. We can also observe that house prices in Oslo and Bærum, Bergen, Trondheim and the national average nearly had a uniform price increase until this crossing point in 2015. After this crossing point, we see a substantial divergence in price development from all the regions.

In the start of 2017 Oslo and Bærum had a price peak, however the growth got quickly reduced as the new housing policy regulations were implemented in 2017. This policy included new national income requirements on mortgages, and a tightening of loan-to-value requirements when buying a second house in Oslo (Regjeringen, 2016). This with the intention to dampen the drastic price growth in the housing market in the Oslo area. From 2018 we can observe that Oslo and Bærum did have a more modest price growth.

Further, we can observe from *Figure 2* a more modest price development in all the regional housing markets from 2017 until 2020, when Covid-19 hit Norway in March of 2020. From this period until 2022 every area has had a relative and strong price increase.

2.0 Related literatures

In this section we review several different papers linking credit, leverage regulation and house prices. Overall, this literature shows that it is unclear to what degree credit regulation drives house prices and how it affects low-wealth households and therefore first-time buyers.

Do credit conditions move house prices? (Daniel L. Greenwald & Adam Guren, 2020)

There has been done a lot of work in the past, on different causes that move house prices. When it comes to whether an expansion and contraction of credit did drive the 2000s housing boom and bust, the existing literature differs and lacks consensus. Some studies show that credit has no effect, while others show that credit did drive most of the housing price cycle. A study done by Daniel L. Greenwald and Adam Guren (2020) showed that the key difference between these results were the extent to which credit-insensitive agents absorbed credit-driven demand. Examples of these insensitive agents are landlords and unconstrained savers. The results suggested that half of the boom and bust in price-to-rent ratios and house prices could be explained by the credit supply. Price-to-rent ratio was the key statistic to estimate whether it was cheaper to rent or own a house or property (Greenwald & Guren, 2020).

Mortgage leverage and house prices (Stephanie Johnson, 2020)

Further studies have also found a connection between mortgage availability and house prices. A study done by Stephanie Johnson (2020) measured the effect of mortgage debt-to-income restrictions on house prices (Johnson, 2020). Johnson (2020) found that the debt-to-income rules diverged in the US in 1999. In locations with tighter debt-to-income requirements, there were an immediate relative contraction in house prices. This shows that adjustments in lending standards can have a dominant effect on local house prices. The research suggests that the effect builds up over time and leads to a smaller house price increase in

these locations during 2002 - 2006. In our research we can substitute places with tighter lending standards to local housing markets with a high share of first-time buyers. This context can further explain the relationship between new regulations and first-time buyers' opportunities in the housing market.

The household effects of mortgage regulation (Knut Are Aastveit, Ragnar Enger Juelsrud and Ella Getz Wold, 2021)

Another study done on this field is the research completed by Knut Are Aastveit, Ragnar Enger Juelsrud and Ella Getz Wold (Aastveit, Juelsrud, & Wold, 2021). They evaluated the impact of mortgage regulation on credit volumes, household balance sheets and the reaction to adverse economic shocks in Norway. Their research found that the loan-to-value regulation, in 2010 and 2012 led to a reduction in the probability of buying a house with 3-6 precent. The reduction was solely driven by low-liquidity households. They did not only look at first-time buyers but also their parents. Because parental response consisted of more than half of total credit effect, when it comes to first-time buyers purchasing real estate. We can speculate that a large share of the first - time buyers are part of the low liquidity households, that they describe in their research. The results also showed that the effect of the regulation improved the solvency of households, as it affected the households by lowering their debt, LTV-ratio, interest rate expenses and decreased the purchasing prices. In addition, the LTV requirement increased the amount of down payment that is required. This reduced the house buyers' liquid assets at the time of purchase and could make them more sensitive to adverse income shocks. After the regulation, the results indicate that high-debt parents of first-time buyers do not sign a mortgage with their children, because they themselves were constrained by the regulation.

Loan-to-Value Ratio Restrictions and House Prices (Jed Armstrong, Hayden Skilling and Fang Yao, 2018**)**

A research paper written by Jed Armstrong, Hayden Skilling and Fang Yao, looked at the effect of macroprudential policy on housing-market dynamics

(Armstrong, Skilling, & Yao, 2018). They used data on the housing-market in New Zealand and evaluated the effect of loan-to-value ratio restrictions on housing prices. Loan-to-value ratio restrictions may be important when it comes to first-time buyers' ability to buy into the housing market. In our thesis, we will do the same only compare local housing markets with a small share of first-time buyer with local housing markets with a high share. Armstrong, Skilling and Yao (2018) used a difference-in-differences model and found that the restrictions that were implemented reduced house price growth. They also got different results when the restrictions where binding or not. When the policy was binding, the effect was very strong, while when it was not binding the effect was minimal.

Can non-interest rate policies stabilize housing markets? Evidence from a panel of 57 economies (Kenneth N. Kuttner and Ilhyock Shim, 2016)

Another relevant paper is "Can non-interest rate policies stabilize housing markets? Evidence from a panel of 57 economies", written by Kenneth N. Kuttner and Ilhyock Shim (Kuttner & Shim, 2016). This research investigated the effectiveness of nine non-interest rate policies on house prices and housing credit. They used data from 57 different economies in a period of 30 years. The results indicate that an increase in housing-related taxes and a decrease in the max debt-service-to-income ratio has a significant effect on housing credit. They found that the increase in housing-related taxes lowered housing price growth by 3-4 percentage points. Further, an introduction or a decrease of a max debt-service-to-income ratio typically decreased the real credit growth rate by 4-6 percentage points. Debt-service-to-income ratio measures the share of debt service payments compared to total disposable income.

The use and effectiveness of macroprudential policies: New evidence (Cerutti, Claessens & Laeven, 2017)

This article document different use of macroprudential policies in 119 countries between 2000 and 2013 (Cerutti, Claessens, & Laeven, 2017). They found that the effect of macroprudential policies generally decreased household credit. However, it also indicated that the policies have less effects on open economies that were

more developed. The result also indicates that the macroprudential policies can dampen financial cycles, and do not work as well in downturns of financial cycles. Examples of these kinds of macroprudential policies are caps on loan to value and debt to income ratios, as well as restrictions to the balance sheet. Restrictions on loan to value are a so-called borrower-based policy.

Risk-weighted capital requirements and portfolio rebalancing (Ragnar E. Juelsrud & Ella Getz Wold, 2018)

We have chosen to explain one study that showed how banks reacted to higher capital requirements and how these adjustments transmitted to the real economy. We can use these results to explain some of the mechanisms that increase banks interest rates, when banks react to higher requirements (Wold & Juelsrud, 2018). Former research done by The Norwegian Ministry of Finance indicates that this kind of buffer could be used to smooth the credit cycle. Specifically, the capital buffer can dampen a credit increase if it is countercyclical. This can be obtained if the banks' responses to a higher capital requirement is a reduction in the credit supply to the household sector. The authors results indicate that capital requirements do not affect lending to the household sector. However, the result depends on the current relative risk-weight between mortgages and corporate lending. Reducing this weight might lead to a redirecting of the reduction of credit supply to the household sector.

Getting a foot on the housing ladder: The role of parents in giving a leg-up (Elin Halvorsen & Kjersti-Gro Lindquist, 2017)

Parental resources have arguably become increasingly important for first-time buyers when trying to buy their first homes. An article published by "Norges Bank" describes whether parental resources is important for first-time buyers (Halvorsen & Lindquist, 2017). This research is relevant to our paper due to how parents can give economic support to a first-time buyer when entering the housing market. Normally, first-time buyers will have a harder time to meet a stricter loan-to-value ratio with a lower equity ratio, than non-first-time buyers. This extra

security or down payment may help first-time buyers to get a leg-up and be able to enter the housing ladder. Their research found that a helping hand from parents increased the probability of entering the housing market and that first-time buyers' income had a bigger importance than the actual help they got from their parents. They also found that parental resources are much more important than before, because of the growing gap between income and house prices.

Transactions sequencing and House Price Pressures (Morten Grindaker, Artashes Karapetyan, Espen R. Moen & Plamen Nenov, 2021)

They show that temporary shocks to the market tightness caused by the moving homeowners transaction sequence decisions impacted house prices (Grindaker, Karapetyan, Moen, & Nenov, 2021). The paper differentiates homeowners into two groups, the agents that sell first and then buy, called sell-first and the group that buy first and sell later, called buy-first. They found that an increase of 10% in the buy-first group will increase house prices with 5% and decrease time-to-sell by 17%. Furthermore, this led to an increase in the market tightness by 15%. The increase in the market tightness will apply to areas that has a one standard deviation larger share of local moving house owners.

One of the mechanisms that can constrain the effect on local market tightness and house prices are the mobility between different local housing markets. The results indactes that if there is a price pressure in a specific local housing market, actors will reallocate their demand to other local areas. This means that how agents are reallocating is endogenous and will react to different conditions in different local housing markets.

3.0 Institutional contexts

In the 2000s household debt and house prices grew considerably and had a two-way long-term interaction (Anundsen & Jansen, 2013). After the financial crisis in 2008, debt slowed down although continued to grow more than household income (Norges Bank, 2018). A fall in house prices may decrease household equity, because a large proportion of the Norwegian household equity usually consists of housing wealth. Furthermore, these households might want to lower their consumption if house prices fall, or bank lending rates increase. This effect may amplify a reduction in the Norwegian economy.

3.1 Macroprudential policy changes during 2010 – 2017

3.1.1 Guidelines for correct lending practices for loans to residential purposes (2010)

In 2010 a new regulation was implemented regarding the lending practices for loans and mortgages. The loan-to-value ratio was set to 90% of the market value. It ensures that lenders need to have at least 10% of their loan in own equity. In addition, the lender should be able to withstand a substantial percentage point increase in the interest rate (The Financial supervisory authority of Norway, 2010, pp. 4-5). The regulations took effect the 3rd of March the same year.

3.1.2 Guidelines for correct lending practices for loans to residential purposes (2011)

The regulation in 2011 stems from the guidelines from 2010. The loan-to-value ratio changed from 90% to 85%. This increased the amount of equity the borrower needs to have, to be able to take out their preferred loan. Additionally, the borrower needs to be able to withstand a five-percentage points increase in the interest rate (The financial supervisory authority of Norway, 2011, pp. 4-5). The regulation took effect the 1st of December later that year.

3.1.3 Regulation on capital requirements for financial institutions (2014)

The Ministry of Finance revised the regulation, to strengthen the bank's financial stability. The minimum requirement of the parameter Loss Given Default (LGD) was increased from 10% to 20% on mortgage loan exposures. The regulation took effect from 01.01.2014 and was a regulation on capital requirements for commercial banks, saving banks, finance companies, holding companies in financial groups, investment firms and management. (Regjeringen, 2013)

3.1.4 Regulation and decision on systematically important financial institutions (2015)

The following capital requirements were a follow-up of the regulation adopted in 2013. Financial institutions with total assets comparable to at least 10% of Mainland Norway's GDP, or at least 5% share of the Norwegian lending market, shall be titled as systematically important. The three institutions that met these criteria are, DNB ASA, Nordea Bank Norge ASA and Kommunalbanken AS. These three banks would therefore have a separate capital buffer requirement, that applies from 01.07.2015. (Regjeringen, 2014)

3.1.5 Regulation on requirements for residential mortgage loans (2015)

On 15.06.2015 The Ministry of Finance changed the regulations on requirements for residential mortgage loans. The regulation took effect from 01.07.2015 to 31.12.2016. With this regulation there is not possible to have a higher loan-to-value ratio than 85% on residential mortgage loans. That means one cannot borrow more than 85 % of the total value.

The main goal of the regulation is to have a sustainable development in the residential mortgage market. Additionally, lenders should be able to withstand a five-percentage points increase in the interest rate, as in the regulation from 2011. If the loan-to-value ratio is above 70 % for residential mortgage loans, the regulation required that the lenders have to demand repayments. Every quarter,

the regulation allows for 10 % of the lender's approved loans to be loans that do not have the right regulatory requirements. The regulation does also allow for moving loans from one bank to another without being counted in the 10 % quota, this ensures competition in the marketplace. (Regjeringen, 2015)

3.1.6 New regulation on requirements for residential mortgage loans (2017)

On 14.12.2016 The Ministry of Finance adopted a new regulation that took effect from 01.01.2017 to 20.06.2018. The loan-to-value ratio on residential mortgage loans that were adopted in 2015 will continue to be relevant, however the new adoption is adding a stricter requirement by limiting the borrower's collected debt to five times gross annual income. This new regulation will act as a supplement to the current regulation that requires lenders to be able to stand a 5 % interest rate increase. The new regulation will also lower the maximum loan-to-value ratio for home equity credit lines from 70 % to 60 %.

The regulation in 2015 allowed for 10 % of the lender's approved loans to be loans that do not have the right regulatory requirements. Apart from Oslo, this quota is retained. In Oslo, the share will be lowered to 8 %. The new regulation will also cap the loan-to-value ratio on secondary homes to 60 %, this limitation will only apply to Oslo (Regjeringen, 2016).

Table 1: Key points on macroprudential policy changes during 2010 – 2017.

Date	Guidelines	Changes
0.3.03.2010	New guidelines for prudent lending practices for loans and mortgages.	**Loan-to-value ratio was set to 90% of market value. Home equity loan (house as collateral) set to 75%.**
01.12.2011	Stricter guidelines for prudent lending practices for loans and mortgages.	**Loan-to-value ratio change from 90% to 85% of market value. Home equity loan decreased to 70%. Lenders should manage a five-percentage points increase in the interest rate.**
01.01.2014	Regulation to strengthen financial institutions and banks financial stability.	**Minimum requirement of the Loss Given Default (LGD) is increased from 10% to 20% on mortgage loan**

		exposures.
01.07.2015	Regulating financial institutions and large banks capital requirements and lending practices.	**Requirements on financial institutions to have at least total assets of 10% of Mainland Norway's GDP, or 5% share of the Norwegian lending market, shall be designated as systematically important.**
01.07.2015 – 31.12.2016	Regulation on residential mortgage loans and the flexibility quota.	**Loan-to-value ratio on residential mortgage loans at 85 %.** **Lenders should still manage a five-percentage points increase in the interest rate.** **A 10% Cap on flexibility for moving loans between banks.**
01.01.2017 – 20.06.2018	Stricter regulation on requirements for residential mortgage loans, nationally and more specific for Oslo.	**<u>Nationally:</u>** **Limiting the borrower's collected debt to five times gross annual income.** **Home equity loan decreased from 70% to 60%.** **10 % of the lender's approved loans do not have to meet the right regulatory requirements.** **<u>Oslo:</u>** **8 % of the lender's approved loans do not have to meet the right regulatory requirements.** **The cap on loan-to-value ratio for secondary homes are set to 60 %.**

Table 1: Key points on macroprudential policy changes during 2010 - 2017.

4.0 Data

We will utilize hedonic price indices for local housing markets in Norway from 1993 to 2017. The data that we use comes directly from Grindaker, Karapetyan, Moen and Nenov (2021). In this paper they collected the data from the official registry of all housing transactions in Norway, provided by Ambita AS. The data represent around 40% of the total population in Norway. The variables that we use in our research are described in *Table 2.*

Table 2: Variable descriptions

Variable (Captions in STATA)	**Description**	**Source**
hp_index_m	House price index	Ambita AS, Norwegian Tax Authority & Statistics Norway
Income	Average household income	Ambita AS, Norwegian Tax Authority & Statistics Norway
first_ time_ buyer	Share of first-time buyers in different local housing markets.	Ambita AS, Norwegian Tax Authority & Statistics Norway
price	Average house price in different local housing markets.	Ambita AS, Norwegian Tax Authority & Statistics Norway
usable_area	Average usable area	Ambita AS, Norwegian Tax Authority & Statistics Norway

Table 2: Variable descriptions

We have quarterly panel data that covers the four largest cities in Norway, Oslo, Bergen, Trondheim, Stavanger and their surrounding municipalities. The municipality of Bærum is split into four different locations of approximately equal size in terms of sales.

The data set consists of information about the average house prices, a house price index and location, as in different local housing markets. We will define a local

housing market by municipality or city neighbourhood. Additionally, we have the share of first-time buyers in different local housing markets. A first-time buyer is defined as an individual who buys a property in Oslo, Trondheim, Bergen, Stavanger and the surrounding municipalities for the first time and is below 40 years of age. The data set also consists of average income and average usable area.

Table 3 is a collection of the five most important used variables in our research. The house price index is different for each local housing market in each quarter and have 6278 observations. The rest of the variables have only 63 observations, because they only differ in different local housing markets and are constant over time.

Table 3: Summary statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
House price index	6278	91.087	50.393	.232	392.761
Average household income	63	464920.64	75656.333	246000	597000
Share of first-time buyers	63	.253	.054	.16	.373
Average house price	63	3384.837	830.087	1898.885	6370.467
Average usable area	63	107.371	25.844	51.056	151.888

Table 3: Summary statistics

5.0 Methodology

5.1 Difference-in-differences

The method difference-in-differences (diff-in-diff) can be considered as one of the most used methods for analysing the implication of policy changes. This method is quasi-experimental, which occurs when an exogenous event happens, such as a policy change that can affect the housing price (Angrist & Pischke, 2014, p. 178).

It is relevant for us to use difference-in-differences method because it considers the potential difference between the separate housing markets. One of them is the difference between starting points of price levels in each housing markets. The second one is other common macroeconomic changes that happens over time, that is not caused by the policy regulation (our treatment).

In this model, there are two groups, a treatment group and a control group. Further we divide these two groups into before and after the policy change was implemented. It is important to mention that the subjects in the control group are different from the treatment group. When comparing these two groups over time, we can construct what would happen to the treatment group if the treatment was not implemented.

The difference-in-differences estimator can be expressed as:

$$\delta_{SS} = \text{Diff} - \text{in} - \text{Diff} = \left(\bar{Y}_{treat,post} - \bar{Y}_{treat,pre}\right) - \left(\bar{Y}_{control,post} - \bar{Y}_{control,pre}\right) \quad (5.1.1)$$

The estimator takes the difference between the expected value of the dependent variable from the treatment group, before and after the regulation. Then it subtracts the difference between the expected value of the same variable from the control group, before and after the regulation. The effect from the policy change can be measured by this estimator (δ_{SS}).

Table 4: Summary of the difference-in-differences estimator

	Pre	Post	Pre - Post
Control group	β_0	$\beta_0 + \delta_0$	δ_0
Treatment group	$\beta_0 + \beta_1$	$\beta_0 + \delta_0 + \beta_1 + \delta_1$	$\delta_0 + \delta_1$
Control – Treatment	β_0	$\beta_1 + \delta_1$	δ_1

Table 4: Summary of the difference-in-differences estimator

By using the diff-in-diff regression model we can find a casual effect on the policy change. The regression will look at the change in the outcome before and after the regulation was implemented, therefore considering what has happened before the regulation change, in both treatment and control group.

A difference-in-differences regression model with two periods and two treatment assignment groups can be expressed as:

$$Y_{st} = \alpha + \beta T_s + \gamma P_t + \delta_{ss}(T_s * P_t) + e_{st} \quad (5.1.2)$$

t: the time period, *s*: local housing market

The first coefficient (α) from the model (5.1.2) above is the constant term. It shows the average outcome of the control group before the policy change was implemented. The second term of the equation (β) is the difference between the control and treatment group before the policy change was implemented. Gamma (γ) is the difference between the average outcome from the control group post and pre the policy change was implemented. Our delta (δ_{ss}) is the difference-in-differences estimator. The last term (e_{st}) is a stochastic error term.

5.1.3 Requirements

There are different assumptions that need to be in place, when using the difference-in-differences method. These assumptions are crucial to avoid spurious relationships.

The most important assumption is to have parallel trends before the treatment is implemented and also in the absence of treatment. Parallel trend assumption is that the treatment and control group have the same rate and direction to display parallel trends in outcomes over time, as illustrated in the *Figure 3* below. The timeline in this figure is quarterly, where "K" equals quarters (2005K1 = 2005 q1). When using this assumption, we assume that the outcome in the treatment group will move in the same direction, parallel, as the control group, if the treatment was not implemented (Gertler, Martinez, Premand, Rawlings, & Vermeersch, 2011). If there are parallel trends, we can look at the outcome in the control group to set up a counterfactual for our treatment group. If there are not parallel trends, the estimated treatment effect will be biased (Gertler, Martinez, Premand, Rawlings, & Vermeersch, 2011). When looking at more than two periods, we may assume something about the parallel trends.

Figure 3: Parallel trend assumption.

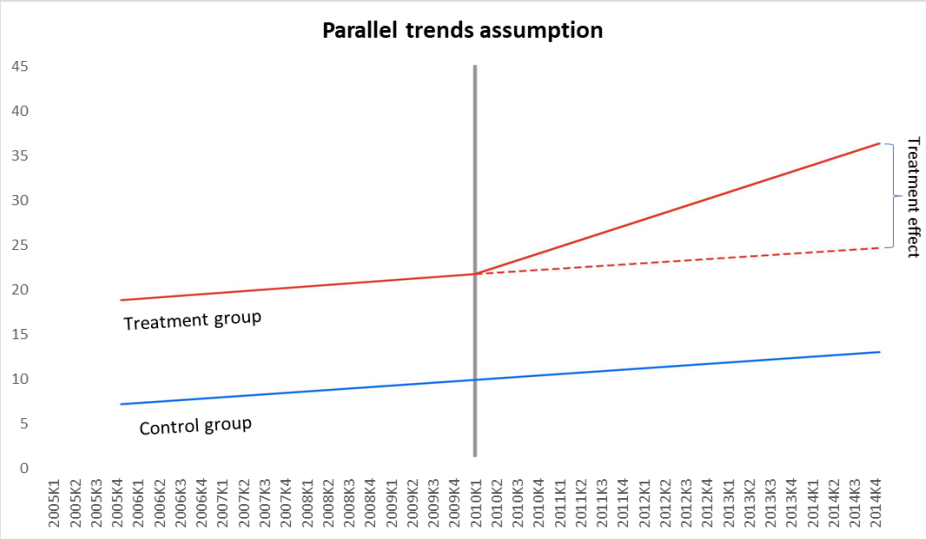

Figure 3: Parallel trend assumption.

Our blue line is what we call the control group, while the red line is the treatment group. The dotted line represents the counterfactual for our treatment group. We can see that there is a reaction happening to the treatment group that change the trend in a new direction. This deviation will give us an indication that the reaction gives us a causal effect on observed outcomes.

Another important assumption implies that the potential outcomes are observable for every member of the population. It is called the observation rule and follows from the Stable Unit Treatment Value assumption (SUTVA). The assumption implies that the treatment is completely representative and that there is no interference between the members of the population (Rubin, 1977).

5.2 Clustered Standard Errors (CSE)

We use clustered standard errors (CSE) when some of the observations in our data set are correlated. This happens when an individual trait is identical or related in our groups within clusters. This is usually the case when we use panel data, or we can get CSE when using experimental design, like in a difference-in-differences quasi-experiment. If we use the conventional diff-in-diff standard errors, then the result may underestimate the standard deviation of the estimated treatment effect. This serial correlation will then lead to an over estimation of the t-stats and significance levels in our results (Bertrand, Duflo, & Mullainathan, 2003).
In our thesis we look at panel data comparing different kind of local housing markets, using a flexible diff-in-diff regression model, so adjusting for CSE is relevant in our case.

5.3 Model

We will use a flexible difference-in-differences model. This model compares the evolution of price changes in local housing markets with a larger share of first-time buyers and local housing markets with a smaller share of first-time buyers, before and after a policy change. (Angrist & Pischke, 2014, p. 205) The treatment group will be the local housing markets with a large share of first-time buyers. The control group will be the local housing markets with a smaller share of first-time buyers. We will divide the local housing markets by municipalities or city neighbourhoods. We estimate the following model:

$$\ln p_{mt} \;=\; \alpha_m + \sum_{s \neq t^*} \beta_s 1\{t = s\} \times d_m \;+\; \gamma_t + \;\epsilon_{ts} \tag{5.3.1}$$

Equation (5.3.1) describes a price index ($\ln p_{mt}$) at time (t) for housing market (m). The price index is logged (ln), so that we can interpret the coefficients as a growth rate. The variable (α_m) is our local housing market fixed effect and the variable (γ_t) is our time fixed effect. The local housing market fixed effect controls the different starting points of price levels in each local housing market.

The time fixed effect considers the common macroeconomic changes that happens over time, that is not caused by the policy regulation.

This is a binary treatment model, where (d_m) is one or zero depending on whether the share of first-time buyers in the local housing market (m) is above or below the median. The regressor is $(1\{t = s\} \times d_m)$, where $(1\{t = s\})$ is the indicator function. The (t^*) is the last pre-treatment period. This function gives a time-varying effect of (d_m) which is picked up by the coefficients (β_s). Subscript (s) is the time index; this is a quarterly index. The last variable is a mean zero error term (ϵ_{ts}).

6.0 Results

We have estimated two different models in our thesis. They both have the same time horizon, from 2007 to 2013. The difference will be that one will impose that (β_s) is constant within a year, while the other will not. We will call the different models, Model 1 and Model 2. Both models have 1762 observations (N). The coefficient that is exactly zero in both models will be the base period, of 2010 and 2010 q1, respectively.

The dependent variable is logged so we can look at the percentage change in our house price index. One unit increase in the independent variable gives us a percentage change in the dependent variable.

6.1 Results from model 1 (yearly observations)

The results of model 1 suggest that there is an effect on local house prices after the policy regulation in 2010 was implemented. The threshold we used was the median share of first-time buyers in all local housing markets, 0.2531. The observed increase in house prices is a relative price increase in local housing markets with a high share of first-time buyers, compared to local housing markets with a low share of first-time buyers.

In *Figure 4* we can clearly see a parallel trend in the three years before the policy regulation. The parallel trend assumption can also be observed in *Table 5*. Here we see that the coefficients to the years pre policy regulation, are -0.0003, -0.0018 and -0.0016 and statistically insignificant from zero. After the treatment was implemented, we can see that the coefficients become positive. This implies that there is an effect on house prices. All post-treatment coefficients are significant with a minimum significant level of 0.05.

The coefficient from the first year after the treatment i.e., 2011 indicates that house prices increased 3.15% in local housing markets with a high share of first-time buyers compared to local housing markets with a low share of first-time buyers, with a significant level of 0.01. In the year 2012 the effect is 3.53%, with a significant level of 0.01. In 2013 the effect is 3.02%, with a significant level of

0.05. Though it increases in the last year, it does not have the same growth as the year before.

Table 5: Estimated coefficients from model 1

Year (treated)	
2007	-0.000310 (0.0222)
2008	-0.00184 (0.0126)
2009	-0.00155 (0.0124)
2010	0 (.)
2011	0.0315** (0.0114)
2012	0.0353** (0.0122)
2013	0.0302* (0.0123)
N	1762
adj. R-sq	0.888
Number of clusters [1] (location_ID)	63
Standard errors [2] in parentheses	
* p<0.05, ** p<0.01, *** p<0.001	

Table 5: Estimated coefficients from model 1

[1] The standard errors are clustered on the local housing market level, with 63 groups.

[2] Standard errors are inside the parentheses while the stars, *, show significance. One star equals a p-value lower than 0.05, two stars equals a p-value lower than 0.01 and lastly three stars equal a p-value lower than 0.001. The p-value is the lowest significance level that we can rejected the null hypothesis. The lesser the p-value the higher the statistical significance.

Table 5 displays the coefficients from model 1. The first column describes the year. The second column displays the estimated treatment effect. 2010 is our base year and is therefore zero. The model has an adjusted R-squared of 0.888.

6.2 Coefficient plot from model 1 (yearly observations)

Figure 4: Estimated coefficient plot from model 1

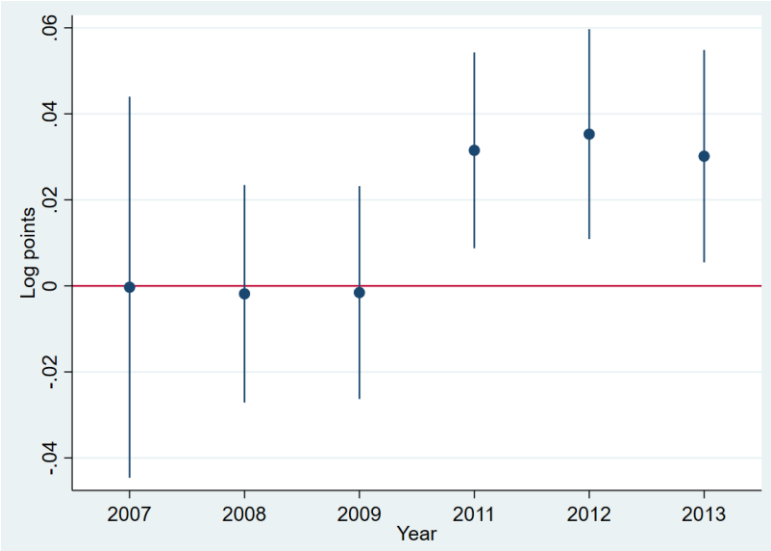

Figure 4: Estimated coefficient plot from model 1

Figure 4 displays the estimated coefficients from our first model. On the Y-axis we have log points from -0.04 to 0.06. On the X-axis the years are uniformly spread. Our base year is 2010 and therefore does not show up in this graph. The plotted coefficients are in log points which can be interpreted approximately as percentage change. The lines that go through the coefficient are the 95 % confidence intervals.

6.3 Results from model 2 (quarterly observations)

In Model 2 we look at quarterly frequency. This is done to improve our identification of the effect of the policy on local house prices. At a quarterly frequency our flexible difference-in-differences framework does not have enough power to reject the null hypothesis. However, it still shows us an increase in house prices after the treatment, only this time we see a gradually build up and not a big jump. Before our base quarter, we now observe in *Figure 5* more positive coefficients that fluctuate more around zero relative to model 1. However, the pre-trend is still consistent with the parallel trend assumption.

Still, we can observe in *Table 6* that the results are consistent with the yearly frequency results. After the first treatment quarter, 2010 quarter 2, we can observe an increase of 0.146%, while the third and fourth quarter of 2010 increased 1.82% and 2.55%, however these quarters are not significant. The rest of the post treatment quarters, apart from 2012 quarter 1, 2013 quarter 3 and 2013 quarter 4 are significant with a minimum significant level of 0.05. In addition, we can see that the logged price increased with 5.24% in 2011 q1, 4.9% in 2011 q2, 3.87% in 2011 q3, 3.12% in 2011 q4, 3.29% in 2012 q1, 5.1% in 2012 q2, 5.37% in 2012 q3, 4.91% in 2012 q4, 4.81% in 2013 q1, 5.43% in 2013 q2, 3.11% in 2013 q3 and 3.24% in 2013 q4.

Table 6: Estimated coefficients from model 2

Quarter (treated)	
2007 q1	0.00484
	(0.0272)
2007 q2	0.00967
	(0.0374)
2007 q3	0.0265
	(0.0184)
2007 q4	0.00287

	(0.0188)
2008 q1	0.0109
	(0.0171)
2008 q2	0.0261
	(0.0195)
2008 q3	0.0158
	(0.0198)
2008 q4	-0.0149
	(0.0187)
2009 q1	-0.00642
	(0.0179)
2009 q2	0.0136
	(0.0183)
2009 q3	0.0120
	(0.0185)
2009 q4	0.0199
	(0.0143)
2010 q1	0
	(.)
2010 q2	0.00146
	(0.0101)
2010 q3	0.0182
	(0.0166)
2010 q4	0.0255
	(0.0180)
2011 q1	0.0524*
	(0.0224)
2011 q2	0.0490*
	(0.0213)
2011 q3	0.0387*

	(0.0162)
2011 q4	0.0312*
	(0.0156)
2012 q1	0.0329
	(0.0166)
2012 q2	0.0509**
	(0.0165)
2012 q3	0.0537**
	(0.0175)
2012 q4	0.0490**
	(0.0173)
2013 q1	0.0481**
	(0.0173)
2013 q2	0.0543**
	(0.0196)
2013 q3	0.0311
	(0.0188)
2013 q4	0.0324
	(0.0184)
N	1762
adj. R-sq	0.887
Number of clusters[3] (location_ID)	63
Standard errors[4] in parentheses	
* p<0.05, ** p<0.01, *** p<0.001	

Table 6: Estimated coefficients from model 2

[3] The standard errors are clustered on the local housing market level, with 63 groups.

[4] Standard errors are inside the parentheses while the stars, *, show significance. One star equals a p-value lower than 0.05, two stars equals a p-value lower than 0.01 and lastly three stars equal a p-value lower than 0.001. The p-value is the lowest significance level that we can rejected the null hypothesis. The lesser the p-value the higher the statistical significance.

The *Table 6* displays the coefficients from model 2. The first column describes the years for each quarter and the constant term. The second column displays the coefficient estimate. 2010 quarter 1 is our base quarter and is therefore zero. The model has an adjusted R-squared of 0.887.

6.4 Coefficient plot from model 2 (quarterly observations)

Figure 5: Estimated coefficient plot from model 2

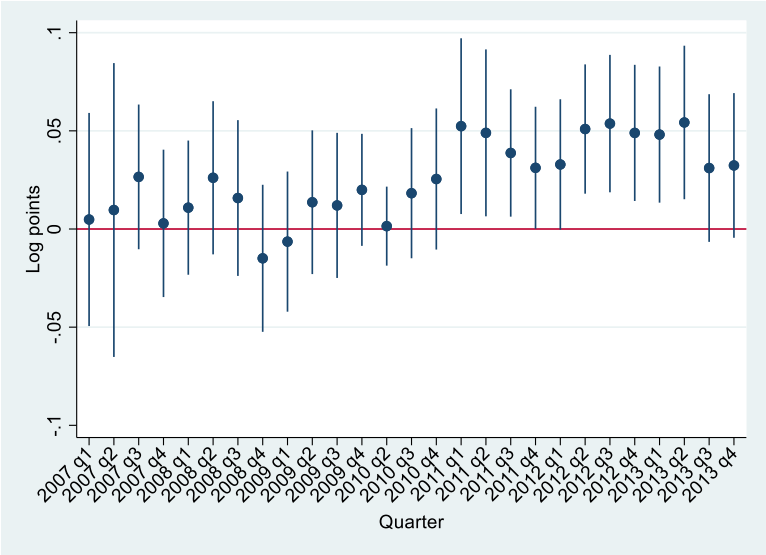

Figure 5: Estimated coefficient plot from model 2

Figure 5 describes our second model. On the Y-axis we have log points. On the X-axis are quarters. Our base quarter is 2010 quarter 1 and therefore does not show up in this graph. The plotted coefficients indicate the log growth in that quarter relative to the base quarter, together with 95% confidence intervals.

7.0 Discussion

The policy regulation from 2010 and 2011 on loan-to-value requirements made it harder for home buyers to take up large loans and likely dampened the demand in the housing market (Wold & Juelsrud, 2018). However, there may be some surprises on the consequences when we look more closely at the different segments and buyers in the housing market.

From the results in section (6.1) we can observe that the policy regulation affected differently in local housing markets with different shares of first-time buyers. This effect shows that after the policy regulation was implemented, there was a price increase in local housing markets with a high share of first-time buyers relative to local housing markets with a low share of first-time buyers.

It is possible that the policy decreased the demand overall in the Norwegian housing markets, however our difference-in-differences model does not consider what happens to this overall decline.

There are two plausible explanations to why prices increased in local housing markets with a high share of first-time buyers relative to local housing markets with a lower share. The first explanation is that the policy did what it was meant to do, to create financial stability and prohibit credit-sensitive agents to overextend their manageable credit limits. Further the regulation made it harder to take up loans and mortgages and the implications were a general decrease in demand and price in the housing market (Greenwald & Guren, 2020). If local housing markets with a low share of first-time buyers had a bigger decline in demand relative to local housing markets with a high share of first-time buyers, we will have a relative demand and price increase in areas with a high share of first-time buyers.

This explanation seems counterfactual, because we observe in *Figure 5* that local housing markets with a larger share of first-time buyers are more responsive to the aggregate housing cycle, by observing the pre-trend effects for 2008 q4 and 2009 q4 from the figure. This indicates that our next explanation about relocation of demand is more plausible.

When we look at the *Figure 6, Figure 7, Figure 8 and Figure 9* below, we observe the price development for housing co-operatives and condominiums price development in Oslo, Bergen, Trondheim and Stavanger.

We observe that all types of apartments are cyclical and one room apartments are especially volatile. It is likely to think that the majority of the one room apartments are the homes that first-time buyers usually purchase.

The data has yearly frequency and shows only the fourth quarter of each year. It is collected from "The Co-operative Housing Federation of Norway" (Norske Boligbyggerlags Landsforbund SA) (NBBL, 2022). In total they have around 4000 sales each quarter. They divide these sales in different regions and sizes. In some regions it might lead to few observations and the results will be less robust. This lack of observations in the data are especially relevant for one room apartments in Bergen (*Figure 7*) after the fourth quarter 2014 and in Stavanger (*Figure 9*) after the fourth quarter 2015. We can observe this when the graph suddenly stops.

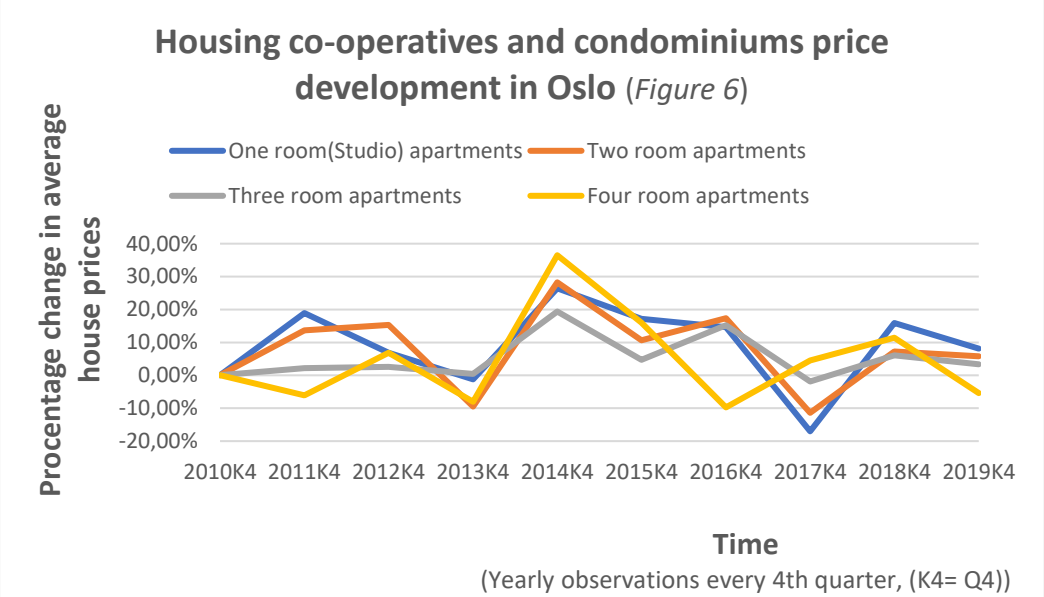

Figure 6: Housing co-operatives and condominiums price development in Oslo.

Sources: *Boligprisstatistikk | Norske Boligbyggelag (nbbl.no)*

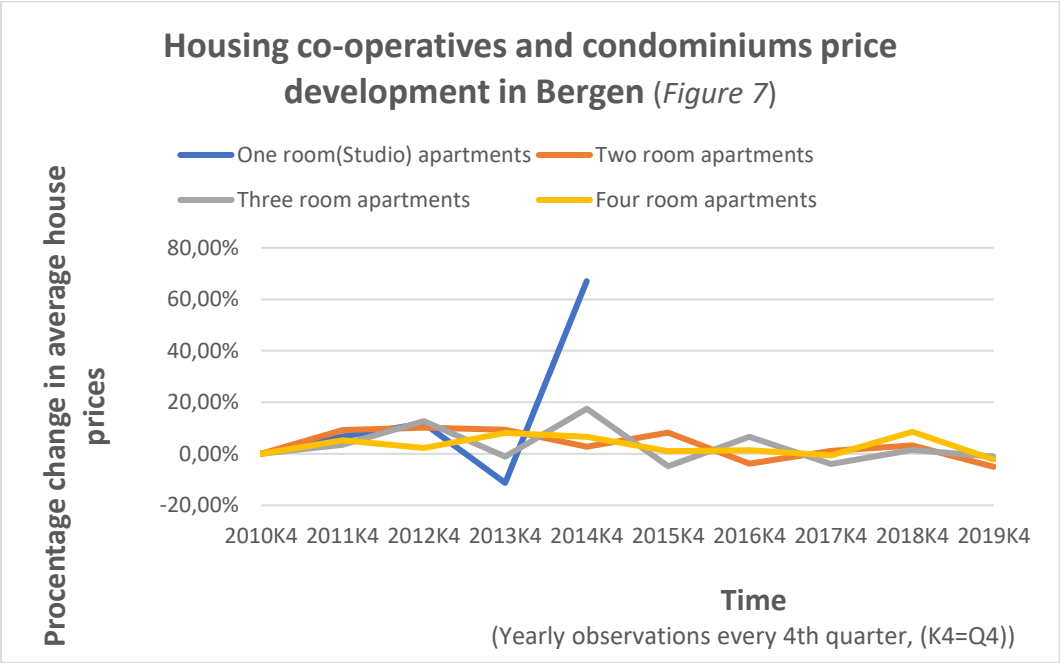

Figure 7: Housing co-operatives and condominiums price development in Bergen.

Sources: *Boligprisstatistikk | Norske Boligbyggelag (nbbl.no)*

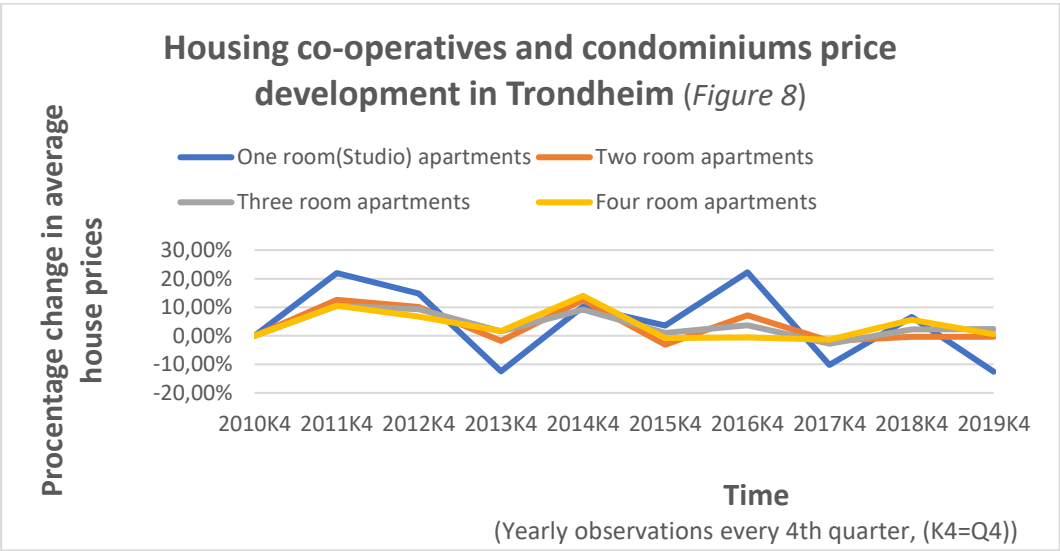

Figure 8: Housing co-operatives and condominiums price development in Trondheim.

Sources: *Boligprisstatistikk | Norske Boligbyggelag (nbbl.no)*

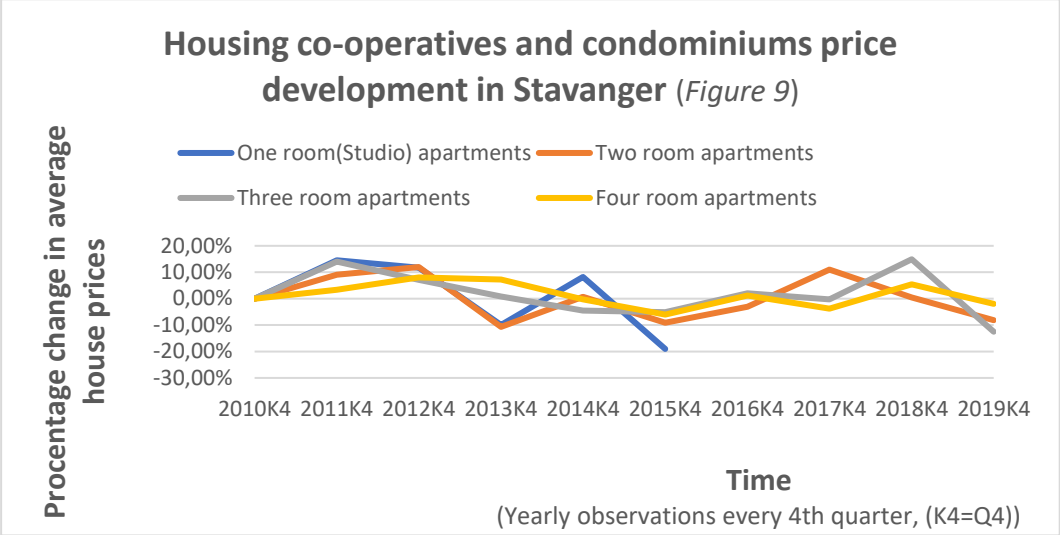

Figure 9: Housing co-operatives and condominiums price development in Stavanger.

Sources: *Boligprisstatistikk | Norske Boligbyggelag (nbbl.no)*

When observing the cyclical behaviour from house prices in *Figure 5* and from the figures above there might be another explanation for the house price increase in local housing markets with a high share of first-time buyers. It is possible that the policy regulation from 2010 was implemented exactly at the same time as a new housing cycle began. Although, it seems very unlikely that these two mechanisms perfectly overlapped each other in the base period in 2010 q1 and had the same development in the post-reform period.

The second explanation is the reallocation of demand between different local housing markets. The policy shifted the demand of first-time buyers from different options in the housing markets to more specific areas.

Before the policy was implemented first-time buyers could buy a property in several local housing markets, including areas with a low share of first-time buyers. After the LTV requirements made it harder to take up larger mortgages, the demand from first-time buyers were reallocated from buying in areas with low share of first-time buyers to only buying in areas with a high share of first-time buyers. This effect will increase the demand and in turn increase the house prices in local housing markets with a high share of first-time buyers.

Research done by Aastveit, Juelsrud and Wold (2021) on mortgage regulation on the household, backs up the hypothesis that first-time buyers probably were the most impacted by the policy regulation (Aastveit, Juelsrud, & Wold, 2021). Showing that new LTV requirements after the financial crises in Norway led to a reduction in the probability to buy a house, was solely driven by households with relatively low liquid wealth. Most likely we can assume that first-time buyers are typically agents with low wealth and low liquidity relative to other agents in the housing market. This means that tighter LTV requirements will likely affect first-time buyers to a higher degree relative to other agents. Moreover, this will affect first-time buyers' opportunities to take up a higher mortgage, although it may not drastically affect their demand of buying a house. Meaning the possibility to branch out to other areas decreased. Now there are more first-time buyers that compete for the same type of property. These properties are often in the same segment when it comes to price, size, amenities and location.

Further the research from Aastveit, Juelsrud and Wold (2021) show that stricter LTV-requirements decreased the purchasing price and made households buy lower priced properties (Aastveit, Juelsrud, & Wold, 2021, p. 33). Looking at the research paper by Grindaker, Karapetyan, Moen and Nenov (2021) they explain that if there is a price pressure in a specific local housing market, actors will most likely reallocate their demand to other local areas (Grindaker, Karapetyan, Moen, & Nenov, 2021, p. 30).

This backs up our hypothesis of the reallocation of demand and explains the price increase in local housing markets with a high share of first-time buyers, relative to areas with a low share of first-time buyers, caused by the LTV regulation.

We can use the example below to explain our hypothesis, by looking at two local housing markets from Oslo. The district "Alna" with 33,7% share of first-time buyers and "Vestre Aker" with 16,7%. These areas have one of the highest and lowest shares of first-time buyers in Oslo and also in the other big Norwegian cities from our data set. Before the policy was implemented, first-time buyers would have the possibility to buy property in different local housing markets. Most likely the effect of the policy regulation is that now more first-time buyers only can afford to live in places such as "Alna". Therefore, these areas become their only option when buying a home. The demand is reallocated, and we can see a price increase in areas with a high share of first-time buyers.

The reallocation hypothesis is based on the claim that first time buyers are more limited when purchasing a home because of the tighter capital requirements from the regulations in 2010 and 2011. These regulations shifted the demand of first-time buyers from other segments and several local housing markets to a narrower field and more specific local housing markets. The matrix in *Table 7* indicates that there are correlations between first-time buyers and more affordable and smaller homes, as well as lower average household income. These types of houses are what we often find in local housing markets with a high share of first-time buyers. This builds up under the reallocation hypothesis that the demand of first time-buyers were reallocated from other more typical expensive areas to these more affordable areas with many first-time buyers.

Table 7: Matrix of correlations between share of first-time buyers, average house prices, average usable area and average household income in a local housing market.

Variables	(1)	(2)	(3)	(4)
(1) Share of first-time buyers	1.000			
(2) Average house prices	-0.392	1.000		
(3) Average usable area	-0.383	0.250	1.000	
(4) Average household income	-0.560	0.328	0.823	1.000

Table 7: Matrix of correlations between share of first-time buyers, average house prices, average usable area and average household income in a local housing market.

In *Table 7* we observe a negative correlation between share of first-time buyers, average house prices, average usable area and average household income in a local housing market. This implies that local housing markets with a high share of first-time buyers relative to low share of first-time buyers tend to have lower house prices, smaller properties, and households with lower average household income.

8.0 Conclusion

In this paper we provide empirical evidence to explain:

Do loan to value requirements matter for local house prices in Norway during the time period 2010 - 2013?

Before conducting this research, we thought that the policy regulation from 2010 and 2011 on LTV requirements would decrease demand and house prices in areas with a high share of first-time buyers as the research done by Armstrong, Skilling and Yao indicates (Armstrong, Skilling, & Yao, 2018). They show that the implementation of tighter and binding restrictions on loan-to-value requirements led to a reduction in house price inflation in New Zealand. This effect also likely happened and caused a reduction in overall demand and house prices in the Norwegian housing market in 2010-2013. Nevertheless, looking at panel data from different local housing markets collected from the five biggest regional housing markets in Norway, we found a price increase in areas with a high share of first-time buyers relatively to areas with a low share of first-time buyers.

This result can be explained by two different explanations. The first is that there was a larger decrease in house prices in areas with low share of first-time buyers relative to areas with a high share of first-time buyers. We do not think this explanation is the reason for the price increase, because the policy most likely effected first-time buyers more than the ones that already had a higher share of wealth, liquidity and were houseowners.

We conclude that the second explanation, that the reallocation of demand of first-time buyers, is the reason for the observed relative price increase in local housing markets with a high share of first-time buyers versus a low share of first-time buyers. Before the policy, they had the opportunity to branch out to different local housing markets. After the regulation their options were limited to areas with higher shares of first-time buyers, and price rose in these areas. Research done by Grindaker, Karapetyan, Moen and Nenov (2021) indactes that if there is a price pressure in a specific local housing market, actors will reallocate their demand to other local areas (Grindaker, Karapetyan, Moen, & Nenov, 2021, p. 30). From our research we observe that there was not a price increase in areas with a low share

of first-time buyers relative to areas with a high share of first-time buyers. However, the policy made the access to capital harder and then weakened the buying power of first-time buyers. This caused the reallocation, that narrowed their demand to the same types of local housing markets.

Anecdotally we have experienced that many first-time buyers struggled even more after the policy was implemented to buy their first home. Not only because of higher LTV requirements and stricter lending practises on mortgages from banks, but the segment that they usually could compete in kept rising in price disproportionately to the rest of the housing market.

Other research discussed in our paper points out that regulation on capital requirements can lead to a decrease in house prices, however our results indicate the opposite when it comes to local housing markets with a high share of first-time buyers. The implications of our findings are that the policy regulation on LTV-requirements from 2010 and 2011, has made it even harder for first-time buyers to enter the housing market and on top of that made it more expensive. The policy implications of regulating LTV- requirements seems to impact differently in each segment in the housing market and especially more unfavourable for first-time buyers, that the regulators may had foreseen. These potential issues that this regulation can cause on financially vulnerable groups should be a priority in further research.

Bibliography

Angrist, J. D., & Pischke, J.-s. (2014). *Mastering Metrics.* New Jersey: Princeton University Press.

Anundsen, A. K., & Jansen, E. S. (2013, 10 11). *Self-reinforcing effects between housing prices and credit: an extended version*. Retrieved from SSB: https://www.ssb.no/en/forskning/discussion-papers/_attachment/142946?fbclid=IwAR2dduJgzjeOdH3EWzkkj-0yCi4bG2yodpuaTrv1ySEEZpfgAZEVzF9-OA0

Armstrong, J., Skilling, H., & Yao, F. (2018, 05). *Reserve Bank of New Zealand*. Retrieved from Loan-to-value Ratio Restrictions and House Prices: https://img.scoop.co.nz/media/pdfs/1804/DP201505_Armstrong_Skilling_Yao_2018_LoantoValue_Ratio_Restriction_and_House_Pr.._.pdf

Bertrand, M., Duflo, E., & Mullainathan, S. (2003). How much should we trust differences-in-Differences estimates? *The Quarterly Journal of Economics*, 249-275.

Cerutti, E., Claessens, S., & Laeven, L. (2017). The use and effectiveness of macroprudential policies: New evidence. *Journal of Financial Stability*, 203-224.

Finanstilsynet. (2010, 03 03). Retningslinjer for forsvarlig utlånspraksis for lån til boligformål.

Finanstilsynet. (2011, 12 01). Retningslinjer for forsvarlig utlånspraksis for lån til boligformål.

Gertler, P. J., Martinez, S., Premand, P., Rawlings, L. B., & Vermeersch, C. M. (2011). Impact Evaluation in Practice. 136.

Greenwald, D. L., & Guren, A. (2020, 08 21). Do credit conditions move house prices?

Grindaker, M., Karapetyan, A., Moen, E., & Nenov, P. (2021). Transaction sequence decisions and housing market volatility: Evidence from Norway.

Halvorsen, E., & Lindquist, K.-G. (2017, 11 7). *Norges Bank*. Retrieved from Getting a foot on the housing ladder: The role of parents in giving a leg-up: https://www.norges-bank.no/contentassets/ee4ddb7ec38344f98e2e2937f9cecbeb/working_paper_19_17.pdf

Johnson, S. (2020, 08 26). Mortgage leverage and house prices.

Kuttner, K. N., & Shim, I. (2016). Can non-interest rate policies stabilize housing markets? Evidence from a panel of 57 economies. *Journal of Financial Stability*, 31-44.

Lechner, M. (2010). The Estimation of Causal Effects by Difference-in-Difference Mthods. *Foundations and Trends in Econometrics*, 165-224.

Mamre, M. O. (2020, 08). *ResearchGate*. Retrieved from Boligkjøpekraften til en representativ lokal førstegangskjøper Housing affordability of a representative local first time buyer: https://www.researchgate.net/publication/343761885_Boligkjopekraften_til_e

n_representativ_lokal_forstegangskjoper_Housing_affordability_of_a_representative_local_first_time_buyer

NBBL. (2022, 06 21). *Boligprisstatistikk*. Retrieved from Norsk Boligbyggelags Landsforbund SA: https://www.nbbl.no/om-oss/statistikk-og-fakta/boligprisstatistikk/?fbclid=IwAR1jVjejrLvaVejnkBso3cmebsEESswasXuj_9RSCfIpcmA4_yIkawD8zlg

Norges Bank. (2018, 04 11). *Norges Bank's consultation response – amendments to and retention of the regulation on new residential mortgage loans*. Retrieved from Norges Bank: https://www.norges-bank.no/en/news-events/news-publications/Submissions/2018/2018-04-11-submission/

Norges Bank. (2022, 06 27). *Overview of Norwegian macroprudential measures since 2010 other than the countercyclical capital buffer*. Retrieved from Norges Bank: https://www.norges-bank.no/en/topics/financial-stability/Advice-on-the-countercyclical-capital-buffer/Countercyclical-capital-buffer/measures-other-authorities/

Regjeringen. (2013, 10 13). *Regjeringen*. Retrieved from Risk weights under the IRB approach: https://www.regjeringen.no/en/historical-archive/Stoltenbergs-2nd-Government/Ministry-of-Finance/Nyheter-og-pressemeldinger/nyheter/2013/risk-weights-under-the-irb-approach/id742309/

Regjeringen. (2014, 05 12). *Regjeringen*. Retrieved from Regulation and decision on systematically important financial institutions: https://www.regjeringen.no/en/historical-archive/solbergs-government/Ministries/fin/press-releases/2014/Regulation-and-decision-on-systemically-important-financial-institutions/id759115/

Regjeringen. (2015, 06 15). *Regjeringen*. Retrieved from Regulation on requirements for residential mortgage loans: https://www.regjeringen.no/en/historical-archive/solbergs-government/Ministries/fin/press-releases/2015/regulation-on-requirements-for-residential-mortgage-loans/id2417372/

Regjeringen. (2016, 12 14). *Regjeringen*. Retrieved from New regulation on requirements for residential mortgage loans: https://www.regjeringen.no/en/historical-archive/solbergs-government/Ministries/fin/press-releases/2016/new-regulation-on-requirements-for-residential-mortgage-loans/id2523967/

Rubin, D. B. (1977). Assignment to Treatment Group on the Basis of a Covariate. *Journal of Educational Researcg Association and American Statistical Association*, 1-26.

Statistics Norway. (2022, 06 10). *Statistikkbanken*. Retrieved from Statistisk sentralbyrå: https://www.ssb.no/statbank/table/08184

Statistics Norway. (2022, 06 10). *Statistikkbanken*. Retrieved from Statistisk sentralbyrå: https://www.ssb.no/statbank/table/07230/

Statistics Norway. (2022, 06 10). *Statistikkbanken*. Retrieved from Statistisk sentralbyrå: https://www.ssb.no/statbank/table/07221/

Sættem, J. B., Hellerud, H. T., & Johansen, G. T. (2012, 08 10). *NRK*. Retrieved from Slik har norske boligpriser utviklet seg gjennom de siste 200 årene: https://www.nrk.no/norge/boligpriser-gjennom-200-ar-1.8273402

The Financial supervisory authority of Norway. (2010, 03 03). *Retningslinjer for forsvarlig utlånspraksis for lån til boligformål*. Retrieved from Finanstilsynet: https://lovdata.no/static/RFT/rft-2010-0011.pdf

The financial supervisory authority of Norway. (2011, 12 01). *Retningslinjer for forsvarlig utlånspraksis for lån til boligformål*. Retrieved from Finanstilsynet: https://lovdata.no/static/RFT/rft-2011-0029.pdf?fbclid=IwAR26_ZOBRiIoSvLQXjsCRxfHLfcyftsBNvwNFzz5-CwiQRENnL4CYBXOqFc

Wig, K. (2021, 09 07). *E24*. Retrieved from Oslo-tall vekker oppsikt: Foreldre hjelper halvparten inn på boligmarkedet: https://e24.no/privatoekonomi/i/x8MBWB/oslo-tall-vekker-oppsikt-foreldre-hjelper-halvparten-inn-paa-boligmarkedet?fbclid=IwAR2LGmqONw6Zc0O8Ya5gJSD5s0SONPMw46danMriClrTE67s_kAjBm1jAxk

Wold, E. G., & Juelsrud, R. E. (2018). Risk-weighted capital requirements and portfolio rebalancing. *Journal of Financial Intermediation*.

Aastveit, K. A., Juelsrud, R. E., & Wold, E. G. (2021, 12). *Norges Bank*. Retrieved from The household effects of mortgage regulation: https://www.norges-bank.no/en/news-events/news-publications/Papers/Working-Papers/2020/62020/